

ILLINOIS
STANDARD SPECIFICATIONS
FOR
CONSTRUCTION OF
AIRPORTS

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
DIVISION OF AERONAUTICS

ADOPTED APRIL 1, 2012

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DIVISION I - GENERAL PROVISIONS

SECTION 10. DEFINITION OF TERMS

Whenever the following terms are used in these specifications, in the contract, in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be interpreted as follows:

10-01 ABBREVIATIONS. Wherever the following abbreviations are used in these Specifications or on the plans, they are to be construed the same as the respective expressions represented:

AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
AC	Federal Aviation Administration Advisory Circulars
ADAAG	Americans with Disabilities Act Accessibility Guidelines
AIP	Airport Improvement Program
AISC	American Institute of Steel Construction
ANLA	American Nursery and Landscape Association
ANSI	American National Standards Institute
ARA	American Railway Association
AREMA	American Railway Engineering and Maintenance of Way Association
ASA	American Standards Association
ASLA	American Society of Landscape Architects
ASTM	ASTM International
AWG	American Wire Gauge
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
BWC	Bridge Welding Code
CRSI	Concrete Reinforcing Steel Institute
EPA	United States Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FHWA	Federal Highway Administration
FSS	Federal Specifications and Standards
GSA	General Services Administration
ICEA	Insulated Cable Engineers Association
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IEMA	Illinois Emergency Management Agency
IEPA	Illinois Environmental Protection Agency
IES	Illuminating Engineering Society
IMSA	International Municipal Signal Association
ISO	Insurance Services Organization
ITE	Institute of Transportation Engineers
MASH	AASHTO Manual for Assessing Safety Hardware
MUTCD	Illinois Manual on Uniform Traffic Control Devices
NACE	National Association of Corrosion Engineers
NCHRP	National Cooperative Highway Research Program
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NRMCA	National Ready-Mix Concrete Association
OSHA	Occupational Safety and Health Administration

SAE	Society of Automotive Engineers
SSPC	Society for Protective Coatings
UL	Underwriters Laboratories
USASI	United States of America Standards Institute
USDA	United States Department of Agriculture

10-02 ACCESS ROAD. The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public highway.

10-03 ADMINISTRATOR. Administrator of the Federal Aviation Administration of the Department of Transportation, or his/her duly authorized representative.

10-04 ADVISORY CIRCULARS. As referred to in this document, these publications shall be the latest current document listed in the Federal Register Checklist as of the time of advertisement. They may be obtained from the U.S. Department of Transportation Publication Section, TAD 443.1, Washington, D.C., 20590 or from the FAA website at www.faa.gov

10-05 ADVERTISEMENT. The public announcement, as required by law, inviting bids for work to be performed and/or materials to be furnished.

Advertisement for bids will be issued by, and in conformance with, the policies of the Illinois Department of Transportation.

10-06 AIR OPERATIONS AREA. For the purpose of these specifications, the term air operations area shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.

10-07 AIRPORT. Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of ways; and airport buildings and facilities located in any of these areas, and includes a heliport.

10-08 AIRPORT IMPROVEMENT PROGRAM (AIP). A grant-in-aid program, administered by the Federal Aviation Administration.

10-09 AIRPORT MANAGEMENT. The person and/or representatives responsible for the daily management and operation of the airport.

10-10 AWARD. The decision of the Division, FAA, and Owner (Sponsor) to accept the proposal of the lowest responsible bidder for the work, subject to the approval and execution of a satisfactory contract therefore, receipt of a bond to secure the performance thereof, and compliance with such other conditions as may be specified or otherwise required by law.

10-11 BID BOND. The security to be furnished by the bidder as guaranty of good faith that he will enter into a Contract with the Owner and will execute the required Bonds covering the work contemplated, if the same is awarded to him.

10-12 BIDDER. Any individual, partnership, firm, corporation, or a legally stated combination, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.

10-13.1 BRIDGE. A structure, including supports, erected over a depression or an obstruction, such as water, highway, or railroad and having a track or passageway for carrying traffic or other moving loads and having a length of more than 20 feet.

10-13.2 BRIDGE LENGTH. The length of a bridge structure is the overall length measured along the line of survey stationing back to back of backwalls of abutments, if present, otherwise end to end of the bridge floor; but in no case less than the total clear opening of the structure. The length of multiple box culverts shall be between the extreme ends of the openings

10-13.3 BRIDGE ROADWAY WIDTH. The clear width measured at right angles to the longitudinal centerline of the bridge between the bottom of curbs or guard timbers or in the case of multiple height of curbs, between the bottoms of the lower risers.

10-14 BUILDING AREA. An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together with all airport buildings and facilities located thereon.

10-15 CALENDAR DAY. Every day shown on the calendar.

10-16 CATAclysmic EVENT. An occurrence, caused exclusively by any of the irresistible forces of nature that is an unexpected, singular event without continued, persistent existence or that is irregularly predictable. The event must occur without the involvement of human causative action, and must not be preventable or capable of substantial limitation in its impact by application of human care, skill, or foresight. Cataclysmic events include earthquakes, floods, flash floods of surface water caused by heavy rains and runoff water, tornadoes, or other cataclysmic phenomena of nature. A flood, defined as water elevation in excess of the channel capacity of a river, stream, other body of water is not a cataclysmic event, unless the flood water elevation exceeds the 100-year flood elevation as defined in the contract.

10-17 CHANGE ORDER. A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for the work affected by such changes. The work, covered by a change order, shall be within the scope of the contract.

10-18 CONTRACT. The written Agreement between the Department or Owner (Sponsor) and the Contractor setting forth the obligations of the parties thereunder, including, but not limited to, the performance of the work, the furnishing of labor and materials, and the basis of payment.

The contract includes the invitation for bids, proposal, letter of award, contract form, payment bond and performance bond, Specifications, Supplemental Specifications, Special Provisions, general and detailed plans, *Manual for Documentation of Airport Materials*, *Airport Construction Documentation Manual*, and any Agreements that are required to complete the construction of the work in an acceptable manner, including authorized extensions thereof, all of which constitute one instrument.

10-19 CONTRACT ITEM (PAY ITEM). A specific unit of work for which a price is provided in the contract. See definition for PAY ITEM.

10-20 CONTRACT TIME. The number of working days, calendar days, or combination allowed for completion of the contract, including authorized time extensions.

When a calendar date of completion is shown in the proposal, the contract shall be completed on or before that date.

10-21 CONTRACTOR. The individual, partnership, firm, corporation, or a legally stated combination, that is liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.

10-22 DEPARTMENT. The State of Illinois, Department of Transportation.

10-23 DIRECTOR. The Director of the Division of Aeronautics, Department of Transportation, State of Illinois.

10-24 DIVISION. The State of Illinois, Department of Transportation, Division of Aeronautics, acting as Authorized Agent, for the purposes of the prosecution of this project of the Owner.

10-25 DRAINAGE SYSTEM. The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.

10-26 ENGINEER. The Chief Engineer of the State of Illinois, Department of Transportation, Division of Aeronautics (acting directly or through an assistant or representative) when the Division is the awarding authority and Agent for the Owner (Sponsor).

10-27 EQUIPMENT. All machinery and equipment, together with the necessary supplies for upkeep and maintenance, and also tools and apparatus necessary for the proper construction and acceptable completion of the work.

10-28 EXTRA WORK. An item of work not provided for in the contract as awarded but found essential and germane to the satisfactory completion of the contract within its intended scope as determined by the Engineer.

10-29 FAA. The Federal Aviation Administration of the United States Department of Transportation. When used to designate a person, FAA shall mean the Administrator or duly authorized representative.

10-30 FEDERAL SPECIFICATIONS. The Federal Specifications and Standards, Commercial Item Descriptions, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government.

10-31 INSPECTOR. The authorized representative of the Engineer assigned to make all necessary inspections and/or tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.

10-32 INTENTION OF TERMS. Whenever, in these specifications or on the plans, the words "directed," "required," "permitted," "ordered," "designated," "prescribed," or words of the like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the Engineer is intended; and similarly, the words "approved," "acceptable," "satisfactory," or words of like import, shall mean approved by, or acceptable to, or satisfactory to the Engineer, subject in each case to the final determination of the Owner.

Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.

10-33 INVITATION FOR BIDS. The advertisement for proposals for all work or materials on which bids are required. Such advertisement will indicate with reasonable accuracy the quantity and location of the work to be done or the character and quantity of the material to be furnished and the time and place of the opening of proposals.

10-34 LABORATORY. The testing laboratory of the Department or any other testing laboratory which may be designated by the Engineer.

10-35 LANDING STRIP. A portion of the usable area of an airport, generally in its natural state of which, as the result of construction work, is suitable for the landing and taking off of aircraft under all favorable weather conditions. The runway is the paved central portion of the landing strip.

10-36 LANDSCAPING. The planning, planting, establishing and caring for trees, shrubs, vines and other vegetation to provide shade, reduce dust, control erosion, or improve the general appearance of the airport.

10-37 LIGHTING. A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.

10-38 MAJOR AND MINOR CONTRACT ITEMS. A major contract item shall be any item that is listed in the proposal, the total cost of which is equal to or greater than 20 percent of the total amount of the award contract. All other items shall be considered minor contract items.

10-39 MATERIALS. Any substances specified for use in the construction of the contract work.

10-40 MEDIAN. The portion of a divided highway or entrance road separating the traveled ways for traffic in opposite directions.

10-41 NOTICE TO BIDDERS. The official notice, included in the proposal form.

10-42 NOTICE TO PROCEED. A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.

10-43 OWNER (SPONSOR). The term "Owner" shall mean the party of the first part or the contracting agency signatory to the contract. For Federally assisted contracts, the term "sponsor" shall have the same meaning as the term "Owner".

10-44 PAVEMENT. The combined surface course, base course, and subbase course, if any, considered as a single unit.

10-45 PAVEMENT STRUCTURES. The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.

10-46 PAY ITEM. A specifically described unit of work for which a price is provided in the contract.

All pay items included in the plan Summary of Quantities are shown with an AR designation (Example Item AR151410 -- Clearing) which indicates a base bid pay item and quantity. Additive Alternate pay items shall be designated by AS, AT, and AU corresponding to Additive Alternate 1, 2, and 3, respectively. Example: AS151410 – Clearing is the pay item for Additive Alternate 1 clearing quantities.

10-47 PAYMENT BOND. The approved form of security furnished by the Contractor and his/her surety as a guaranty that he will pay in full all bills and accounts for materials and labor used in the construction of the work. The amount of the payment bond shall be not less than one hundred percent (100%) of the total contract amount.

10-48 PERFORMANCE BOND. The approved form of security furnished by the Contractor and his/her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract. The amount of the performance bond shall be not less than one hundred percent (100%) of the total contract amount.

10-49 PLANS. The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specification.

10-50 PROGRESS SCHEDULE. A schedule provided by the Contractor showing the sequence of work. The schedule shall indicate also the individual rates and the number of calendar days estimated for the completion of each item in order to carry the project to completion within the contract time.

10-51 PROJECT. The agreed scope of work for accomplishing specific airport development with respect to a particular airport.

10-52 PROJECT ENGINEER. The representative of the Owner, whether employed directly by the Owner or employed by an engineering firm retained by the Owner, acting as the immediate supervisor of the Resident Engineer. The Project Engineer must be a Licensed Professional Engineer in the State of Illinois.

10-53 PROPOSAL. The offer of a bidder, on the prescribed form, to perform the work and to furnish the labor and materials at the prices quoted.

10-54 PROPOSAL GUARANTY. The security furnished with a proposal to guarantee that the bidder will enter into a contract if the bid is accepted.

10-55 RAILROAD. The Railroad or Railway Company whose property is involved in the work.

10-56 RAILROAD ENGINEER. The Chief Engineer or Superintendent of the Railroad, or authorized representative limited by the particular duties entrusted to him/her.

10-57 RESIDENT ENGINEER/RESIDENT TECHNICIAN. The representative of the Owner, whether employed directly by the Owner or employed by an engineering firm retained by the Owner, immediately in charge of the engineering details of a construction project and acting under the supervision of the Project Engineer. The Resident Engineer must meet the approval and qualification requirements set forth by the Division and reside on the construction site at all times the Contractor is working. The term Resident Engineer, as used throughout these specifications, shall mean Resident Engineer/Resident Technician.

10-58 RIGHT-OF-WAY. A general term denoting land, property, or interest therein, usually in a strip, acquired for or devoted to transportation purposes.

10-59 ROADBED. The graded portion of a highway, access road, or entrance road within side slopes, prepared as a foundation for the pavement structure and shoulders.

10-60 ROADSIDE. A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway, access road or entrance road may also be considered roadside.

10-61 ROADSIDE DEVELOPMENT. Those items necessary to complete highway, access road or entrance road, which provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching and the placing of other ground covers; and such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the area.

10-62 ROADWAY. The portion of the right-of-way within limits of construction.

10-63 RUNWAY. The area on the airport prepared for the landing and takeoff of aircraft.

10-64 SHOULDER. The portion of the roadway, taxiway or runway contiguous with the traveled way for accommodation of stopped vehicles, emergency use, and lateral support of base and surface courses.

10-65 SIDEWALK. That portion of the pavement primarily constructed for use of pedestrians.

10-66 SPECIAL PROVISIONS. Additions and revisions to the Standard and Supplemental Specifications covering conditions peculiar to an individual contract.

10-67 SPECIFICATIONS. The body of directions, provisions, and requirements contained herein, or in any supplement adopted by the Division, together with written agreements and all documents of any description made or to be made pertaining to the method or manner of performing the work, the quantities, or the quality of materials or workmanship to be furnished under the contract.

10-68 STANDARDS. The Division Standard Drawings, and supplements, amendments, and indices thereto, as prepared and issued by the Division. These may be procured from the Division, by written or personal request, free of charge.

10-69 STATE. The State of Illinois.

10-70 STRUCTURE. Unless otherwise defined in the Specifications, structures shall comprise all objects constructed of materials other than earth, required by the contract to be built or to be removed, but not including surfacing, base courses, subbases, gutters, curbs, sidewalks, and driveway pavement.

10-71 SUBCONTRACTOR. An individual, firm, partnership or corporation who, with the written consent of the Engineer, assumes obligation for performing specified pay items for the Contractor.

10-72 SUBGRADE. The compacted soil which forms the pavement foundation.

10-73 SUBSTRUCTURE. All of that part of the structure below the bearings of simple and continuous spans, skewbacks of arches and tops of footings of rigid frames, together with the backwalls, wingwalls and wing protection railings.

10-74 SUPERSTRUCTURE. The entire structure except the substructure.

10-75 SUPERINTENDENT. The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions regarding the engineering details from the Resident Engineer, and who shall supervise and direct the construction.

10-76 SUPPLEMENTAL AGREEMENT. A written agreement between the Contractor and the Division covering: 1) work that would increase or decrease the total amount of the awarded contract, or any major contract item, by more than 25 percent, such increased or decreased work being within the scope of the originally awarded contract; or 2) work that is not within the scope of the originally awarded contract.

10-77 SUPPLEMENTAL SPECIFICATIONS. Additions and revisions to the Standard Specifications contained herein that are adopted subsequent to issuance of this book.

10-78 SURETY. The corporation, partnership or individual, other than the Contractor, executing the Performance Bond, Payment Bond and/or Bid Bond.

10-79 TAXIWAY. For the purpose of this document, the term taxiway means the portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways or aircraft parking areas.

10-80 TRAVELED WAY. The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

10-81 UTILITY. The privately, publicly, municipally or cooperatively owned line, facility or system for producing, transmitting or distributing communications, cable television, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, storm water not connected with airport drainage, and other similar commodities, including publicly owned fire and police signal systems and street lighting systems, which directly or indirectly serve the public or any part thereof. The term "utility" shall also mean the utility company, inclusive of any wholly owned or controlled subsidiary.

10-82 WARRANTY. The Contractor's assurance that all materials and all workmanship will be provided as represented in the plans and specifications and in accordance with Section 70-25.

10-83 WORK. The furnishing of all labor, materials, tools, equipment and incidentals necessary or convenient to the Contractor's performance of all the duties and obligations imposed by the contract, plans, and specifications. Work may also be used in context to describe, in whole or in part, the completed facilities to be constructed, altered or removed, as detailed in the Contract. The Engineer will have exclusive authority to determine the intent and meaning of the usage of this term wherever it appears in the Contract.

SECTION 20. ADVERTISEMENT, BIDDING, AWARD, AND CONTRACT EXECUTION

20-01 PROCEDURE TO BE IN ACCORDANCE WITH RULES. The procedures for the advertisement, bidding, award, and contract execution shall be in accordance with the rules of the Department published at 44 Illinois Administrative Code 650 and 660. The invitation for bids contains additional requirements published in accordance with the rules. Bidders and the Contractor shall comply with the rules and all procedures published in the invitation for bids.

SECTION 30. RESERVED

SECTION 40. SCOPE OF WORK

40-01 INTENT OF THE CONTRACT. The intent of the contract is to prescribe a complete outline of work which the Contractor undertakes to do in full compliance with the plans and specifications. The Contractor shall perform all earthwork, construct all base and surface courses, structures, and such additional, extra, and incidental construction as may be necessary to complete the work to the finished lines, grades, and cross sections in a substantial and acceptable manner. The Contractor shall furnish all required materials, equipment, tools, labor, and incidentals, unless otherwise provided in the contract, and shall include the cost of these items in the unit prices bid for the work. The quantities appearing in the bid schedule of prices are estimates prepared for the establishment of pay item prices and the comparison of bids. Payment to the Contractor will be made for the actual measured quantities performed and accepted or material furnished and accepted according to the contract, and the scheduled quantities may be increased, decreased, or deleted as herein provided.

Under no circumstances shall the Contractor exceed any established pay item quantity without notification to the Engineer and receipt of written authorization as provided herein.

40-02 ALTERATION OF WORK AND QUANTITIES. The Owner reserves and shall have the right to make such alterations in the work as may be necessary or desirable to complete the work originally intended in an acceptable manner. Unless otherwise specified herein, the Engineer shall be and is hereby authorized to make such alterations in the work as may increase or decrease the originally awarded contract quantities, provided that the aggregate of such alterations does not change the total contract cost or the total cost of any major contract item by more than 25 percent (total cost being based on the unit prices and estimated quantities in the awarded contract). Alterations that do not exceed the 25 percent limitation shall not invalidate the contract nor release the surety, and the Contractor agrees to accept payment for such alterations as if the altered work had been a part of the original contract. These alterations that are for work within the general scope of the contract shall be covered by "Change Orders" issued by the Engineer. Change Orders for altered work shall include extensions of contract time where, in the Engineer's opinion, such extensions are commensurate with the amount and difficulty of added work.

Should the total cost of any major contract item change by 25 percent or more, with the aggregate amount of altered work less than the 25 percent limitation hereinbefore specified, the alteration shall be subject to approval, prior to construction, by the Engineer and handled as a supplemental agreement.

Should the aggregate amount of altered work exceed the 25 percent limitation hereinbefore specified, such excess altered work shall be covered by supplemental agreement. If the Owner and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the Owner reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

All supplemental agreements shall be approved by the Division and shall include valid wage determinations of the U.S. Secretary of Labor when the amount of the supplemental agreement exceeds \$2,000.00. However, if the Contractor elects to waive the limitations on work that increases or decreases the originally awarded contract or any major contract item by more than 25 percent, the supplemental agreement shall be subject to the same U.S. Secretary of Labor wage determinations as was included in the originally awarded contract.

All supplemental agreements shall require consent of the Contractor's Surety and separate performance and payment bonds.

40-03 DELETED ITEMS. The Engineer may, in the Owner's best interest, delete from the work any contract item, except major contract items. Major contract items may be deleted by a supplemental agreement. Such deletion of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be deleted or otherwise ordered to be nonperformed, the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to delete such item. Payment for work performed shall be in accordance with the subsection titled PAYMENT FOR DELETED ITEMS of Section 90.

40-04 EXTRA WORK. Should acceptable completion of the contract require the Contractor to perform an item of work for which no basis of payment has been provided in the original contract or previously issued change orders or supplemental agreements, and same shall be called "Extra Work." Extra Work that is within the general scope of the contract shall be covered by written change order. Change orders for such Extra Work shall contain agreed unit prices for performing the change order work in accordance with the requirements specified in the order, and shall contain any adjustment to the contract time that, in the Engineer's opinion, is necessary for completion of such Extra Work.

When determined by the Engineer to be in the Owner's best interest, he may order the Contractor to proceed with Extra Work by force account as provided in the subsection titled PAYMENT FOR EXTRA AND FORCE ACCOUNT WORK of Section 90.

Extra Work that is necessary for acceptable completion of the project, but is not within the general scope of the work covered by the original contract shall be covered by a Supplemental Agreement as hereinbefore defined in the subsection titled SUPPLEMENTAL AGREEMENT of Section 10.

Any claim for payment of Extra Work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the Owner.

40-05 MAINTENANCE OF TRAFFIC. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas of the airport with respect to his/her own operations and the operations of all his/her subcontractors as specified in the subsection titled LIMITATION OF OPERATIONS of Section 80. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, for, and upon the airport as specified in the subsection titled CONTRACTOR'S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS in Section 70.

With respect to his/her own operations and the operations of all his/her subcontractors, the Contractor shall provide marking, light, and other acceptable means of identifying personnel; equipment; vehicles; storage areas; and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport.

When the contract requires the maintenance of vehicular traffic on an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep such road, street, or highway open to all traffic and shall provide such maintenance as may be required to accommodate traffic. The Contractor shall furnish, erect, and maintain barricades, warning signs, flagmen and other traffic control devices in reasonable conformity with the manual of Uniform Traffic Control Devices for Streets and Highways (published by the United States Government Printing Office), unless otherwise specified herein. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets, or highways. Unless otherwise specified herein, the Contractor will not be required to furnish snow removal for such existing road, street or highway.

The Contractor shall make his/her own estimate of all labor, materials, equipment and incidentals necessary for providing the maintenance of aircraft and vehicular traffic as specified in this subsection.

When not provided for as a contract item, the cost of maintaining the aircraft and vehicular traffic specified in this subsection shall not be measured or paid for directly, but shall be included in the various contract items.

Air traffic shall be maintained at the airport throughout the construction period as shown in the approved Safety Plan. All construction along a runway, taxiway, or apron edge necessitating its closure shall be expedited to minimize closure time.

The Airport Management will give proper notice to the nearest Flight Service Station and the Airways Facilities Chief of the Federal Aviation Administration prior to beginning construction.

If it will be necessary to close portions of the runways, apron and taxiways during the proposed construction, the Contractor shall notify the Airport Management through the Resident Engineer a minimum of 72 hours prior to the initiation of any work which requires closure of active airfield pavements for the issuance of the appropriate Notice to Airmen (NOTAM) and user coordination.

The Contractor shall consult with the Resident Engineer in arranging construction operations. The Airport Management will at all times have jurisdiction over the safety of air and ground traffic during construction. Wherever the safety of air traffic during construction is concerned, Airport Management decisions as to methods, procedures and measures used shall be final, and any and all Contractors performing work must be governed by such decisions.

The Contractor shall not be entitled to any extra compensation due to delays or inconveniences caused by said necessary methods, procedures, and measures to protect air and ground traffic.

The Contractor shall be responsible for cleaning and maintaining all haul roads to the work area. The Contractor shall maintain these areas as required or as directed by the Resident Engineer. Should the Contractor fail to respond to the Resident Engineer's notification, the Division may suspend work until such time as the unsatisfactory condition is corrected.

A flagger in contact with the Common Traffic Advisory Frequency (CTAF) shall be furnished by the Contractor at any time the active runways, taxiways, or airfield pavement are crossed or used for a haul road. The flagger shall be located to direct vehicular traffic to and from the construction operation. Flaggers shall be experienced in radio operation at an airport. The Contractor shall provide his/her own radio capable of transmitting and receiving on the CTAF.

The Contractor shall notify the FAA Airways Facilities Field Office or System Management Office a minimum of 72 hours prior to working in NAVAID critical areas.

The Contractor shall provide his/her own radio capable of transmitting and receiving on the air traffic control tower's frequency or the airport's Unicom frequency.

40-06 REMOVAL OF EXISTING STRUCTURES. All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall be measured or counted and paid for in accordance with the contract specifications.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the Resident Engineer shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the Resident Engineer in accordance with the provisions of the contract.

Except as provided in the subsection titled RIGHTS IN AND USE OF MATERIALS FOUND IN THE WORK of this section, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of work) shall be utilized in the work as otherwise provided for in the contract and shall remain the property of the Owner when so utilized in the work.

40-07 RIGHTS IN AND USE OF MATERIALS FOUND IN THE WORK. Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the use of which is intended by the terms of the contract to be either embankment or waste, he may at his/her option either:

- A. Use such material in another contract item, providing such use is approved by the Resident Engineer and is in conformance with the contract specifications application to such use; or
- B. Remove such material from the site, upon written approval of the Resident Engineer; or
- C. Use such material for his/her own temporary construction on site; or
- D. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option A., B., or C., he shall request the Resident Engineer's approval in advance of such use.

Should the Resident Engineer approve the Contractor's request to exercise option A., B., or C., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at his/her own expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for his/her use of such material so used in the work or removed from the site.

Should the Resident Engineer approve the Contractor's exercise of option A., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.

It is understood and agreed that the Contractor shall make no claim for delays by reason of his/her exercise of option A., B., or C.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the line, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

No material found or abandoned during the work shall be taken from the airport without the approval of the Resident Engineer. The Airport Management reserves the right to any material found or abandoned during the work. Any such material shall be turned over to the Airport Management at a site designated by the Resident Engineer.

40-08 FINAL CLEANING UP. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. He shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of such property owner.

The Contractor shall clean off all cement streaks or drippings, paint smears or drippings, rust stains, oil, grease, bituminous materials, dirt, and other foreign materials deposited or accumulated on or in any structure or curb and gutter due to his/her operation.

SECTION 50. CONTROL OF WORK

50-01 AUTHORITY OF THE ENGINEER. All work of the contract shall be completed to the satisfaction of the Engineer. The decision of the Engineer shall be final on all questions which may arise regarding, including but not limited to, the quality and acceptability of materials and work; the interpretation of the contract plans and specifications; the fulfillment of the contract; the measurement of quantities and payment under the contract; and the determination of the existence of changed or differing site conditions.

The contract does not require the Engineer to provide the Contractor with direction or advice on how to do the work. If the Engineer approves or recommends any method or manner for doing the work, the approval or recommendation shall not guarantee following the method or manner will result in compliance with the contract, relieve the Contractor of the risks and obligations of the contract, or create liability for the Department.

50-02 CONFORMITY WITH PLANS AND SPECIFICATIONS. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans, or specifications.

If the Engineer finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications but that the portion of the work affected will, in his/her opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable, he will order the affected work be accepted and remain in place. In this event, the Engineer will document his/her determination and recommended contract price adjustments will be based on good engineering judgment and such tests or retests of the affected work as are, in his/her opinion, needed. Changes in the contract price shall be covered by contract modifications (change order or supplemental agreement) as applicable.

If the Engineer finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the Engineer's written orders.

For the purpose of this subsection, the term "reasonably close conformity" shall not be construed as waiving the Contractor's responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall not be construed as waiving the Engineer's and the Resident Engineer's right to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's prosecution of the work, when, in the Engineer's and the Resident Engineer's opinion, such compliance is essential to provide an acceptable finished portion of the work.

For the purpose of this subsection, the term "reasonably close conformity" is also intended to provide the Engineer with the authority to use good engineering judgment in his/her determinations as to acceptance of work that is not in strict conformity but will provide a finished product equal to or better than that intended by the requirements of the contract, plans, and specifications.

The Engineer will not be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 COORDINATION OF CONTRACT, PLANS, AND SPECIFICATIONS. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions and the following relationships apply:

Hierarchy of Contract Documents		
Special Provisions	Hold over:	Plans, Recurring Special Provisions, Supplemental Specifications, and Standard Specifications
Plans	Hold over:	Recurring Special Provisions, Supplemental Specifications, and Standard Specifications
Recurring Special Provisions	Hold over:	Supplemental Specifications and Standard Specifications
Supplemental Specifications	Hold over:	Standard Specifications
Contract Plans	Hold over:	Standard Plans

Hierarchy of Standard Specifications		
Technical Specifications	Hold over:	General Provisions, Cited Standards for Materials or Testing, Cited FAA Advisory Circulars
General Provisions	Hold over:	Cited Standards for Materials or Testing, Cited FAA Advisory Circulars

The Contractor shall not take advantage of any apparent error or omission on the plans or specifications. In the event the Contractor discovers any apparent error or discrepancy, he shall immediately call upon the Engineer for interpretation and decision, and such decision shall be final.

50-04 COOPERATION OF CONTRACTOR. The Contractor will be supplied with a minimum of two sets of approved plans and contract assemblies including special provisions, one set of which the Contractor shall keep available on the work at all times.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the Resident Engineer, his/her inspectors, and other Contractors in every way possible. The Resident Engineer shall allocate the work and designate the sequence of construction in case of controversy between Contractors.

The Contractor shall have on the work at all times, as the Contractor's agent, a competent English-speaking superintendent capable of reading and thoroughly understanding the plans and Specifications and thoroughly experienced in the type of work being performed, who shall receive instructions from the Resident Engineer or authorized representatives. The superintendent shall have full authority to execute orders or directions of the Resident Engineer without delay, and to promptly supply such materials, equipment, tools, labor and incidentals as may be required. Such superintendent shall be furnished irrespective of the amount of work sublet.

A weekly meeting shall be scheduled during construction to discuss work areas, scheduling, etc. The superintendent for the project, the subcontractor's foreman, and the Resident Engineer are required to attend this meeting. The Airport Management and the Division may attend the meeting.

50-05 COOPERATION BETWEEN CONTRACTORS. The Division reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct his/her work so as not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with his/her contract and shall protect and save harmless the Division and Owner from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced by him because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange his/her work and shall place and dispose of the materials being used so as not to interfere with the operations of the other Contractors within the limits of the same project. He shall join his/her work with that of the others in acceptable manner and shall perform it in proper sequence to that of the others.

Other contracts may be under construction concurrently resulting in more than one Contractor working on the airport at the same time.

The Contractor shall plan and conduct his/her work so as not to interfere or hinder the progress or work being performed by other Contractors. The timely prosecution of the overall project is dependent upon the proper coordination between Contractors. It is to be fully understood by the Contractor that the prosecution of the overall projects and the safety and convenience of the aviation public are the governing criteria for resolving conflicts which may arise between his/her schedule and the schedule of other Contractors. When conflicts arise, resolution of such conflicts will be made by the Airport Management through the Resident Engineer in the best interest of the airport. Delays, changes in scheduling, or expedition of work under this contract to coordinate the timely prosecution of work will be considered incidental to the contract and no additional compensation will be allowed.

50-06 CONSTRUCTION LAYOUT STAKES. The Contractor will be required to furnish and place construction layout stakes for this project. The Resident Engineer will locate and reference the centerline of survey and all intersecting points and will establish bench marks along the line of the improvement outside construction limits. Locating and referencing the centerline of survey shall consist of locating and referencing control points such as point of curvature, points of tangent, and sufficient points on tangent to provide a line of sight. Control points set by the Resident Engineer shall be identified in the field to the Contractor, and the field notes shall be kept in the office of the Resident Engineer.

The Contractor shall provide field surveys directed by a registered surveyor or engineer, and set all additional stakes for this project which are needed to establish offset stakes, reference points, slope stakes, pavement and grade, stakes for culverts, sewers and drainage structures, paved gutters, walls, monuments, fence, right-of-way lines, and any other horizontal or vertical controls, including supplementary bench marks necessary to secure a correct layout of the work. Grading slope stakes shall be set at sufficient intervals (not to exceed 100 feet) to accurately outline the slopes. Stakes for line and grade of pavement shall be set at sufficient station intervals (not to exceed 25 feet) to assure substantial conformance to plan line and grade. Staking of right-of-way lines, if applicable, shall consist of placing tall stakes, properly identified and readily discernible, at points of change in width or direction of the right-of-way and at points along the line so that at least two of the stakes can be seen distinctly from any point of the line. Right-of-way lines shall be staked at locations where construction is to be performed prior to beginning construction. The Contractor will not be required to set additional stakes to locate a utility line which is not included as a pay item in the contract, or to determine the property line between properties.

The Contractor shall be responsible for having the finished work substantially conform to the line, grades, elevations and dimensions called for in the plans. Any inspection or checking of the Contractor's layout by the Resident Engineer and the acceptance of all or any part of it shall not relieve the Contractor of his/her responsibility to secure the proper dimensions, grades, and elevations of the several parts of the work. The Contractor shall exercise care in the preservation of stakes and bench marks, and shall have them reset by a registered land surveyor at his/her expense when any are damaged, lost, displaced or removed. The Contractor shall use a registered surveyor or engineer and competent personnel and suitable equipment for the layout work required.

RESPONSIBILITY OF THE RESIDENT ENGINEER

- A. The Resident Engineer will locate and reference the centerline of all pavements and applicable baselines at 500 ft intervals. Locating and referencing the centerline of survey will consist of locating and referencing the control points of the centerline such as PC's, PT's, and as many POT's as are necessary to provide a line of sight.
- B. Bench marks will be established along the project outside of construction lines and not exceeding 1,000 foot intervals horizontally and 20 feet vertically.

- C. Stakes set for A. and B. above shall be identified in the field to the Contractor and the field notes kept in the Resident Engineer's office for references by him.
- D. The Resident Engineer will check clearances both horizontal and vertical at all grade separations, if applicable.
- E. The Resident Engineer will make random checks of the Contractor's staking to determine if the work is in substantial conformance with the plans. Where the Contractor's work will tie into the work that is being or will be done by others, checks will be made to determine if the work is in conformance with the proposed overall grade and horizontal alignment.
- F. The Resident Engineer will set all stakes for utility adjustments and for building fences, if necessary, along the right-of-way line by parties other than the Contractor.
- G. Immediately after the Contractor has staked the drainage structures, the Resident Engineer will check the staking, either visually or by instrument, to determine if the structures fit the waterways in horizontal alignment and vertical elevation. If it is necessary to redesign the drainage structure, the Resident Engineer will furnish a revised design and re-stake the structure.
- H. The Resident Engineer will make all measurements and take all cross sections from which the various pay items are to be measured, such as cross sections for all borrow pits and channel changes, additional measurements needed to determine the amount of earthwork and all measurements on which the depth of subbase, bases or pavements are to be verified.
- I. Where the Contractor, in setting construction stakes, discovers discrepancies, the Resident Engineer will check to determine their nature and make whatever revisions are necessary in the plans, including the recross-sectioning of the area involved, and all additional re-staking necessary.
- J. The Resident Engineer will accept responsibility for the accuracy of specific stakes that are covered by random instrument checks and recorded, provided no displacement occurs. Any errors that are apparent shall be immediately called to the Contractor's attention, and the Contractor shall be required to make the necessary correction before the stakes are used for construction purposes.
- K. All measurements necessary to determine the final pay quantities must be made by the Resident Engineer independently of the Contractor's station stakes and any bench marks established by the Contractor.
- L. If requested, the Resident Engineer will furnish a schedule showing the pavement profile grade elevations at intervals of 25 feet.

RESPONSIBILITY OF THE CONTRACTOR

- A. The Contractor will set all other stakes necessary to establish limits and elevations of the work and shall define right-of-way for the project, if applicable.
- B. The right-of-way shall be considered to be defined when stakes readily discernible, have been placed at points of change in width or direction of the right-of-way line and at points along the line so that at least two such right-of-way stakes can be seen from any point on the line.
- C. The Contractor will not be required to set additional stakes to locate a utility line or to determine the property line between properties.
- D. Field notes shall be kept in standard survey field notebooks and these books shall become the property of the Division at the completion of the project.
- E. It is not considered the responsibility of the Contractor to make a detailed check of the accuracy of the plans; however, it is expected that the Contractor will advise the Resident Engineer promptly of known errors in the plans.

- F. The Contractor shall reset the existing control points shown on the plans and establish ties for the reset points.

The ties established shall meet the approval of the Resident Engineer.

The Contractor will be restricted to iron pins or drill holes for monumentation. Nails and iron pins shall not be used in locations where they could be removed by snow plows.

The control points to be reset are all survey monuments, PI's, PC's, PT's, and POT's.

This item shall not be paid for separately, but shall be considered incidental to the pay item for which the layout is required.

- G. The Contractor shall be required to establish a grid at the edges of each paving line on 25' centers and document elevations prior to placing the proposed pavement. These grades shall immediately be provided to the Resident Engineer. The Contractor shall also provide a table showing the existing pavement elevations, proposed pavement elevations and the proposed pavement thickness a minimum of 36 hours prior to paving. If for any reason the pavement thickness is less than the design thickness, the profiles may be adjusted.

50-07 AUTOMATICALLY CONTROLLED EQUIPMENT. Whenever batching or mixing plant equipment is required to be operated automatically under the contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for a period of 48 hours following the breakdown or malfunction, provided this method of operations will produce results which conform to all other requirements of the contract.

50-08 AUTHORITY AND DUTIES OF THE RESIDENT ENGINEER. As the direct representative of the Project Engineer, the Resident Engineer has immediate charge of the engineering details of each construction project. The Resident Engineer is authorized to administer the project to ensure satisfactory completion of the construction. The Resident Engineer is authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The Resident Engineer is not authorized to revoke, alter, or waive any provision of the contract. The Resident Engineer is not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

The Resident Engineer is authorized to notify the Contractor or the Contractor's representative of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials and to suspend any work in question until such issues can be referred to the Engineer for his/her decision.

The Resident Engineer is responsible for reviewing and verifying conformance of all shop drawings with the plans and specifications.

50-09 AUTHORITY AND DUTIES OF THE INSPECTOR. Inspectors will be authorized to inspect all work done and materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication or manufacture of the materials to be used. Inspectors are not authorized to revoke, alter or waive any provision of the contract. Inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

50-10 INSPECTION OF THE WORK. All materials and each part or detail of the work shall be subject at all times to inspection by the Engineer. Such inspection may include mill, plant, or shop inspection, and any material furnished under the specifications is subject to such inspection. The Engineer shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the Engineer requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the placing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or

examined prove unacceptable, the uncovering or removing, and the placing of the covering or making good of the parts removed, will be at the Contractor's expense.

Any work done or materials used without supervision or inspection by an authorized representative of the Engineer may be ordered removed and replaced at the Contractor's expense unless the representative failed to inspect after having been given reasonable notice in writing that the work was to be performed.

For federally assisted contracts, the work shall be subject to the inspection of the representatives of the Federal Government, but such inspections shall in no sense make the Federal Government a party to the contract.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the Owner, authorized representatives of the owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

Work performed by the Contractor outside of daylight hours shall be done under sufficient artificial area lighting to allow for proper construction methods and inspection.

Lights shall consist of vehicle or moveable pole mounted floodlights and/or spotlights of sufficient number to illuminate the work area. Vehicle headlights will be allowed only in addition to other lights mentioned above. Lighting shall not interfere with air operations. Any work being performed under insufficient artificial lighting, in the Resident Engineer's judgment, shall be stopped until such time as additional lighting is provided. All work performed during that time will not be acceptable until proper inspection and testing can be made.

50-11 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK. All work which does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the Engineer as provided in the subsection titled CONFORMITY WITH PLANS AND SPECIFICATIONS of this section.

Unacceptable work and defective pavement, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of the subsection titled CONTRACTOR'S RESPONSIBILITY FOR WORK of Section 70.

No removal work made under provision of this subsection shall be done without lines and grades having been given by the Resident Engineer. Work done contrary to the instructions of the Resident Engineer, work done beyond the lines shown on the plans or as given, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor's expense.

50-12 LOAD RESTRICTIONS. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage which may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor shall be responsible for all damage done by his/her hauling equipment and shall correct such damage at his/her own expense.

Prior to the start of construction operations, the Resident Engineer and the Contractor shall document the condition of the local roads and the airport entrance roads to be used for Contractor's access and haul routes.

Contractor's use of the existing airfield pavement and airport entrance pavements by equipment and loaded trucks shall be minimized. Any damage to existing airport pavement shall be repaired by the Contractor at his/her own expense.

If the Contractor uses existing airfield pavements, he shall sweep all airport pavements as directed by the Resident Engineer or Airport Management. Failure to comply with the Resident Engineer's or the Airport Management's directives will be grounds for suspension of work until such time as the unsatisfactory condition is corrected.

The Contractor shall obtain all necessary permits and temporary easements for the public road(s) to be used for construction hauling and construction access with the City, Township, County, Illinois Department of Transportation and/or any agency that maintains the road(s). The Contractor shall be responsible for any damage to the public roadways caused by construction traffic hauling to this project.

The Contractor shall provide, install and maintain any warning signs (trucks entering highway, etc.) as required by the City, Township, County or Illinois Department of Transportation and/or any agency that maintains the roadway.

50-13 MAINTENANCE DURING CONSTRUCTION. The Contractor shall maintain the work during construction and until the work is accepted. This maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the unit prices bid on the various contract items, and the Contractor will not be paid an additional amount for such work.

Waste and loose material capable of causing damage to aircraft landing gears, propellers or engines should not be placed on active aircraft movement areas. Material tracked on these areas shall be removed continuously during the work.

50-14 FAILURE TO MAINTAIN THE WORK. Should the Contractor at any time fail to maintain the work as provided in the subsection titled MAINTENANCE DURING CONSTRUCTION of this section, the Resident Engineer shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to any exigency that exists.

Should the Contractor fail to respond to the Resident Engineer's notification, the Engineer may suspend any work necessary for the Owner to correct such unsatisfactory maintenance condition, depending of the exigency that exists. Any maintenance cost incurred by the Owner shall be deducted from monies due or to become due the Contractor.

50-15 PARTIAL ACCEPTANCE. If at any time during the prosecution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the Owner, he may request, through the Resident Engineer, the Engineer to make final inspection of that unit. If the Engineer finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, he may accept it as being completed, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the Owner shall not void or alter any provision of the contract.

50-16 FINAL INSPECTION. Upon due notice from the Contractor of presumptive completion of the entire project, the Engineer will make an inspection. If all construction provided for and contemplated by the contract is found to be completed in accordance with the contract, plans, and specifications such inspection shall constitute the final inspection. The Engineer shall notify the Contractor in writing of final acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the Engineer will give the Contractor the necessary instructions (punch list) for correction of same, and the Contractor shall immediately comply with and execute such punch list. Upon correction of the work, another inspection will be made to determine that the work has been satisfactorily completed. In such

event, the Engineer will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

50-17 CLAIMS FOR ADJUSTMENT AND DISPUTES. If for any reason the Contractor deems that additional compensation is due him for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, he shall notify the Engineer in writing of his/her intention to claim such additional compensation before he begins the work on which he bases the claim. If such notification is not given or the Engineer is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the Engineer has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit his/her written claim to the Engineer.

Nothing in this subsection shall be construed as a waiver of the Contractor's right to dispute final payment based on difference in measurements or computations.

50-18 PLANS AND WORK DRAWINGS. Plans showing details as are necessary to give a comprehensive idea of the construction contemplated will be furnished by the Engineer.

The Contractor shall submit to the Project Engineer for review and comment, such additional shop, working, or layout drawings pertaining to the construction of the work, as may be required, and prior to the approval of such plans or drawings, any work done or materials ordered shall be at the Contractor's risk.

When the contract includes work adjacent to a highway or roadway and falsework, cofferdams, or sheeting is required, the Contractor shall submit to the Project Engineer for approval and the Highway District Engineer's approval, plans for the falsework, cofferdams, or sheeting. The plans shall be submitted sufficiently in advance of the time the Contractor intends to start work to permit checking. No such work shall be started prior to receipt by the Contractor of approval of the plans for the falsework, cofferdams, or sheeting. The Contractor shall give the Project Engineer not less than 10 days notice, in writing, prior to beginning such construction. The cost of furnishing such drawings shall be incidental to the contract and no additional compensation will be allowed the Contractor for any delays resulting therefrom.

The Contractor shall prepare shop, working, or layout drawings for all parts of the work. Before commencing any work on a pay item or providing any material, the Contractor shall submit for review by the Project Engineer, all drawings relating to the construction arrangement or disposition of the work including drainage and electrical materials entering into the contract, and show the complete materials with manufacturer's specifications of same. The Contractor shall carefully check all his/her drawings making sure they are complete in all detail.

Shop drawings submitted by the Contractor for materials and/or equipment to be provided as a part of the contract shall be reviewed by the Project Engineer. Shop drawings shall be fully descriptive, complete and of sufficient detail for ready determination of compliance.

Shop drawings submittals shall contain a letter of certification from the manufacturer stating that all materials furnished for the project conform to the contract documents requirements.

The review of the submittals by the Project Engineer with "no exceptions taken" will indicate only that the general method of construction and detailing is satisfactory. Such review will not relieve the Contractor of the responsibility for any error which may exist as the Contractor is responsible for the dimensions and designs of adequate connections, detail and satisfactory construction of all work. The Project Engineer shall note any "exceptions taken" to date submitted and indicate when resubmittal is required to determine compliance.

To aid the Contractor in his/her preparation of the shop drawing submittal, a list of submittals will be provided by the Division at the pre-construction conference. This list will not be considered by the Contractor as being complete. The Resident Engineer or the Division at his/her option may request additional information if in his/her opinion, the information is necessary to adequately review the work.

Drawings shall be submitted within two weeks after the date of the Notice to Proceed or within six weeks of the Notice of Award whichever occurs first.

The Contractor shall submit at least eight (8) copies of each drawing to be reviewed, of which six (6) copies will be retained by the Project Engineer for his/her use and records. Two (2) copies of each drawing will be returned to the Contractor.

The following information shall be clearly marked on each shop, working, and layout drawing, catalog cut, pamphlet specifications sheet, etc., submitted.

PROJECT LOCATION:	(Airport Name)
PROJECT TITLE:	
PROJECT NUMBERS:	Illinois Project: AIP Project:
CONTRACT ITEM:	
SUBMITTED BY:	(Contractor/Subcontractor Name)
DATE:	

50-19 MATERIAL DOCUMENTATION RESPONSIBILITIES OF THE CONTRACTOR. The Standard Specifications for Construction of Airports make provisions for inspection of materials and construction and establish that it is the Contractor's responsibility to provide materials that meet specification requirements and to produce work strictly in accordance with the intent of the plans and specifications. It requires the close cooperation and communication between the Contractor, the Resident Engineer and the producer/supplier to assure proper inspection coverage. The Contractor's responsibilities include but aren't limited to:

- A. As far in advance as possible, the Contractor shall furnish the Resident Engineer information as to the producers (not the suppliers) of all materials and all components that will be used on the project.
- B. The Contractor shall order materials as early as possible and notify the District Office or the Bureau of Materials and Physical Research so that proper arrangements may be made for inspection if the material is source inspected and approved under IDOT jurisdiction. When contacting IDOT, the Contractor shall reference the MISTIC Contract Number for the contract.
- C. The Contractor shall notify the supplier that State inspection is required and inform the supplier not to ship without inspection.
- D. When ordering, the Contractor shall give the supplier the correct MISTIC Contract Number (A####-1), kind of material and by specification identification. He shall instruct the supplier that this information should appear on the delivery ticket. A copy of the delivery ticket and any evidence of inspection shall be forwarded to the Resident Engineer.
- E. The Contractor shall submit to the Resident Engineer a catalog cut/specification sheet for the material and a letter of certification from the producer that the material will meet the project specifications. These submittals should be made as far in advance of installation as possible.
- F. The Contractor should instruct the supplier to provide materials that are sufficient to insure that tests made at the job site will fall within the specification limits.
- G. IDOT inspectors usually are assigned to the plants, quarries or other supply sources as needed. The Contractor should plan the work so that IDOT has sufficient advance notice to assign an inspector if that material inspection is required.
- H. The Resident Engineer reserves the right to request additional evidence of inspection or documentation of questionable materials.

SECTION 60. CONTROL OF MATERIALS

60-01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS. The materials used on the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish complete statements to the Engineer as to the origin, composition, and manufacture of all materials to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

As a minimum, the Contractor shall provide, upon delivery, statements (shipment tickets, source, manufacturer's certification, analysis, sample, etc.) as required by the Illinois Department of Transportation, Division of Aeronautics "Manual for Documentation of Airport Materials - Latest Edition" or requested by the Division of Aeronautics Engineer of Construction and Materials.

No materials shall be incorporated into the work nor shall any payment be made on any materials until the proper material documentation in accordance with the Standard Specifications, Supplemental Specifications, applicable Recurring Special Provisions and Contract Special Provisions has been submitted and reviewed with no exceptions taken by the Resident Engineer or the Project Engineer.

All steel and manufactured products shall have proof of domesticity documentation accompanying the material.

Any and all steel products used in the performance of the contract is required to adhere to the Illinois Steel Products Procurement Act, which requires that all steel items be of 100 percent domestic origin and manufacture. Any products listed under the Federal Aviation Administration's (FAA) nationwide approved list of "Equipment Meeting Buy American Requirements" shall be deemed as meeting the requirements of the Illinois Steel Products Procurement Act.

The Contractor must assure that only domestic steel and domestically manufactured products will be used by the Contractor, subcontractors, producers, and suppliers in the performance of the contract. The North American Free Trade Agreement (NAFTA) specifically excluded federal grant programs such as the AIP. Therefore, NAFTA does not change the requirement to comply with the Buy American requirement in the Act. Exceptions to this are for products, other than steel, that:

- A. the FAA has determined, under the Aviation Safety and Capacity Expansion Act of 1990, are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality;
- B. the FAA has determined, under the Aviation Safety and Capacity Expansion Act of 1990, that domestic preference would be inconsistent with the public interest;
- C. the FAA has determined that inclusion of domestic material will increase the cost of the overall project contract by more than 25 percent; or
- D. the FAA has determined, under the Aviation Safety and Capacity Expansion Act of 1990,
 1. the cost of components and subcomponents produced in the United States is more than 60 percent of the cost of all components of the facility or equipment, and
 2. final assembly of the facility or equipment has occurred in the United States.

The FAA must grant waivers for any items that are included in these above exceptions. The Contractor can review items already approved under the FAA nationwide approved list of "Equipment Meeting Buy American Requirements" on the FAA website, which do not require a specific FAA waiver.

All waivers are the responsibility of the Contractor, must be obtained prior to the Notice to Proceed, and must be submitted to the Division for review and approval before being forwarded to the FAA. Any

products used on the project that cannot meet the domestic requirement, and for which a waiver prior to the Notice to Proceed was not obtained, will be rejected for use and subject to removal and replacement with no additional compensation.

At the Engineer's option, materials may be approved at the source of supply before delivery is started. If it found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

The Contractor shall furnish airport lighting equipment that conforms to the requirements of cited materials specifications. In addition, where an FAA specification for airport lighting equipment is cited in the plans or specifications, the Contractor shall furnish such equipment that is:

- A. Listed in the FAA Advisory Circular (AC) 150/5345-53, Approved Airport Lighting Equipment, that is in effect on the date of advertisement; and,
- B. Produced by a manufacturer qualified (by FAA) to produce such specified and listed equipment.

60-02 SAMPLES, TESTS AND CITED SPECIFICATIONS. All materials used in work shall be subject to inspection, testing and approval by the Engineer before incorporation in the work. Any work in which untested materials are used without approval or written permission of the Engineer shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the Engineer, shall be removed at the Contractor's expense. Unless otherwise designated, tests in accordance with the cited standard methods of ASTM, AASHTO, Federal Specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids will be made by and at the expense of the Engineer. Samples will be taken by a qualified representative of the Engineer. The testing organizations performing on site field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel, including the Contractor's representative at his/her request. Unless otherwise designated, samples will be taken by a qualified representative of the Engineer. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representatives at his/her request.

60-03 CERTIFICATION OF COMPLIANCE. The Engineer may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's certificates of compliance stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the Engineer.

When a material or assembly is specified by "brand name or equal" and the Contractor elects to furnish the specified "brand name", the Contractor shall be required to furnish the manufacturer's certificate of compliance for each lot of such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

- A. Conformance to the specified performance, testing, quality or dimensional requirements; and,
- B. Suitability of the material or assembly for the use intended in the contract work.

Should the Contractor propose to furnish an "or equal" material or assembly, he shall furnish the manufacturer's certificates of compliance as hereinbefore described for the specified brand name material or assembly. However, the Engineer shall be the sole judge as to whether the proposed "or equal" is suitable for use in the work.

The Engineer reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

60-04 PLANT INSPECTION. The Engineer or his/her authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for his/her acceptance of the material or assembly.

Should the Engineer conduct plant inspections, the following conditions shall exist:

- A. The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom he has contracted for materials.
- B. The Engineer shall have full entry, within the allowable site specific safety regulations, at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.
- C. If required by the Engineer, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Office or working space should be conveniently located with respect to the plant.

It is understood and agreed that the Engineer shall have the right to re-test any material which has been tested and approved at the source of supply after it has been delivered to the site. The Engineer shall have the right to reject only material which, when re-tested, does not meet the requirements of the contract, plans or specifications.

60-05 RESIDENT ENGINEER'S FIELD OFFICE. The Contractor shall furnish for the duration of the project one building for the exclusive use of the Resident Engineer as a field office and field testing laboratory when and as specified in each project.

60-06 STORAGE OF MATERIALS. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the Engineer. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans, the storage of materials and the location of the Contractor's plant and parked equipment or vehicles shall be as directed by the Engineer. Private property shall not be used for storage purposes without written permission of the owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the Engineer a copy of the property owner's permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at his/her entire expense, except as otherwise agreed to (in writing) by the owner or lessee of the property.

Topsoil shall be stockpiled at the locations designated by the Resident Engineer and in accordance with the approved Safety and Phasing Plan.

Stockpiled material at the construction site should be prominently marked and lighted in a manner acceptable to the Airport Management, when required by the Airport Management.

Stockpiled material should be constrained in a manner to prevent movement resulting from aircraft blast or wind conditions in excess of 10 knots.

60-07 UNACCEPTABLE MATERIALS. All materials not conforming to the requirements of the contract at the time they are used will be considered unacceptable and all such materials will be rejected and shall be removed immediately from the site of the work unless otherwise instructed by the Engineer. If in place, they shall be removed and replaced with acceptable materials at no additional cost to the Department. No rejected material, the defects of which have been corrected, shall be used until approval has been given.

60-08 OWNER-FURNISHED MATERIALS. The Contractor shall furnish all materials required to complete the work, except those specified herein (if any) to be furnished by the Owner. Owner-furnished materials shall be made available to the Contractor at the location specified herein.

All costs of handling, transportation from the specified location to the site of work, storage, and installing Owner-furnished materials shall be included in the unit price bid for the contract item in which such Owner-furnished material is used.

After any Owner-furnished material has been delivered to the location specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies which may occur during the Contractor's handling, storage, or use of such Owner-furnished material. The Owner will deduct from any monies due or to become due the Contractor any cost incurred by the Owner in making good such loss due to the Contractor's handling, storage, or use of Owner-furnished materials.

60-09 SOURCE OF MATERIALS. The Contractor, as soon as possible following the contract award, shall inform the Division of the sources of all materials contained in the contract.

If the Contractor decides to investigate new sources of supply, the Contractor shall furnish without charge such preliminary samples and reports rendered, but it is understood that such tests are for informational purposes only and that they shall not be construed as a guarantee of acceptance of any material which may be delivered later for incorporation in the work. Only materials actually delivered for use will be considered, and their acceptance will be based solely upon the results of the tests made on these materials.

If the Contractor installs equipment or apparatus to produce materials from new sources of supply, it will be at his/her own risk, and the Contractor shall assume full responsibility for the production of uniform and satisfactory materials. In case of failure of a source of supply to produce materials satisfactory to the Division, the Contractor shall indemnify and save harmless the Division from any and all claims for loss or damage of whatever nature which the Contractor may have suffered by reason of the installation of equipment and the operation of such sources of supply.

60-10 HANDLING MATERIALS. All materials shall be handled in such manner as to preserve their quality and fitness for the work. Aggregates shall be transported from the storage sites to the work in tight vehicles so constructed as to prevent loss or segregation of materials after loading and measuring in order that there may be no inconsistencies in the quantities of materials intended for incorporation in the work as loaded, and the quantities as actually received at the place of operations.

SECTION 70. LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

70-01 LAWS TO BE OBSERVED. The Contractor shall at all times observe and comply with all Federal and State laws, local laws, ordinances, and regulations which in any manner affect the conduct of the work, and all such orders or enactments as exist at the present and which may be enacted later, of legislative bodies or tribunals having legal jurisdiction or which may have affect over the work, and no plea of misunderstanding or ignorance thereof will be considered. The Contractor shall indemnify and save harmless the Owner and the State and all of its officers, agents, employees, and servants against any claim or liability arising from or based on the violation of such law, ordinance, regulation, order, or enactment, whether by the Contractor or anyone subject to the Contractor.

70-02 WORKER'S COMPENSATION INSURANCE. Prior to the approval of his/her contract by the Division, the Contractor shall furnish to the Division certificates of insurance covering Worker's Compensation, or such satisfactory evidence that this liability is otherwise taken care of according to Section 4(a) of the "Worker's Compensation Act of the State of Illinois" as amended

Such insurance, or other means of protection as herein provided, shall be kept in force until all work to be performed under the terms of the contract has been completed and accepted in according to the Specifications, and it is hereby understood and agreed that the maintenance of such insurance or other protection, until acceptance of the work by the Division, is a part of the contract. Failure to maintain such insurance, cancellation by the Industrial Commission of its approval of such other means of protection as might have been elected, or any other act which results in lack of protection under the said "Worker's Compensation Act" may be considered as a breach of the contract.

70-03 EMPLOYMENT PREFERENCE. The Contractor shall comply with the "Veterans Preference Act" as amended. The foregoing requirements shall not be applied to discriminate or give preference to veterans of a district over veterans of any political jurisdiction, state, possession, or territory of the United States on Federal-Aid projects.

70-04 PERMITS, LICENSES, AND FEES. The Contractor shall procure all permits and licenses, pay all charges and fees, and give all notices necessary and incident to the due and lawful prosecution of the work.

It will be the Contractor's responsibility to obtain permission and any applicable permits to use the roads (federal, state, county, township) leading to the airport construction site. The Contractor will be responsible for road maintenance, cleanup and any other requirements agreed upon for the right to use the roads. This requirement will be considered an incidental cost to the contract and no additional compensation will be allowed.

70-05 PATENTED DEVICES, MATERIALS, AND PROCESSES. If any design, device, material, or process covered by letters, patent or copyright is used by the Contractor, whether required or not, the Contractor shall provide for such use by suitable legal agreement with the patentee or owner, guaranteeing the Division indemnity from and against all claims for infringement, and shall include the cost of such agreement in the price bid for the work. It shall be the duty of the Contractor, if so demanded by the Division, to furnish said Division with a copy of the legal agreement with the patentee or owner, and if such copy is not furnished when demanded, then the Division may, if it so elects, withhold any and all payments to said Contractor until said legal agreement is furnished. If a suitable legal agreement with the patentee or owner is not made as required herein, the Contractor and surety shall indemnify and save harmless the Division from any and all claims for infringement by reason of the use of any such patented design, device, material, or process, or any trademark or copyright in connection with the work agreed to be performed under the contract, and shall indemnify the Division for any cost, expense, and damages which it may be obliged to pay by reason of any such infringement at any time during the prosecution or after the completion of the work.

70-06 RESTORATION OF SURFACES DISTURBED BY OTHERS. The Owner reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the Owner, such authorized work (by others) is indicated as follows:

Owner (Utility or Other Facility)
Location (See Plan Sheet No.)
Person to Contact (Name, Title, Address and Phone)

The Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the Engineer.

Should the owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such owners by arranging and performing the work in this contract so as to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the Engineer, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work..

70-07 FEDERAL AID PARTICIPATION. For Federally assisted contracts, the United States Government has agreed to reimburse the Owner for some portion of the contract costs. Such reimbursement is made from time to time upon the Owner's (Sponsor's) request to the FAA. In consideration of the United States Government's (FAA) agreement with the Owner, the Owner has included provisions in this contract pursuant to the requirements of the Title 49 of the United States Code (USC) and the Rules and Regulations of the FAA that pertain to the work.

As required by the USC, the contract work is subject to the inspection and approval of duly authorized representatives of the Administrator, FAA and is further subject to those provisions of the rules and regulations that are cited in the contract, plans, or specifications.

No requirement of the USC, the rules and regulations implementing the USC, or this contract shall be construed as making the Federal Government a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

70-08 SANITARY, HEALTH AND SAFETY PROVISIONS. The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of his/her employees as may be necessary to comply with the requirements of the State and local Board of Health, or of other bodies or tribunals having jurisdiction.

Attention is directed to Federal, State, and local laws, rules and regulations concerning construction safety, and health standards. The Contractor shall not require any worker to work in surroundings or under conditions which are unsanitary, hazardous, or dangerous to his/her health or safety.

70-09 PUBLIC CONVENIENCE AND SAFETY. The Contractor shall control his/her operations and those of his/her subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to his/her own operations and those of his/her subcontractors and all suppliers in accordance with the subsection titled MAINTENANCE OF TRAFFIC of Section 40 hereinbefore specified and shall limit such operations for the convenience and safety of the traveling public as specified in the subsection titled LIMITATIONS OF OPERATIONS of Section 80 hereinafter.

70-10 BARRICADES, WARNING SIGNS AND HAZARD MARKINGS. The Contractor shall furnish, erect, and maintain all barricades, warning signs, and markings for hazards necessary to protect the public and the work. When used during periods of darkness, such barricades, warning signs and hazard markings shall be suitably illuminated. Unless otherwise specified, barricades, warning signs, and markings for hazards that are in the air operations area shall be a maximum of 18 inches high. Unless otherwise specified, barricades shall be spaced not more than 10 feet apart.

For vehicular and pedestrian traffic, the Contractor shall furnish, erect, and maintain barricades, warning signs, lights and other traffic control devices in reasonable conformity with the Manual of

Uniform Traffic Control Devices for Streets and Highways (published by the United States Government Printing Office).

Type I barricades shall be provided and conform to IDOT Division of Highways Specifications and Standards for Type I Barricades. The barricades shall be lighted with a flashing or steady-burning red light. The barricades shall be sufficiently weighted with sandbags or other appropriate method to withstand high winds or jet blast without dislocation.

Barricades shall be placed as shown in the plans or as directed by the Resident Engineer or Airport Management. The Contractor shall be responsible for supplying, maintaining and any moving of all barricades. Lights shall be maintained in proper working order. No separate payment will be made for supplying, maintaining and moving barricades but shall be considered incidental to the contract. Any cost of labor and equipment necessary to insure safety at the airport for the duration of the project will be considered incidental to the contract and no additional reimbursement for these items of work will be allowed.

When the work requires closing an air operations area of the airport or portion of such area, the Contractor shall furnish, erect, and maintain temporary markings and associated lighting conforming to the requirements of FAA Advisory Circular 150/5340-1 (latest revision), Standards for Airport Markings.

The Contractor shall furnish, erect, and maintain markings and associated lighting of open trenches, excavations, temporary stock piles, and his/her parked construction equipment that may be hazardous to the operation of emergency fire-rescue or maintenance vehicles on the airport in reasonable conformance to FAA Advisory Circular 150/5370-2 (latest revision), Safety on Airports During Construction Activity.

The Contractor shall identify each motorized vehicle or piece of construction equipment in reasonable conformance to FAA Advisory Circular 150/5370-2 (latest revision).

When any vehicle is required to travel over any portion of the aircraft movement area and runway approach area, the vehicle shall be properly identified to operate in the area or provided with a flag on a staff so attached to the vehicle so that the flag will be readily visible. The flag should be not less than 3-foot square consisting of a checkered pattern of international orange and white squares of not less than one foot on each side and displayed in full view above the vehicle. A flag or escort vehicle is not required for vehicles which have been painted, marked and lighted for routine use on aircraft movement areas. Contractor vehicles that are engaged in continuous hauling operations are not required to display a flag. Any vehicle operating on the movement area during the hours of darkness should be equipped with an amber flashing dome-type light, in accordance with local and/or state codes.

The Contractor shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing work which requires such erection and shall maintain the barricades, warning signs, and markings for hazards until their dismantling is directed by the Resident Engineer.

Open-flame type lights shall not be permitted within the air operations areas of the airport.

70-11 USE OF EXPLOSIVES. When the use of explosives is necessary for the prosecution of the work, the Contractor shall exercise the utmost care not to endanger life or property, including new work. The Contractor shall be responsible for all damage resulting from the use of explosives.

All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the Engineer and, in general, not closer than 1,000 feet from the work or from any building, road or other place of human occupancy.

The Contractor shall notify each property owner and public utility company having structures or facilities in proximity to the site of the work of his/her intention to use explosives. Such notice shall be given sufficiently in advance to enable them to take such steps as they may deem necessary to protect their property from injury.

The use of electrical blasting caps shall not be permitted on or within 1,000 feet of the airport property.

70-12 PROTECTION AND RESTORATION OF PROPERTY. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property marks until the Resident Engineer has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the prosecution of the work, resulting from any act, omission, neglect, or misconduct in his manner or method of executing the work, or at any time due to defective work or materials, and said responsibility will not be released until the project shall have been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect or misconduct in the execution of the work, or in consequence of the nonexecution thereof by the Contractor, he shall restore, at his/her own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, rebuilding, or otherwise restoring as may be directed, or he shall make good such damage or injury in an acceptable manner.

The Contractor shall take special precautions during construction to protect existing pavement, graded ground, landscaping, areas with turf or sod, buildings, lights, guidance signs, Nav aids, and other existing features of the airport and surrounding area from damage or disturbance. Any such areas disturbed, damaged, or destroyed by the Contractor, except those areas within the limits of construction, shall be returned to their pre-construction condition to the satisfaction of the Engineer. The cost of work necessary to accomplish these requirements shall be considered incidental to the contract and no additional compensation will be allowed.

The Contractor shall take every precaution against fire.

70-13 RESPONSIBILITY FOR DAMAGE CLAIMS. The Contractor shall indemnify and save harmless the Division, the Owner and the FAA and their officers and employees from all suits, actions or claims of any character brought because of any injuries or damage received or sustained by any person or persons, or property on account of the operations of the Contractor; on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act of omission, neglect, or misconduct of said Contractor; or because of any claims or amounts arising or recovered under the "Worker's Compensation Act" or any other law, ordinance, order, or decree. The Contractor shall also indemnify and save harmless the engineering firm retained by the Owner to provide construction inspection. Money due the Contractor under and by virtue of his/her contract retained as may be considered necessary by the Division for such purpose may be retained for the use of the Division or, in case no money is due, his/her claims for injuries or damages as aforesaid shall have been settled and suitable evidence to that effect furnished to the Division, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he is adequately protected by public liability and property damage insurance.

This contract is not intended by any of the Provisions of any part of the contract to create the public or any member thereof a third party beneficiary, or to authorize any one not a party to this contract to maintain a suit for personal injuries or property damage pursuant to the terms or Provisions of this contract. The duties, obligations and responsibilities of the parties to this contract with respect to third parties shall remain as imposed by law.

The Contractor, prior to execution of the contract, shall file with the Division copies of completed certificates of insurance, satisfactory to the Division, to afford protection against all claims for damages to public or private property, and injuries to persons, arising out of and during the progress of the work to its completion, as defined by Section 80-12. The policy of insurance shall include the owner and the participating agencies as an additional insured or provide separate coverage with an Owner's Protective policy. The minimum amounts of insurance shall be as follows, except no restrictions or occurrence limits will be permitted:

Bodily Injury Liability	Property Damage Liability	
Each Occurrence	Each Occurrence	Aggregate
\$2,000,000	\$1,000,000	\$2,000,000

All such insurance must include an endorsement whereby the insurer agrees to notify the Division at least 30 days prior to nonrenewal, reduction or cancellation. The Contractor shall cease operations on the project if the insurance is cancelled or reduced below the required amount of coverage. All costs for insurance as specified herein will not be paid for separately, but shall be considered as incidental to the contract. The engineering firm retained by the Owner to provide construction inspection shall be included as an additional named insured on the certificate of insurance.

70-14 THIRD PARTY BENEFICIARY CLAUSE. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create the public or any member thereof a third party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-15 OPENING SECTIONS OF THE WORK TO TRAFFIC. No portion of the work may be opened by the Contractor for public use until approved by the Resident Engineer. Should it become necessary to open a portion of the work to public traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the Resident Engineer, such portion of work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provisions of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the Owner shall be repaired by the Contractor at his/her expense.

The Contractor shall make his/her own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

It is necessary for the Contractor to complete the contract work in such a way as to maintain airfield access for all aircraft. The Contractor shall submit a progress schedule to the Project Engineer in conformance with Section 80-02 showing the estimated beginning and completion dates of each sequence of work. It is vitally important to plan and conduct the work in such a manner that the length and amount of interruption to air traffic at the airport is minimized. If necessary to complete the work within the time limitations for the contract and the schedule approved by the Division, the Contractor shall work longer than regular hours or use multiple crews and equipment, or a combination of such techniques. Any premium costs of overtime or multiple crew and equipment operations shall be at the Contractor's expense.

70-16 CONTRACTOR'S RESPONSIBILITY FOR WORK. All work of the contract, including work added to the contract, shall be under the charge and care of the Contractor until final acceptance by the Division. The Contractor shall assume all responsibility for injury or damage to the work by action of the elements or from any other cause whatsoever, and shall rebuild, repair, restore, and make good, at his/her expense, all injuries or damages to the work, except that when the work is opened to traffic by written order of the Engineer, the provisions of this article shall not apply to damage caused by such traffic and not due to the Contractor's fault or negligence.

When materials are furnished to the Contractor by the Division or Owner, for inclusion in the work, the Contractor's responsibility for all such materials shall be the same as for materials furnished by him.

In case of suspension of work from any cause whatsoever, the Contractor shall be responsible for the project and shall take such precautions as may be necessary to prevent damage to the project, provide for normal drainage and shall erect any necessary temporary structures, signs, or other facilities at his/her expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under his/her contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

70-17 CONTRACTOR'S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS. As provided in the subsection titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section, the Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the owner to construct, reconstruct, or maintain such utility services or facilities during the progress of the work. In

addition, the Contractor shall control his/her operations or prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and the owners are indicated as follows:

Utility Service or Facility
Person to Contact (Name, Title, Address, & Phone)
Owner's Emergency Contact (Phone)

It shall be the Contractor's responsibility to determine the actual location of all such facilities, including service connections to underground utilities. Prior to construction, the Contractor shall notify the utility company of his/her operational plans. The Contractor shall make arrangements for detailed information and assistance in locating utilities. In the event an unexpected utility interference is encountered during construction, the Contractor shall immediately notify the utility company, the Owner and the Resident Engineer. Any such mains and/or services disturbed by the Contractor's operations shall be restored immediately at his/her expense to the satisfaction of the utility company, Owner and the Engineer.

At points where the Contractor's operations are adjacent to properties of railroad, telegraph, telephone and power companies, or are adjacent to other property, damage to which might result in considerable expense, loss or inconvenience, work shall not be commenced until all arrangements necessary for the protection thereof have been made.

It is understood and agreed that the location of the underground utilities as indicated on the plans has been obtained from existing records. Neither the Owner, Division, nor the Project Engineers assume any responsibility whatsoever in respect to the accuracy, completeness or sufficiency of the information. There is no guarantee, either expressed or implied, that the locations, size and type of material of existing underground utilities indicated are representative of those to be encountered in the construction. Any inaccuracy or omission in such information shall not relieve the Contractor of his/her responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the owners of all utility services or other facilities of his/her plan of operations. Such notification shall be in writing addressed to THE PERSON TO CONTACT as provided hereinbefore in this subsection and the subsection titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section. A copy of each notification shall be given to the Engineer.

Within the State of Illinois, a State-Wide One Call Notice System has been established for notifying utilities. Outside the city limits of the City of Chicago, the system is known as the Joint Utility Locating Information for Excavators (JULIE) System. Within the city limits of the City of Chicago the system is known as DIGGER. All utility companies and municipalities which have buried utility facilities in the State of Illinois are a part of this system.

The Contractor shall call JULIE (800-892-0123) or DIGGER (312-744-7000), a minimum of 48 hours in advance of work being done in the area, and they will notify all member utility companies involved that their respective utility should be located. The political name of the township where the work is located, as shown on the location map, along with other location information such as land section and quarter section will have to be given.

For utilities which are not members of JULIE or DIGGER, the Contractor shall contact the owners directly. The plan general notes will indicate which utilities are not members of JULIE or DIGGER.

The type of utility and color used for marking are shown in the following table:

Utility Service	Color
Electric Power, Distribution and Transmission	Safety Red
Municipal Electrical Systems	Safety Red
Gas Distribution and Transmission	High Visibility Safety Yellow
Oil Distribution and Transmission	High Visibility Safety Yellow
Telephone and Telegraph System	Safety Alert Orange
Community Antenna and Television Systems	Safety Alert Orange
Water Systems	Safety Precaution Blue
Sewer Systems	Safety Green
Non-Potable Water and Slurry Lines	Safety Purple
Temporary Survey	Safety Pink
Proposed Excavation	Safety White (Black when snow is on the ground)

In addition to the general written notification hereinbefore provided, it shall be the responsibility of the Contractor to keep such individual owners advised of changes in his/her plan of operations that would affect such owners. The Contractor shall cooperate with the owners of any underground or overhead utility lines in their removal and rearrangement operations in order that these operations may progress in a reasonable manner, that duplication of rearrangement work may be reduced to a minimum, and that services rendered by those parties will not be unnecessarily interrupted.

Prior to commencing the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such owner of his/her plan of operation. If, in the Contractor's opinion, the owner's assistance is needed to locate the utility service or facility or the presence of a representative of the owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner's PERSON TO CONTACT no later than two normal business days prior to the Contractor's commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the Engineer.

The Contractor's failure to give the two days notice hereinabove provided shall be cause for the Engineer to suspend the Contractor's operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use excavation methods acceptable to the Engineer within 3 feet of such outside limits at such points as may be required to insure protection from damage due to the Contractor's operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, he shall immediately notify the proper authority and the Engineer and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the Engineer continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to his/her operation whether or not due to negligence or accident. The Division reserves the right to deduct such costs from any monies due or which may become due the Contractor, or his/her surety.

70-18 FURNISHING RIGHTS-OF-WAY. The Owner will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor's operations.

70-19 PERSONAL LIABILITY OF PUBLIC OFFICIALS. In carrying out any of the contract provisions or in exercising any power or authority granted to him by this contract, there shall be no liability upon the Engineer, his/her authorized representatives, or any official of the Owner either personally or as an official of the Owner. It is understood that in such matters they act solely as agents and representatives of the Owner.

70-20 NO WAIVER OF LEGAL RIGHTS. The Division shall not be precluded or estopped by final acceptance or final payment, or any measurement, estimate, or certificate made either before or after completion and acceptance of the work and payment therefore, from showing the true amount and

character of the work performed and materials furnished by the Contractor, nor from showing that any such measurement, estimate or certificate is untrue or is incorrectly made, nor that the work or materials do not in fact conform to the contract. The Division shall not be precluded or estopped, by final acceptance, final payment or any measurement, estimate, or certificate and payment in accordance therewith, from recovering from the Contractor or its sureties, or both, such overpayment and damage as it may sustain by reason of the Contractor's failure to comply with the terms of the contract.

A waiver on the part of the Division of any right under the contract or of a breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach or right to enforce any provision of the contract.

70-21 ENVIRONMENTAL PROTECTION. The Contractor shall comply with all Federal, State and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter. The Contractor shall conduct and schedule operations so as to avoid or minimize siltation of streams, lakes, ponds and reservoirs. Where, in the opinion of the Engineer, the land has a high potential for erosion, the areas that can be exposed by construction operations at any one time will be subject to approval by the Engineer and the duration of the exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion control features shall be constructed concurrently with other work as directed by the Engineer.

70-22 ARCHAEOLOGICAL AND HISTORICAL FINDINGS. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during his/her operations, any building, part of a building, structure, or object which is incongruous with its surroundings, he shall immediately cease operations in that location and notify the Engineer. The Engineer will immediately investigate the Contractor's findings and will direct the Contractor to either resume his/her operations or to suspend operations as directed.

Should the Engineer order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract modification (change order or supplemental agreement) as provided in the subsection titled EXTRA WORK of Section 40 and the subsection titled PAYMENT FOR EXTRA WORK AND FORCE ACCOUNT WORK of Section 90. If appropriate, the contract modification shall include an extension of contract time in accordance with the subsection titled DETERMINATION AND EXTENSION OF CONTRACT TIME of Section 80.

70-23 CONTRACTOR'S PUBLIC LIABILITY AND PROPERTY DAMAGE LIABILITY INSURANCE.

The Contractor, with respect to the work that he performs, will be required to carry regular Contractors' Public Liability Insurance, including automobile coverage, in limits of not less than \$500,000 for all damages arising out of bodily injuries to or death of one person and subject to that limit for each person, a total amount of \$1,000,000 for all damages arising out of bodily injuries to or death of two or more persons in any one accident, and regular Contractors' Property Damage Liability Insurance, including automobile coverage, in limits of not less than \$500,000 for all damages arising out of injury to or destruction of property in any one accident and, subject to that limit per accident, a total (or aggregate) limit of \$1,000,000 for all damages arising out of injury to or destruction of property during the policy period.

The Contractor shall furnish a certified copy of the policy to the Division. The policy shall provide that in the event the insurance should be changed or cancelled, such change or cancellation shall not be effective until 30 days after the Division has received notice of such change or cancellation from the insurance company.

70-24 CONTRACTOR'S PROTECTIVE PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE.

At the time of filing his/her contract and bonds, the Contractor shall notify the Division, in writing, as to whether or not he proposes to sublet any of the work under the terms of his/her contract. The Contractor, with respect to the operations performed for him by subcontractors, will be required to carry Contractors' Protective Public Liability and Property Damage Liability Insurance, including automobile

coverage, in the same limits as prescribed in the subsection titled CONTRACTORS' PUBLIC LIABILITY AND PROPERTY DAMAGE LIABILITY INSURANCE of this section, and shall furnish copies of policies of such insurance and certificates as above required. If no part of the work is to be sublet, this article will not apply.

Insurance coverage as required above shall be kept in force until all work to be performed under the terms of the contract has been accepted by the Division and it is clearly understood that the upkeep of these insurance policies until acceptance of the work by the Division is a part of the contract. The Contractor shall include the cost of all such insurance in his/her unit bid prices and no extra compensation will be granted to him, nor will any deduction be made by the Division due to extra work and/or decreased quantities of work and/or elimination of items.

Such insurance or other means of protection as herein provided shall be kept in force until all work to be performed under the terms of the contract has been completed and accepted in accordance with the specifications and it is hereby understood and agreed that the maintenance of such insurance or other protection, until acceptance of the work by the Division, is a part of the contract. Failure to maintain such insurance, cancellation by the Industrial Commission of its approval of such other means of protection as might have been elected, or any other act which results in lack of protection under the said "Worker's Compensation Act" may be considered as a breach of the contract.

70-25 CONTRACTOR'S WARRANTY. All materials and equipment furnished under this contract will be new unless otherwise specified, and that all work will be of good quality, free from faults and defects and in conformance with the contract documents. All work not so conforming to these standards may be considered defective. If required by the Division, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

Except where otherwise required by the Specifications, the Contractor shall provide written guarantee of all of the work performed under the contract, certifying the work to be free from defects in materials and workmanship for a period of one (1) year from the date of final acceptance of his/her completed contract work. Final completion and acceptance of the work shall be deemed to have occurred on the date of acceptance by the Owner, the Division, and the FAA, if applicable, and shall be the date of the final inspection providing no defects are observed.

In specific instances where longer guarantees are stipulated for a particular portion of the work, such longer periods shall govern and be subject to the terms of this paragraph. If the Owner has exercised his/her privilege of partial occupancy or use, the guarantee period for that occupied or used portion, and that portion only, shall commence on the date of such partial occupancy or use, provided, however, that if such equipment or portion of work is found defective or otherwise not to comply with the requirements of the contract documents, the guarantee period shall not commence until the work is corrected to comply with the contract requirements.

If the Contractor, after such notice, fails to promptly comply with the terms of the guarantee, the Owner may have the defects corrected and the Contractor and his/her surety shall be liable for all expenses thus incurred.

70-26 CONTRACTOR'S RESPONSIBILITY FOR SAFETY DURING CONSTRUCTION.

As a minimum, the Contractor shall be responsible for safety during construction as follows:

- A. Possess a copy of the approved Safety Plan distributed at the preconstruction meeting.
- B. Comply with the approved Safety Plan and construction activity plans associated with the construction project and ensure that construction personnel are familiar with safety procedures and regulations on the Airport.
- C. Provide a point of contact that will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the Airport.
- D. Possess a copy of FAA Advisory Circular 150/5370-2 (latest revision), Operational Safety on Airports During Construction.

SECTION 80. PROSECUTION AND PROGRESS

80-01 SUBLETTING OF CONTRACT. The Contractor shall not subcontract, sell, transfer, assign, or otherwise dispose of the contract or contracts or any portion thereof, or of his/her right, title, or interest therein, without written consent of the Engineer. Notwithstanding consent to subcontract approved by the Engineer, the Contractor shall perform with the Contractor's own organization, work amounting to not less than 51 percent of the total contract cost, and with materials purchased or produced by the Contractor. Items designated in the contract as "specialty items" may be performed by subcontract and the cost of any such specialty items so performed by subcontract may be deducted from the total cost before computing the amount of work required to be performed by the Contractor with his/her own organization. "Specialty items" will be those items so designated on the Summary of Quantities included in the plans.

No subcontracts, or assignments of payments due or to become due, shall in any case release the Contractor or surety of liability under the contract and bonds. All transactions of the Engineer shall be with the Contractor. The Contractor shall have a representative on the job at all times when either contract or subcontract work is being performed.

All requests to subcontract shall contain a certification that the subcontract agreement exists in writing, that the subcontract incorporates by reference the terms and conditions of the contract, and that the subcontract incorporates fully therein the required Federal and State Equal Employment Opportunity provisions and labor Compliance provisions, including the contract wage requirements. The Contractor shall permit Department or Federal representative to examine the subcontract agreements upon notice.

The Engineer may order the Contractor to remove a subcontractor who does not perform satisfactory work or does not possess the integrity, experience, ability, and equipment the work requires in accordance with the terms and conditions of the contract. The Contractor shall comply at once and shall not employ the subcontractor for any further work under the contract.

All subcontractors shall be registered with the Department as a condition for approval to perform work on the contract.

80-02 PROGRESS SCHEDULE. Prior to the issuance of the Notice to Proceed, the Contractor shall submit to the Engineer a satisfactory progress schedule which shall show the proposed sequence of work, and how the Contractor proposes to complete the various items of work within the number of calendar days set up in the contract.

This schedule shall be used for checking the progress of the work.

The Contractor shall confer with the Engineer at regular intervals in regard to the prosecution of the work in accordance with the progress schedule.

80-03 NOTICE TO PROCEED. The notice to proceed shall state the date on which it is expected the Contractor will begin the construction and from which date contract time will be charged. The Contractor shall begin the work to be performed under the contract within 10 days of the date set by the Engineer in the written notice to proceed, but in any event, the Contractor shall notify the Project Engineer at least 24 hours in advance of the time actual construction operations will begin. If no date is specified, the Contract Time will begin on the date the Contractor actually begins construction or ten (10) days from the date of the Notice to Proceed, whichever is earlier.

80-04 PROSECUTION AND PROGRESS. Unless otherwise specified, the Contractor shall submit his/her progress schedule for the Engineer as stated in subsection 80-02 PROGRESS SCHEDULE above. The Contractor's progress schedule, when approved by the Engineer, may be used to establish major construction operations and to check on the progress of the work. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the Engineer's request, submit a revised schedule for completion of the work within the contract time and modify his/her operations to provide such additional materials, equipment, and labor necessary to meet

the revised schedule. Should the prosecution of the work be discontinued for any reason, the Contractor shall notify the Engineer through the Resident Engineer at least 24 hours in advance of resuming operations.

For Federal Aid contracts, the Contractor shall not commence any actual construction prior to the date on which the notice to proceed is issued by the Engineer. Payment for work accomplished prior to the Notice to Proceed will be disallowed.

The Contractor shall notify the Resident Engineer in writing of any possible delays in delivery or availability of materials or equipment associated with this project.

Where required, the Contractor shall comply with Federal Aviation Regulations Part 107 (Airport Security), Aviation Transportation Security Act Regulation 1542, Federal Air Regulation 139 (Airport Certification), and with all rules and regulations of the Airport, including, but not limited to, control and access to the airfield by Contractor's employees and agents. In the event the Owner is assessed a fine by a governing agency for breach of security resulting from actions of Contractor's employees and agents, the Contractor shall fully reimburse the Authority for the amount of such fine.

80-05 LIMITATIONS OF OPERATIONS. The Contractor shall control his/her operations and the operations of his/her subcontractors and all suppliers so as to provide for the free and unobstructed movement of aircraft in the AIR OPERATIONS AREAS of the airport.

When the work requires the Contractor to conduct his/her operations within an AIR OPERATIONS AREA of the airport, the work shall be coordinated with airport management (through the Resident Engineer) at least 48 hours prior to commencement of such work. The Contractor shall not close an AIR OPERATIONS AREA until so authorized by the Engineer and until the necessary temporary marking and associated lighting are in place as provided in the subsection titled BARRICADES, WARNING SIGNS, AND HAZARD MARKINGS of Section 70.

When the contract work requires the Contractor to work within an AIR OPERATIONS AREA (AOA) of the airport on an intermittent basis (intermittent opening and closing of the AIR OPERATIONS AREA), the Contractor shall maintain constant communications as hereinafter specified; immediately obey all instructions to vacate the AIR OPERATIONS AREA; immediately obey all instruction to resume work in such AIR OPERATIONS AREA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AIR OPERATIONS AREA until the satisfactory conditions are provided. The Contractor shall not commence new work that would be prejudicial to work already started.

The Contractor shall be required to conform to safety standards contained in AC 150/5370-2, Operational Safety on Airports During Construction.

80-06 CHARACTER OF WORKERS, METHODS, AND EQUIPMENT. The Contractor shall, at all times, employ and provide sufficient labor, tools, equipment and other incidental items for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skills and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform all work properly and satisfactorily.

Any person employed by the Contractor or by any subcontractor who, in the opinion of the Resident Engineer, does not perform work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the Resident Engineer, be removed at once by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without the approval of the Resident Engineer.

Should the Contractor fail to remove such person or persons as required above, or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the Resident Engineer may suspend the work by written notice until such orders are complied with.

All equipment which is proposed to be used on the work shall be of sufficient size and in such mechanical condition to meet requirements of the work and to produce a satisfactory quality of work.

Equipment used on any portion of the work shall be such that no injury to previously completed work, adjacent property, or existing airport facilities will result from its use.

When the methods and equipment to be used by the Contractor in accomplishing the construction are not prescribed in the contract, the Contractor is free to use any methods or equipment that can be demonstrated to the Resident Engineer as satisfactory to accomplish the contract work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such methods and equipment shall be used unless others are authorized by the Engineer. If the Contractor desires to use a method or type of equipment other than that specified in the contract, he may request authority from the Engineer to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If the approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the Engineer determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the Engineer may direct. No change will be made in basis of payment for the contract items involved nor in the contract time as a result of authorizing a change in methods or equipment under this subsection.

80-07 TEMPORARY SUSPENSION OF THE WORK. The Resident Engineer shall have the obligation and authority to recommend suspension of the work whole or in part, for such period or periods as he may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the prosecution of the work, or for such time as is necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the Engineer or the Resident Engineer, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the Engineer's order to suspend work to the effective date of the Engineer's order to resume the work. Claims for such compensation shall be filed with the Resident Engineer within the time period stated in the Engineer's order to resume work. The Contractor shall submit with his/her claim information substantiating the amount shown on the claim. The Resident Engineer will forward the Contractor's claim to the Division for the consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather, for suspension made at the request of the Engineer, or for any other delay provided for in the contract, plans, or specifications.

If it should become necessary to suspend work for an indefinite period, the Contractor shall store all materials in such a manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

80-08 DETERMINATION AND EXTENSION OF CONTRACT TIME. The number of calendar days allowed for completion of the work shall be stated in the proposal and contract and shall be known as the CONTRACT TIME.

Conditions beyond the Contractor's control such as strikes, lockouts, unusual delays in transportation, temporary suspension of the principal item of work under construction or temporary suspension of the entire work which have been ordered by the Engineer for reasons not the fault of the Contractor, shall not be charged against the contract time.

The Engineer will not make charges against the contract time prior to the effective date of the notice to proceed.

The Engineer will begin charges against the contract time on the first working day after the effective date of the notice to proceed, as stated in Section 10-42.

The Engineer will not make charges against the contract time after the date of final acceptance as defined in the Section 50-16 FINAL INSPECTION..

The Contractor will be allowed one week in which to file a written protest setting forth his/her objections to the Engineer's biweekly statement. If no objection is filed within such specified time, the weekly statement shall be considered as acceptable to the Contractor.

The contract time (stated in the proposal) is based on the originally estimated quantities as described in the Subsection titled INTERPRETATION OF QUANTITITES IN BID SCHEDULE in the PROCUREMENT POLICIES Section of the proposal. Should the satisfactory completion of the contract require performance of work in greater quantities than those estimated in the proposal, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in contract time shall not consider either the cost of work or the extension of contract time that has been covered by change order or supplemental agreement and shall be made at the time of final payment.

CONTRACT TIME based on CALENDAR DAYS shall consist of the number of calendar days stated in the contract counting from the effective date written in the notice to proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the Engineer's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in the contract time shall not consider either the cost of work or the extension of contract time that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.

If the Contractor finds it impossible for reasons beyond his/her control to complete the work within the contract time as specified, or as extended in accordance with the provisions of this subsection, he may, at any time prior to the expiration of the contract time as extended, make a written request to the Engineer for an extension of time setting forth the reasons which he believes will justify the granting of his/her request. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the Engineer finds that the work was delayed because of conditions beyond the control and without the fault of the Contractor, he may extend the time for completion in such amount as the conditions justify. The extended time for completion shall then be in full force and effect, the same as though it were the original time for completion.

80-09 FAILURE TO COMPLETE ON TIME. For each calendar day, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in the subsection titled DETERMINATION AND EXTENSION OF CONTRACT TIME of this section) the sum specified in the contract and proposal as liquidated damages will be deducted from any money due or to become due the Contractor or his/her surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages that will be incurred by the Division should the Contractor fail to complete the work in the time provided in his/her contract. Should the Contractor fail to complete the work within the final contract time, he shall be liable to the Division in the amount shown in the following schedule of deductions, not as a penalty but as liquidated damages, for each day of overrun in the final contract time.

See contract documents for current schedule of deductions.

Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a waiver of any requirement under the contract.

80-10 DEFAULT AND TERMINATION OF CONTRACT. If the Contractor fails to begin the work under contract within the time specified, or fails to perform the work with sufficient workers and equipment or with sufficient materials to insure the completion of said work within the specified time, or shall perform the work unsuitably, as determined by the Engineer, or shall neglect or refuse to remove materials or perform anew such work as shall be rejected as defective and unsuitable, or shall discontinue the prosecution of the work, or if the Contractor shall become insolvent or be declared bankrupt, or shall commit any act of bankruptcy, or insolvency, or shall make an assignment for the benefit of creditors,

or from any other cause whatsoever shall not carry on the work in a manner approved by the Engineer, or otherwise fails to conform to the terms of the contract, the Engineer will give notice in writing to the Contractor and the Contractor's surety of such delinquency, said notice to specify the corrective measures required. If the Contractor, within a period of ten days after said notice, shall not proceed according to, the Division shall, upon written certificate from the Engineer of the fact of such delinquency and the Contractor's failure to comply with said notice, have full power and authority to forfeit the rights of the Contractor and at its option to call upon the surety to complete the work according to the terms of the contract, or it may take over the work, including any or all materials and equipment on the ground as may be suitable and acceptable, and may complete the work with its own forces, or use such other methods as, in its opinion, shall be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the Division, together with the cost of completing the work under contract, shall be deducted from any monies due or which become due on such contract. In case the expense so incurred by the Division shall be less than the sum which would have been payable under the contract if it had been completed by the Contractor, the Contractor shall be entitled to receive the difference subject to any claims or liens thereon which may be filed with the Division or any prior assignment filed with it, and in case such expense shall exceed the sum which would have been payable under the contract, the Contractor and the surety shall be liable and shall pay to the Division the amount of such excess.

80-11 TERMINATION FOR NATIONAL EMERGENCIES. The Owner shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the prosecution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that is not incorporated in the work, shall at the option of the Contractor be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the Engineer.

Termination of the contract or a portion thereof shall neither relieve the Contractor of his/her responsibilities for the completed work nor shall it relieve his/her surety of its obligation for and concerning any just claim arising out of the work performed.

80-12 TERMINATION OF THE CONTRACTOR'S RESPONSIBILITY. Whenever the improvement called for by the contract shall have been completely performed on the part of the Contractor and all parts of the work have been approved by the Engineer and accepted by the participating agencies according to the contract, and the final estimate paid, the Contractor's obligations shall then be considered fulfilled, except as set forth in his/her bond and in Sections 70-13 and 70-20.

80-13 CONTRACTOR'S ACCESS TO AIRFIELD. The Contractor shall not have access to any part of the active airfield facilities (runways, aprons, or taxiways, and associated safety areas) for any equipment or personnel without the approval of the Airport Management.

The Contractor's access shall be at the locations shown in the Plans. The Contractor shall be responsible for maintaining these roads in a condition satisfactory to the Resident Engineer, Airport Management and his/her own access needs.

The Contractor shall provide haul road structure of his/her own design to suit his/her needs. Lack of adequate access to the site will not be an allowable consideration for an extension of time.

The Contractor shall be required to maintain security on the airport as specified or as directed by the Airport Management.

The Contractor shall be responsible for keeping all access gates closed and locked during work hours. If the Contractor chooses to leave a gate open, then he shall post a competent, properly trained security guard to prevent unauthorized entries. The Contractor shall replace any unsatisfactory security guards if so directed by the Division or Airport Management.

The Contractor shall install and maintain a heavy-duty padlock on all access gates. The Contractor shall provide keys for the padlock to the Resident Engineer, Maintenance Supervisor (where applicable), Security Chief (where applicable), and Airport Management. No additional keys are to be distributed unless authorized by the Airport Management.

The Contractor shall provide a sign at all access gates saying "Authorized Personnel Only".

All cost relating to Contractor's access and security shall be the responsibility of the Contractor.

Upon completion of construction, all areas shall be regraded, cleaned of all debris and restored to the satisfaction of the Resident Engineer and the Airport Management.

No concrete waste or wash-out shall be buried on airport property. In the event that a concrete waste or wash-out pit is constructed, inspection of the pit shall take place by the Resident Engineer after clean-out is completed and before backfilling begins.

If required by the Airport Management, the Contractor shall obtain Airport Security forms from the designated Airport Security representative. These forms shall be completed by all personnel expected to work on the Project, and submitted to Airport Management 48 hours in advance of the time the individual is scheduled to be at the work site.

SECTION 90. MEASUREMENT AND PAYMENT

90-01 MEASUREMENT OF QUANTITIES. All work completed under the contract will be measured by the Resident Engineer, or his/her duly authorized representatives, using United States Customary Units of Measurement.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the Resident Engineer.

Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains and similar items shall be measured parallel to the base or foundation upon which such items are placed.

In computing volumes of excavation, the average end area method or other acceptable methods will be used.

The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe, culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inches.

The term "ton" will mean the short ton consisting of 2,000 pounds avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, approved scales by competent, qualified personnel at locations designated by the Project Engineer. If material is shipped by rail, the car weight may be accepted provided that payment will be made only for the actual weight of material. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the Resident Engineer directs, and each truck shall bear a plainly legible identification mark.

Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable to the Engineer, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity and all loads shall be leveled when the vehicles arrive at the point of delivery.

When requested by the Contractor and approved by the Engineer in writing, material specified to be measured by the cubic yard may be weighed and such weights will be converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Bituminous materials will be measured by the gallon or ton. When measured by volume, such volumes will be measured at 60 degrees F. or will be corrected to the volume at 60 degrees F. using ASTM D 1250 for asphalts or ASTM D 633 for tars.

Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when bituminous material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.

When bituminous materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, may be used for computing quantities.

Cement will be measured by the ton or hundredweight unless otherwise specified.

Timber will be measured by the thousand feet board measure (M.F.B.M.) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

The term "lump sum" when used as an item of payment will mean complete payment for the work described in the contract.

When a complete structure or structural unit (in effect, "lump sum" work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered by the Engineer in connection with force account work will be measured as agreed in the change order or supplemental agreement authorizing such force account work as provided in the subsection titled PAYMENT FOR EXTRA AND FORCE ACCOUNT WORK of this section.

When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gage, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales.

Scales shall be accurate within one-half percent of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the inspector before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam of dial and shall not exceed one-tenth of 1 percent of the nominal rated capacity of the scale, but not less than 1 pound. The use of spring balances will not be permitted.

Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and inspector can safely and conveniently view them.

Scale installations shall have available, ten standard 50-pound weights for testing the weighing equipment or suitable weights and devices for other approved equipment.

Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.

Scales "overweighing" (indicating more than correct weight) will not be permitted to operate and all materials received subsequent to the last previous correct weighing-accuracy-test will be reduced by the percentage of error in excess of one-half of 1 percent.

In the event inspection reveals the scales have been "underweighing" (indicating less than correct weight) they shall be adjusted and no additional payment to the Contractor will be allowed for materials previously weighed and recorded.

All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection for the weighing of materials for proportioning or payment, shall be included in the unit contract prices for the various items of the project.

When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans, the Contractor and Engineer may agree in writing by use of form AER-981 that the plan quantities for specific pay items are accurate and shall be used as the final pay quantities. If so agreed, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved unless errors are discovered after the work has begun, the Engineer revises the

dimensions shown on the plans or there is any dispute regarding the accuracy of the plan quantities. If revised dimensions result in increase or decrease in the quantities of work, the final quantities for payment will be revised in the amount represented by the authorized (approved by change order) changes in dimensions. If disagreement exists between the Contractor and the Resident Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities to be measured as herein specified.

90-02 SCOPE OF PAYMENT. The Contractor shall receive and accept the compensation as herein provided, in full payment for furnishing all materials, labor, tools, and equipment; for performing all work contemplated and embraced under the contract; for all loss or damage arising out of the nature of the work and from the action of the elements; for any unforeseen difficulties or obstructions which may arise or be encountered during the prosecution of the work until its final acceptance by the Division; for all risks of every description connected with the prosecution of the work; also, for all expenses incurred by or in consequence of suspension or discontinuance of such prosecution of the work as herein specified, or for any infringement of patents, trademarks, or copyrights, and for completing the work in an acceptable manner according to the plans and specifications.

The payment of any current estimate prior to final acceptance of the work by the Division shall in no way constitute an acknowledgement of the acceptance of the work, nor in any way prejudice or affect the obligation of the Contractor, at his/her expense, to repair, correct, renew, or replace any defects or imperfections in the construction of the work under contract and its appurtenances, nor any damage due or attributable to such defects, which defects, imperfections, or damage shall have been discovered on or before the final inspection and acceptance of the work. The Engineer shall be the sole judge of such defects, imperfections, or damage, and the Contractor shall be liable to the Division or Owner (Sponsor) for failure to correct the same as provided herein.

90-03 COMPENSATION FOR ALTERED QUANTITIES. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in the subsection titled ALTERATION OF WORK AND QUANTITIES of Section 40 will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from his/her unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 PAYMENT FOR DELETED ITEMS. As specified in the subsection titled DELETED ITEMS of Section 40, the Engineer shall have the right to delete from the work or order nonperformance, any contract item except major contract items, in the best interest of the Owner (Sponsor).

Should the Engineer delete or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices for any work actually completed and acceptable prior to the Engineer's order to delete or nonperform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the Engineer's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the Owner.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the deleted contract item prior to the date of the Engineer's order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature and amount of such costs.

90-05 PAYMENT FOR EXTRA AND FORCE ACCOUNT WORK. Extra work which results from any of the changes as specified in Section 40 shall not be started until authorization from the Engineer is received, which authorization shall state the items of work to be performed and the methods of payment for each item. Work performed without such order will not be paid for.

Extra work will be paid for at either the contract price, a lump sum price or agreed unit prices, or on a force account basis.

- A. Lump Sum Price or Agreed Unit Price. When extra work is to be paid for at either a lump sum price or agreed unit prices, the lump sum or unit prices shall be agreed upon by the Contractor and Engineer.
- B. Force Account Basis. When extra work is to be paid for by force account, the basis for the force account shall be as follows:
1. Labor. For all labor and foremen in direct charge of the specific operations, the Contractor shall receive the actual normal rate of wage paid for each and every hour that said labor and foremen are actually engaged in such work.

The Contractor shall receive the actual costs paid to, or in behalf of, workers by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits or other benefits, when such employment contract generally applicable to the classes of labor employed on the work.

An amount equal to 35 percent of the sum of the above items will also be paid the Contractor.

2. Bond, Insurance and Tax. For property damage, liability and workmen's compensation insurance premiums, unemployment insurance contributions and social security taxes on the force account work the Contractor shall receive the actual cost, to which 10 percent will be added. The Contractor shall furnish satisfactory evidence of the rate or rates paid for such bond, insurance and tax.
3. Materials. For materials accepted by the Engineer and used, the Contractor shall receive the actual cost of such materials delivered on the work, including transportation charges paid by the Contractor (exclusive of machinery rentals as hereinafter set forth), to which cost 15 percent will be added.
4. Equipment. Equipment used for extra work shall be authorized by the Engineer. The equipment shall be specifically described, be of suitable size and capacity for the work to be performed, and be in good operating condition. For such equipment, the Contractor will be paid as follows:
 - a. Contractor Owned Equipment. Contractor owned equipment will be paid for by the hour using the applicable FHWA hourly rate from the "Equipment Watch Rental Rate Blue Book" (Blue Book) in effect when the force account work begins. The FHWA hourly rate is calculated as follows.

$$\text{FHWA hourly rate} = (\text{monthly rate}/176) \times (\text{model year adj.}) \times (\text{Illinois adj.}) + \text{EOC}$$

Where: EOC = Estimated Operating Costs per hour (from the Blue Book)

The time allowed will be the actual time the equipment is operating on the extra work. For the time required to move the equipment to and from the site of the extra work and any authorized idle (standby) time, payment will be made at the following hourly rate: $0.5 \times (\text{FHWA hourly rate} - \text{EOC})$.

All time allowed shall fall within the working hours authorized for the extra work.

The rates above include the cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs, overhaul and maintenance of any kind, depreciation, storage, overhead, profits, insurance, and all incidentals. The rates do not include labor.

The Contractor shall submit to the Engineer sufficient information for each piece of equipment and its attachments to enable the Engineer to determine the proper equipment category. If a rate is not established in the Blue Book for a particular piece of equipment, the Engineer will establish a rate for that piece of equipment that is consistent with its cost and use in the industry.

- b. Rented Equipment. Whenever it is necessary for the Contractor to rent equipment to perform extra work, the rental and transportation costs of the equipment plus five percent for overhead will be paid. In no case shall the rental rates exceed those of established distributors or equipment rental agencies.

All prices shall be agreed to in writing before the equipment is used.

5. Miscellaneous. No additional allowance will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.
6. Comparison of Records. The Contractor and the Resident Engineer shall compare records of the cost of force account work at the end of each day. Agreement shall be indicated by signature of the Contractor and Resident Engineer or their duly authorized representatives.
7. Statements. No payment will be made for work performed on a force account basis until the Contractor has furnished the Engineer with itemized statements of the cost of such force account work. Statements shall be accompanied and supported by invoices for all materials used and transportation charges. However, if materials used on the force account work are not specifically purchased for such work but are taken from the Contractor's stock, then in lieu of the invoices, the Contractor shall furnish an affidavit certifying that such materials were taken from his/her stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the Contractor.

Itemized statements at the cost of force account work shall be detailed as follows:

- a. Name, classification, date, daily hours, total hours, rate, and extension for each laborer and foreman. Payrolls shall be submitted to substantiate actual wages paid if so requested by the Engineer.
 - b. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.
 - c. Quantities of materials, prices and extensions.
 - d. Transportation of materials.
 - e. Cost of property damage, liability and workmen's compensation insurance premiums, unemployment insurance contributions, and social security tax.
8. Work Performed by an Approved Subcontractor. When extra work is performed by an approved subcontractor, the Contractor shall receive, as administrative costs, an amount equal to five percent of the total approved costs of such work with the minimum payment being \$100.

The additional payment, based on the percentages specified above, shall constitute full compensation for all items of expense not specifically provided for the force account work. The total payment made as provided above shall constitute full compensation for such work.

90-06 INCREASED QUANTITIES. Payment will not be made for quantities in excess of the maximum payment percentages found in the Airport Construction Documentation Manual, latest edition.

90-07 PARTIAL PAYMENTS. At least twice a month, and/or when construction progress warrants, the Division shall prepare a Construction Progress Payment (CPP) based upon the weekly construction reports prepared in the field by the Resident Engineer. This CPP will be computed for the amount of the value of the work completed since the previous CPP. Retainage for each CPP to the Contractor shall be calculated as follows:

- A. For the first 50 percent of the total contract value, an amount of 10 percent of the value of the completed work shall be retained from the Contractor until after completion of the entire final contract and to the satisfaction of the Division.

- B. After more than 50 percent of the total contract value is completed, the Division may, at its discretion, certify the remaining partial payments be made to the Contractor without further retainage, provided that satisfactory progress is being made, and provided that the total retained amount is not less than 5 percent of the total adjusted contract value.
- C. At the discretion of the Division and with the consent of the surety, a semi-final Construction Progress Payment may be made when the principal contract payment items have been satisfactorily completed. In no event shall the amount retained from the Contractor after making the semi-final payment be less than 1 percent of the adjusted contract value, nor less than \$500.00. (This provision of making a semi-final construction progress payment is not applicable when the Contractor chooses the Trust Agreement option of Article 70-09.)

If, upon delivery of any of the materials, the Contractor fails to supply documentation meeting the requirements of the Illinois Department of Transportation, Division of Aeronautics "Manual for Documentation of Airport Materials," (latest edition), the Division shall not include payment for that material on a Contractor Progress Payment report until such statements have been furnished. Copies of the Division of Aeronautics "Manual for Documentation of Airport Materials" may be obtained by contacting the Division. Copies are also available on the internet at the Illinois Department of Transportation's website.

90-08 PAYMENT FOR MATERIALS ON HAND. A payment may, at the discretion of the Division and upon presentation of receipted bills and freight bills, be made for the value of acceptable reinforcing steel, structural steel, stone, gravel, sand, or other nonperishable materials delivered on the work or in acceptable storage places and not used at the time of such payment. Such materials, when so paid for by the Division, shall become the property of the Division, and in the event of default on the part of the Contractor, the Division may use or cause to be used such materials in the construction of the work provided for in the contract. The value of stored or stockpiled items shall be reduced on progress payments as the stockpiled items are used in the work.

Such delivered costs of stored or stock-piled materials may be included in a separate progress payment or be included in the next partial payment after the following conditions are met:

- A. The material has been stored or stockpiled in a manner acceptable to Resident Engineer at or on an approved site.
- B. The Division has been furnished with acceptable evidence of the quantity and quality of such stored or stockpiled materials.
- C. The Contractor has furnished the Division with satisfactory evidence that the material and transportation costs have been paid.

It is understood and agreed that the Contractor is solely responsible for all materials stored or stockpiled.

It is understood and agreed that the Division's payment for such stored or stockpiled materials shall in no way relieve the Contractor of his/her responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of the partial payments for materials on hand exceed the delivered purchase price for such materials, or the total value of the contract payment item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the storage of stockpiled materials in accordance with the provisions of this subsection.

90-09 ACCEPTANCE AND FINAL PAYMENT. Whenever the improvement provided for by the contract shall have been completely performed on the part of the Contractor, and all parts of the work have been approved by the Division, a final construction payment showing the value of the work, will be prepared by the Division as soon as the necessary measurements and computations can be made, all

prior CPP's upon which payments have been made being approximate only and subject to correction in the final payment. The amount of the final payment will be the final adjusted contract value, less all previous payments and less any sums that have been deducted or retained by virtue of liquidated damages or otherwise under the provisions of the contract. The final payment will be paid to the Contractor as soon as practicable after the final approval of work, provided the Contractor has furnished to the Division satisfactory evidence that all sums of money due for any labor, materials, apparatus, fixtures, or machinery furnished for the purpose of the contract have been paid or that the person or persons to whom the same may be due have consented to such final payment.

If the Contractor has filed a claim for additional compensation under the provisions of the subsection titled CLAIMS FOR ADJUSTMENTS AND DISPUTES of Section 50 or under the provisions of this subsection, such claims will be considered by the Owner in accordance to local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final payment.

90-10 TRUST AGREEMENT OPTION. When the awarding authority is the State of Illinois and at the request of a Contractor the amounts to be paid to the Contractor, including the amounts to be retained from the Contractor as set forth in this Article and Articles 90-06 and 90-07, may be deposited under the Division of Aeronautics Trust Agreement with an Illinois financial institution of the Contractor's choice. The Contractor shall receive any interest thereon. The Trust Agreement contains, as a minimum, the following provisions:

- A. The terms and conditions for depositing the retainage, holding the retainage in trust and the final disbursement of the retainage;
- B. The return or repayment of retainage upon demand made by the Division;
- C. The types of investments the financial institution may make with the retainage;
- D. The terms and conditions of the return or repayment of retainage in case of default of the Contractor;
- E. The Division's right to withhold progress payments on account of lien claims, liquidated damages, or as otherwise provided by the contract.
- F. The Contractor's responsibilities for obtaining the written consent of the financial institution, and any costs or service fees for administering the Trust Agreement shall be borne by the Contractor;
- G. The termination of the Trust Agreement upon completion of the contract.

DIVISION II- PAVING CONSTRUCTION DETAILS

EARTHWORK

ITEM 150510 ENGINEER'S FIELD OFFICE

DESCRIPTION

150-1.1. This item shall consist of furnishing and maintaining in good condition for the exclusive use of the Resident Engineer, a weatherproof building or buildings hereinafter described at locations approved by the Engineer. Unless otherwise provided, the building shall be independent of any building used by the Contractor and all keys to the buildings shall be turned over to the Resident Engineer. The Engineer will designate the location of the building and it shall remain on the work site until released by the Engineer. (Mobile units may be substituted with the approval of the Engineer.)

CONSTRUCTION METHODS

150-2.1. Field offices shall have a minimum ceiling height of 7 feet and a minimum floor space of 240 square feet. The office shall be provided with sufficient heat, natural and artificial light, and air conditioning. Doors and windows shall be equipped with locks approved by the Resident Engineer.

Windows shall be equipped with exterior screens to allow adequate ventilation. All windows shall be equipped with interior shades, curtains or blinds.

Suitable on-site sanitary facilities separate from those for the Contractor's personnel, meeting Federal, State, and local health department requirements shall be provided, maintained clean and in good working condition, and shall be stocked with lavatory and sanitary supplies at all times.

In addition, the following equipment and furniture meeting the approval of the Resident Engineer shall be furnished:

- A. Two desks and two non-folding chairs with upholstered seats and backs.
- B. One four-post drafting table with minimum top size of 37½ x 48 in. The top shall be basswood or equivalent and capable of being tilted through an angle of 50 degrees. An adjustable height drafting stool with upholstered seat and back shall also be provided.
- C. Two free standing four drawer legal size file cabinets with lock and an Underwriters' Laboratories insulated file device 350 degrees one hour rating..
- D. Four folding chairs
- E. One equipment cabinet of minimum inside dimension of 44" high x 24" wide x 30" deep with lock. The walls shall be of steel with a 3/32" minimum thickness with concealed hinges and enclosed lock constructed in such a manner as to prevent entry by force. The cabinet assembly shall be permanently attached to a structural element of the field office in a manner to prevent theft of the entire cabinet.
- F. 1 carbon dioxide fire extinguisher (10 lb. rated capacity)
- G. One electric water cooler dispenser with water supply as needed
- H. One telephone, with touch tone, where available, and a digital telephone answering machine or a cellular telephone with voicemail, for exclusive use by the Resident Engineer. Two additional dedicated telephone lines, one for fax, and one for computer shall also be provided for the exclusive use of the Resident Engineer.

- I. One dry process copy machine (including maintenance and operating supplies) capable of both collating and reproducing prints up to a legal size (8.5" x 14") and capable of copying field books
- J. One standard fax machine (including maintenance and operating supplies), with dedicated phone line
- K. Beam tank(s)*
- L. One refrigerator with a minimum size of 8 cubic feet with a freezer unit.
- M. One electric desk tape calculator and adding machine with tape or one tape printing calculator

* For projects requiring PCC flexural strength testing, the Contractor shall provide a beam tank shed as part of this item. This shed shall be large enough to hold all the necessary beam tanks. The Contractor shall make provisions in this shed to heat/cool as necessary to keep beam tank water temperature between 70° - 76° F. The Contractor shall be required to provide water to the beam shed as required to protect the beams. If the beam tank is not located at the Engineer's Field Office, the shed shall be large enough to store the beam breaker. The shed shall be locked and the Resident Engineer given all keys.

BASIS OF PAYMENT

150-3.1 The building will include all utility costs and shall be released to the Contractor in good condition at the end of the project.

Payment for providing the field office fully equipped as specified shall be made at the contract lump sum price. The Resident Engineer shall make payment for all long distance phone calls made by his/her representatives or himself.

ITEM 150520 MOBILIZATION

DESCRIPTION

150-1.1 This item shall include all activities and associated costs related to transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable.

This item includes mobilization required by the contract at the time of notice to proceed. If additional mobilization activities and costs are required during the performance of the contract as a result of added items of work, such costs shall be included in the unit price for the item or items of work added. This does not apply to any approved "time and materials work."

This item also includes all efforts related to restoration of the project site, staging area and haul road as directed in the bidding documents at the conclusion of the job. This activity includes, but is not limited to, incidental grading, seeding and clean-up, as required to restore the project site to original condition.

METHOD OF MEASUREMENT

150-2.1 This item shall consist of the mobilization of the contractor's forces and equipment necessary for performing the work required under the contract. It does not include mobilization for specific items of work for which payment is provided elsewhere in the contract.

Transportation of any materials incorporated into the permanent works shall not be considered a mobilization item.

All roads, parking lots, fences, structures, etc., shall be protected from damage by equipment during the contract period.

Access shall be as shown on the drawings. Alternate access routes must be approved by the Engineer prior to use. All access routes shall be restored by the contractor to a condition equal to or better than the condition prior to the commencement of work under this contract.

BASIS OF PAYMENT

150-3.1 This item shall be paid for at the lump sum price for MOBILIZATION. The amount which a Contractor will receive payment for, according to the following schedule, will be limited to six percent of the original contract amount. Should the bid for mobilization exceed six percent, the amount over six percent will not be paid until 90 percent of the adjusted contract value is earned.

- A. Upon issuance of the Notice to Proceed, 50 percent of the pay item will be paid.
- B. When ten percent of the original contract amount is earned, an additional 10 percent of the pay item will be paid.
- C. The remaining 40 percent of the pay item will be paid along with any amount bid in excess of six percent of the original contract amount upon final acceptance of the project by the Engineer. Final acceptance includes satisfactory completion of all punch list items in accordance with written instruction from the engineer as well as acceptance of all final documentation.

Nothing herein shall be construed to limit or preclude partial payment for other items as provided for by the contract.

ITEM 150560 TEMPORARY THRESHOLD

DESCRIPTION

150-1.1 This item shall consist of the installation, maintenance and removal of temporary thresholds at the locations shown in the plans.

Installation and removal shall include the following:

- Installation and removal of temporary "jumper" cables as shown in the plans to keep all circuits operable.
- Covering of distance-to-go sign legends when called for in the plans.
- Disconnection and re-connection of all runway lights within the closed portion of the runway.
- Installation and removal of temporary threshold lights and required materials for installation.
- Relocation of amber filters/lenses from the closed areas to the first 2,000' of the open runway when called for in the plans.
- Temporary markings and marking removals shown in the plans.
- Furnishing and installing new Runway End Identifier Lights (REILs) at the temporary threshold when called for in the plans.

Maintenance shall include all materials, equipment and labor necessary to keep the temporary threshold lighting operating as required.

EQUIPMENT AND MATERIALS

150-2.1 Cable and connections shall be in accordance with Item 108.

150-2.2 Threshold lights shall be in accordance with Item 125.

150-2.3 TEMPORARY REILS When called for in the plans, temporary REILs shall be installed at the temporary threshold.

The Contractor shall furnish and install a series circuit power adaptor to convert the runway edge light constant current series circuit power into the 120/240 VAC power needed by the existing REILs. The power adaptor shall be furnished by the manufacturer of the existing REILs and shall be compatible with the existing REILs. The Contractor shall obtain the manufacturer and model number for the existing REILs from the Airport.

The power adapter and associated wiring shall be buried underground.

Power and control wiring shall be as required by REIL manufacturer and as specified in Item 108.

CONSTRUCTION METHODS

150-3.1 GENERAL Placing and removal of the temporary thresholds shall be scheduled to minimize closures of the runways. Closure periods outlined in the Plans are maximums and should not be exceeded. Multiple crews shall be used if necessary to complete the work within the closure period.

150-3.2 LIGHTING At the location of the temporary relocated thresholds, temporary lights shall be installed 10' off pavement edge at 10' spacing, on each side of the runway as shown in the plans. Temporary lights may be the threshold lights and transformers from the relocated runway.

The Contractor shall make all temporary connections necessary to complete the existing runway circuit.

150-3.3 MASKING OF LEGENDS The Contractor shall cover or mask completely the existing legends of the distance-to-go signs when called for in the plans.

150-3.4 DISABLING LIGHTS The Contractor shall disable or render inoperable all runway edge lights in the closed portion of the runway by disconnecting the light at the transformer.

150-3.5 DISABLING APPROACH LIGHTS AND NAVAIDS The Contractor shall disable or render inoperable all approach lighting systems and navigational aids associated with the closed portion of the runway or affected by the proposed construction by disconnecting the systems at the vault.

150-3.6 RELOCATION OF LENSES The Contractor shall relocate the existing filters or lenses from the closed portion of the runway to the first 2,000' of the active portion of the runway when called for in the plans.

150-3.7 REMOVAL OF TEMPORARY THRESHOLD Upon completion of the specified work, the temporary threshold lights shall be removed and the runway circuit shall be completed.

150-3.8 TEMPORARY MARKINGS Temporary markings shall conform to Item 620. Reflective traffic tape may be used if properly maintained.

150-3.9 MARKING REMOVAL Marking removal shall conform to Item 620.

150-3.10 TEMPORARY REILS Temporary REILs shall be installed as detailed on the plans.

The REIL power and control wiring shall be installed as required by REIL manufacturer and in compliance with Item 108.

150-3.11 REIL REMOVAL When called for in the plans, upon completion of the specified work, the temporary REILs and power adaptor shall be removed, cleaned and refurbished as required and turned over to the Airport.

METHOD OF MEASUREMENT

150-4.1 The installation and removal of the temporary threshold lighting shall be measured as a lump sum item completed and accepted by the Engineer.

BASIS OF PAYMENT

150-5.1 Payment for this item shall be at the contract lump sum for the completed work. This price shall be full compensation for furnishing all material, for all preparation, assembly and installation of materials, for all removals, lighting, coverings, restoration, and for all labor, equipment, tools and incidentals necessary to complete the item.

Costs associated with maintenance of the temporary threshold shall be considered incidental to the overall contract and not included in the lump sum items below.

ITEM 151 CLEARING AND GRUBBING

DESCRIPTION

151-1.1 This item shall consist of clearing or clearing and grubbing, including the disposal of materials, for all areas within the limits designated on the plans or as required by the Resident Engineer.

Clearing shall consist of the cutting and removal of all trees, stumps, brush, logs, hedges, the removal of fences and other loose or projecting material from the designated areas. The grubbing of stumps and roots will not be required.

Clearing, when so designated, shall consist of the cutting and removal of isolated single trees or isolated groups of trees. The cutting of all the trees of this classification shall be in accordance with the requirements for the particular area being cleared, or as shown on the plans, or as directed by the Engineer. The trees shall be considered isolated when they are 40 feet or more apart, with the exception of a small clump of approximately five trees or less.

Clearing and grubbing shall consist of clearing the surface of the ground of the designated areas of all trees, stumps, down timber, logs, snags, brush, undergrowth, hedges, heavy growth of grass or weeds, fences structures, debris, and rubbish of any nature, natural obstructions or such material which in the opinion of the Resident Engineer is unsuitable for the foundation of strips, pavements, or other required structures, including the grubbing of stumps, roots, matted roots, foundations, and the disposal from the project of all spoil materials resulting from clearing and grubbing by burning or otherwise.

This item shall also consist of removal of all incidental items within the limits shown on the plans.

CONSTRUCTION METHODS

151-2.1 GENERAL. The areas denoted on the plans to be cleared or cleared and grubbed under this item shall be staked on the ground by the Resident Engineer. The clearing and grubbing shall be done at a satisfactory distance in advance of the grading operations. Unless otherwise specified, no cutting or trimming of trees shall occur between April 1 and September 30, both days inclusive, due to potential impact to the Indiana Bat, which is protected by the Endangered Species Act of 1973. If otherwise specified, the Contractor shall verify that the required permits have been obtained prior to the commencement of tree cutting or trimming operations.

All spoil materials removed by clearing or by clearing and grubbing shall be disposed of by burning (approval required by Airport Management for burning on-site) or by removal to approved disposal areas. Piles for burning shall be placed either in the cleared area near the center or in adjacent open spaces where no damage to trees, other vegetation, or other property will occur. The Contractor will be responsible for controlling fires in compliance with all Federal and State laws and regulations relative to building fires at the site. Ashes resulting from burning shall be removed and disposed of when directed by the Resident Engineer. Burning of removed vegetative material may be allowed provided such burning is in compliance with all Federal, State and Local guidelines and the Airport Management requirements. Permission to burn shall be coordinated with the Airport Management daily and when changes in weather conditions may affect the airport.

The Contractor shall procure an EPA Clean Air Permit for burning. The permit shall require an air curtain destructor at each burn pit.

Under no circumstances shall burning be allowed if it has been deemed that burning may cause interference to airport operations. In no case shall burning be allowed within 750 feet of the centerline of any runway.

The Contractor is responsible for clean-up of burn areas.

As far as practicable, waste concrete and masonry shall be placed on slopes of embankments or channels. When embankments are constructed of such material, this material shall be placed in accordance with requirements for formation of embankments. Any broken concrete or masonry which cannot be used in construction, and all other materials not considered suitable for use elsewhere, shall

be disposed of by the Contractor. In no case shall any discarded materials be left in windrows or piles adjacent to or within the airport limits. The manner and location of disposal of materials shall be subject to the approval of the Engineer and shall not create an unsightly or objectionable view. When the Contractor is required to locate a disposal area outside the airport property limits at his/her own expense, he shall obtain and file with the Engineer, permission in writing from the property owner for the use of private property for this purpose. All waste materials which are not used or burned at the site shall be removed and disposed of legally off airport property.

If the plans or the specifications require the saving of merchantable timber, the Contractor shall trim the limbs and tops from designated trees, saw them into suitable lengths, and make the material available for removal by other agencies.

The removal of existing structures and utilities required to permit orderly progress of work shall be accomplished by local agencies, unless otherwise shown on the plans. Whenever a telephone or telegraph pole, pipeline, conduit, sewer, roadway, or other utility is encountered and must be removed or relocated the Contractor shall advise the Resident Engineer who will notify the proper local authority or owner and attempt to secure prompt action.

151-2.2 CLEARING. The Contractor shall clear the staked or indicated area of all objectionable materials. Trees unavoidably falling outside the specified limits must be cut up, removed, and disposed of in satisfactory manner. In order to minimize damage to trees that are to be left standing, trees shall be felled toward the center of area being cleared. The Contractor shall preserve and protect from injury all trees not to be removed. The trees, stumps, and brush shall be cut to a height of not more than 12 inches above the ground. The grubbing of stumps and roots will not be required.

When isolated trees are designated for clearing, the trees shall be classed in accordance with the butt diameter size as measured at a point of 4.5 feet above the ground level or at a designated height specified in the proposal.

Fences shall be removed and disposed of when directed by the Resident Engineer. Fence wire shall be neatly rolled and the wire and posts stored on the airport if they are to be used again, or stored at a designated location if the fence is to remain the property of a local owner or of the Airport Owner.

151-2.3 CLEARING AND GRUBBING. In areas shown in the plans or as designated by the Resident Engineer to be cleared and grubbed, all stumps, roots, buried logs, brush and other unsatisfactory materials shall be removed.

Any buildings and miscellaneous structures that are shown on the plans to be removed shall be demolished or removed, and all materials therefrom shall be disposed of either by burning or otherwise removed from the site. The remaining or existing foundations, wells, cesspools, and all like structures shall be destroyed by breaking out or breaking down the materials of which the foundations, wells, cesspools, etc., are built to a depth at least 2 feet below the existing surrounding ground. Any broken concrete, blocks, or other objectionable material which cannot be used in backfill shall be removed and disposed of. The holes or openings shall be backfilled with acceptable material and properly compacted.

All holes remaining after the grubbing operation in embankment areas shall have the sides broken down to flatten out the slopes, and shall be filled with acceptable material, moistened and properly compacted in layers to the density required in Item 152. The same construction procedure shall be applied to all holes remaining after grubbing in excavation areas where the depth of holes exceeds the depth of the proposed excavation.

151-2.4 METAL GUARDRAIL REMOVAL. This work shall consist of the removal and disposal of existing metal guardrail at the locations designated. The guardrail shall be removed completely. The guardrail posts shall be pulled not cut off. All holes shall be filled and compacted. The removed material shall be disposed of off airport property.

151-2.5 PIPE REMOVAL. The work shall consist of the removal of existing concrete or corrugated metal pipe including any anchor walls. Pipes shall be disposed of by the Contractor off of airport property.

Trenches resulting from the removal shall be backfilled in accordance with Item 152.

151-2.6 HEADWALL REMOVAL. This work shall consist of the removal and disposal of existing concrete headwalls and other cast in-place concrete outlet structures at the locations designated in the plans.

The headwalls shall be removed completely and disposed of off airport property. Care shall be taken by the Contractor to prevent damage to the existing pipe.

Trenches resulting from the removal shall be backfilled in accordance with Item 152.

151-2.7 END SECTION REMOVAL. This work shall consist of the removal and disposal of existing precast concrete or metal end sections. The end sections shall be removed completely and disposed of off of airport property. Care shall be taken by the Contractor to prevent damage to the existing pipe.

Trenches resulting from the removal shall be backfilled in accordance with Item 152.

151-2.8 INLET REMOVAL. This work shall consist of the removal of existing drainage structures from the locations shown in the plans. These structures shall be removed completely and the resulting waste materials shall be disposed of off of airport property

Excavations resulting from the removals shall be backfilled in accordance with Item 152.

151-2.9 CLEANOUT REMOVAL. This work shall consist of removal of existing cleanouts and the capping of the adjacent underdrain which will remain in place. The Contractor shall be required to carefully remove the existing cleanout using methods which will minimize damage to the underdrain and cap the underdrain with concrete or a plastic cap. These structures shall be removed completely and the resulting waste materials shall be disposed of off of airport property.

The excavation shall be backfilled with a material which meets the requirements of IDOT FA-02 as specified in Item 705.

151-2.10 FENCE REMOVAL. This work shall consist of the removal and disposal of existing wire fence. The fence shall be removed completely including posts and foundations. The fence posts shall be pulled not cut off. All holes shall be filled and compacted. The removed material shall be disposed of off airport property.

151-2.11 BUILDING REMOVAL. This work shall consist of building and foundation removal. The Contractor will be allowed to burn any portion of the building in accordance with Section 151-2.1. The remainder of the building and foundation shall be disposed of by the Contractor off of airport property.

METHOD OF MEASUREMENT

151-3.1 The quantities of clearing or clearing and grubbing as shown by the limits on the plans or as ordered by the Resident Engineer shall be cited in terms of the number of acres or fractions thereof, of land specifically cleared or cleared and grubbed, unless lump sum bid is specified in the proposal.

When isolated trees are designated for clearing, the quantities of trees, as determined in accordance with ranges of butt diameter size, measured at a point 4.5 feet above the ground level at the tree, shall be paid for according to the schedule of sizes as follows:

The number of trees:

From 0 to 2-1/2 feet, butt diameter
From 2-1/2 to 5 feet, butt diameter
For 5 feet or more, butt diameter

When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans and the Contractor and the Resident Engineer have agreed in writing by the use of form AER-981 that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the Plans have been altered or when disagreement exists between the Contractor and the Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured as herein specified.

The quantities of clearing or clearing and grubbing will be measured by the acre. The entire area will be used in computing the acres. No deductions will be made for bare areas and existing roads occurring within these limits unless otherwise specified or shown on the plans.

BASIS OF PAYMENT

151-4.1. Payment shall be made at the contract unit price per acre for clearing. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

151-4.2. Payment shall be made at the contract unit price for clearing isolated trees. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

151-4.3. Payment shall be made at the contract unit price per acre for clearing and grubbing. This price shall be full compensation for furnishing all materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

The removal of items within the clearing or clearing and grubbing limits shall be considered incidental to this item, unless shown or specified as otherwise.

ITEM 152 EXCAVATION AND EMBANKMENT

DESCRIPTION

152-1.1 This item shall consist of excavating, removing, and satisfactorily disposing of all materials within the limits of the work required to construct the landing strips, runways, taxiways, aprons, intermediate, and other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity with the dimensions and typical section shown on the plans and with the lines and grades established by the Resident Engineer.

All suitable material taken from excavation shall be used in the formation of embankment, subgrade, and for backfilling as indicated on the plans or as directed by the Resident Engineer.

When the volume of the excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development or wasted as directed. When the volume of excavation is not sufficient for constructing the fill to the grades indicated, the deficiency shall be supplied from borrow sources at locations within the airport or other authorized areas.

This item shall consist of all topsoil stripping, excavation and undercutting, embankment, final shaping, topsoiling, pavement shoulder construction, grading and compacting necessary to construct the proposed embankments in conformance with the lines and grades shown in the plans and in conformance with the specifications.

The Contractor is required to test the existing soils and provide the Resident Engineer with the maximum dry density and optimum moisture. All associated labor, equipment, materials and incidentals associated with obtaining the Proctor information is considered incidental to Item 152. If in the opinion of the Resident Engineer the Proctor information is determined to be non-representative of the material being placed, he may require the Contractor to provide an additional Proctor that is representative of the materials used.

Upon completion of the embankments, the Contractor shall grade all areas to drain.

152-1.2 CLASSIFICATION. All material excavation, regardless of source, including vegetation stripping and shoulder construction shall be defined as "Unclassified Excavation" unless designated otherwise.

When provided for in the proposal, Borrow Excavation shall consist of all excavation made outside of the normal grading limits but on airport property.

All material hauled to the construction site from an offsite source for embankment other than shoulder adjustment shall be classified as "Offsite Borrow Excavation".

All excavation associated with shoulder adjustment adjacent to the pavement improvements regardless of source and including vegetation stripping, shall be classified as "Shoulder Adjustment" and shall be measured as such.

CONSTRUCTION METHODS

152-2.1 GENERAL. The rough excavation shall be carried to the necessary depth to obtain the specified depth of subgrade densification shown on the plans. Likewise, on embankments, the depth of subgrade densification shall be as shown on the plans. Should the Contractor, through negligence or other fault, excavate below the designated lines, he shall replace the excavation with approved materials, in an approved manner and condition, at his/her own expense. The Resident Engineer shall have complete control over the excavation, moving, placing, and disposition of all material and shall determine the suitability of material to be placed in embankments. All material determined unsuitable shall be disposed of in waste areas or as directed. Topsoil shall not be used in fills or in subgrades but shall be handled and placed as directed.

The Contractor shall inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated. No payment will be made for any excavated material which is used for purposes other than those designated. All spoil areas shall be leveled to a uniform line and section and shall present a neat appearance before project acceptance. The surface elevation of spoil areas shall not extend above the surface elevation of adjacent or contiguous usable areas of the airport.

Those areas outside of the pavement areas in which the top layer of soil material becomes compacted, due to hauling or to any other activity of the Contractor, shall be scarified and disked to a depth of 4 inches, as directed, to loosen and pulverize the soil.

If it is necessary to interrupt existing surface drainage, sewers or underdrainage, conduits, utilities, or similar underground structures, or parts thereof, the Contractor shall be responsible for and shall take all necessary precautions to protect and preserve or provide temporary services. When such facilities are encountered, the Contractor shall notify the Resident Engineer, who shall arrange for their removal, if necessary. The Contractor shall, at his/her own expense, satisfactorily repair all damage to such facilities or structures which may result from any of his/her operations during the period of the contract.

152-2.2 EXCAVATION. Excavation shall be performed as indicated on the contract plans to the lines, grades, and elevation shown or as directed by the Resident Engineer, and shall be made so that the requirements for formation of embankments can be followed. No excavation or stripping shall be started until the Resident Engineer has taken cross-sectional elevations and measurements of the existing ground surface. All material encountered within the limits indicated shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained so that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the work.

When selective grading is specified or required as indicated on the plans, the excavated material shall be handled to allow the selected material to be properly placed in the embankment and in the capping of pavement subgrades as determined from the soil profile and soil characteristics. This material shall be deposited within the designated areas of the airport as shown on the plans or as directed by the Resident Engineer.

If, at the time of excavation, it is not possible to place any material in its proper section of the permanent construction, it shall be stockpiled in approved areas for later use.

Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for landing strips, subgrades, roads, shoulders, intermediate areas, or any areas intended for turfing shall be excavated to a minimum depth of 12 inches, or to the depth specified by the Resident Engineer, below the contemplated surface of the subgrade or the designated grades. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified, to provide a satisfactory foundation. Unsatisfactory materials shall be disposed of at locations designated by the Resident Engineer. All material so excavated shall be paid for at the contract unit price per cubic yard for "Unclassified Excavation". The portion so excavated shall be refilled with suitable selected material as specified, obtained from the grading operations or borrow area and thoroughly compacted by rolling. The necessary refilling will constitute a part of the embankment. Where rock cuts are made and refilled with selected material, or where trenching out is done to provide for a course of pavement, the depths thus created shall be ditched at frequent intervals to provide adequate drainage.

The Contractor shall make the distribution as indicated on the plans. Widening or narrowing of the section and raising or lowering of the grade to avoid haul will not be permitted. The right is reserved to make minor adjustments or revisions in lines or grades, if found necessary, as the work progresses due to discrepancies in the plans or to obtain satisfactory construction.

Overbreak, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the Resident Engineer. The Resident Engineer shall determine if the displacement of such material was unavoidable and his/her decision shall be final. All overbreak shall be removed by the Contractor and disposed of as directed; however, payment will not be made for the removal and disposal of overbreak which the Resident Engineer determines as avoidable. Unavoidable overbreak will be classified as "Unclassified Excavation".

The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by local agencies, unless otherwise shown on the plans. All existing foundations shall be excavated for at least 2 feet below the top of the subgrade and the material disposed of as directed. All foundations thus excavated shall be backfilled with suitable material and compacted.

Excavation and embankment shall be compacted to a density of not less than the percentage of the maximum density, at optimum moisture, shown in TABLE 1 as determined by the compaction control tests cited in Division VII for ASTM D 698 (Standard Proctor) for Aircraft weights of less than 60,000 pounds and for ASTM D 1557 (Modified Proctor) for aircraft weights of 60,000 pounds or more.

In cut areas the top 6" of subgrade shall be compacted to a density of not less than the percentage of the maximum density shown in TABLE 1, at optimum moisture, as determined by the compaction control tests cited in Division VII.

TABLE 1: COMPACTION REQUIREMENTS

LOCATION	CUT (TOP 8" OF SUBGRADE)	FILL
Below Proposed Airfield Pavements	95%	95%
Below Proposed Vehicle Roadways & Paved Shoulders, ASTM D 698 - Standard	95%	95%
Embankments Outside Pavement Limits, ASTM D 698 - Standard	N/A	90%
Shoulder Adjustments less than 6" compacted thickness	3 Passes of a Sheepsfoot Roller	3 Passes of a Sheepsfoot Roller

In cut sections, if necessary, the Contractor shall take the following steps in an effort to obtain not less than 95% of the standard laboratory density in the subgrade.

- A. Step 1. Cut plan ditches which drain the area at least to grade. This shall be done at least two weeks prior to Step 2.
- B. Step 2. Air dry the top 200 mm (8-inches) of subgrade. This procedure shall include at least two 200 mm (8-inch) depth processing utilizing discs or tillers each day for 3 consecutive good drying days.
- C. Step 3. Recompact the layer processed in Step 2 to achieve not less than 95% density, or until at least 9 passes of a roller which has demonstrated ability to obtain the density on adjacent earthwork have been made.

Stockpiling of unclassified excavated material including topsoil for later use shall be done at the Contractor's expense.

No payment or measurement for payment will be made for suitable materials removed, manipulated, and replaced in order to obtain density. Any removal, manipulation, aeration, replacement, and recompaction of suitable materials necessary to obtain the required density shall be considered as incidental to the excavation and embankment operations, and shall be performed by the Contractor at no additional cost to the project.

Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top 6 inches of the subgrade. The finished grading operations conforming to the typical cross section shall be completed and maintained at least 1,000 feet ahead of the paving operations.

In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to the line or finished grade of the slope. All cut-and-fill slopes shall be uniformly dressed to the slope, cross section, and alignment shown on the plans or as directed by the Resident Engineer.

Blasting, when necessary, will be permitted only when proper precautions are taken for the protection and safety of all persons, the work, and the property. All damage done to the work or property shall be repaired at the Contractor's expense. All operations of the Contractor in connection with the

transportation, storage, and use of explosives shall be approved by the Engineer. Any approval given will not relieve the Contractor of his/her responsibility in blasting operations.

152-2.3 BORROW EXCAVATION. When provided for in the proposal, borrow excavation shall consist of excavation made from borrow areas within the limits of the airport property outside the normal grading limits, or from areas outside the airport when specified. Borrow area(s) within the airport property from which borrow may be obtained will be designated. Borrow excavation shall be made only at these designated locations and within the horizontal and vertical limits as staked or as directed. On completion of borrow operations, the borrow area shall be finished to a neat and uniform grade acceptable to the Resident Engineer.

When borrow sources are outside the boundaries of the airport property, it shall be the Contractor's responsibility to locate and obtain the supply, subject to the approval of the Project Engineer. The Contractor shall notify the Resident Engineer, sufficiently in advance of the beginning of excavation, so necessary measurements and tests can be made. All objectionable material shall be disposed of as directed. All borrow pits shall be opened up immediately to expose the vertical face of various strata of acceptable material to enable obtaining a uniform product. Borrow pits shall be excavated to regular lines to permit accurate measurements and shall be drained and left in a neat and presentable condition with all slopes dressed uniformly.

The borrow excavation shall be handled and placed as specified in these specifications for excavation and embankment.

152-2.4 DRAINAGE EXCAVATION. Drainage excavation shall consist of excavating for drainage ditches such as intercepting, inlet or outlet, temporary levee construction, or any other type as designed or as shown on the plans. The work shall be performed in the proper sequence with the other construction. The location of all ditches or levees shall be established on the ground. All satisfactory material shall be placed in fills; unsatisfactory material shall be placed in spoil areas or as directed. Waste or surplus material shall be disposed of as shown on plans or as directed. Intercepting ditches shall be constructed prior to the starting of adjacent excavation operations. All necessary handwork shall be performed to secure a finish true to line, elevation, and cross section, as designated.

Ditches constructed on the project shall be maintained to the required cross section and shall be kept free from debris or obstructions until the project is accepted. Where necessary, sufficient openings shall be provided through spoil banks to permit drainage from adjacent lands.

The Contractor shall construct temporary channel relocations to divert storm water from the locations of proposed drainage structures. These channel relocations shall be at the location and of a cross section designed by the Contractor. Excavation for the temporary channel relocations shall not be measured for payment.

152-2.5 PREPARATION OF EMBANKMENT AREA. Embankment areas shall be cleared and grubbed in accordance with the requirements in Item 151. All depressions or holes below the ground surface, whether caused by grubbing or otherwise, shall be backfilled with suitable material and compacted to ground surface before the construction of the embankment will be permitted to start.

Immediately prior to the placing of the fill materials, the entire area upon which the embankment is to be placed, except where limited by rock, shall be scarified and broken by means of a disc harrow or plow, or other approved equipment, to a depth of 6 inches. Scarifying shall be done approximately parallel to the axis of the fill. All roots, debris, large stones, or objectionable material that would cause interference with the compaction of the foundation or fill shall be removed from the area and disposed of as directed. A thin layer (approximately 3 inches) of the fill material shall be spread over the scarified foundation and the whole area compacted as required in the specifications.

Where embankments are to be constructed against existing slopes which are 3:1 or steeper, steps or benches, a minimum of 10' wide shall be cut into the existing slope as each layer of new embankment material is being placed and spread. Material excavated by the benching process shall be incorporated into the embankment and shall not be measured for payment.

For overlays, prior to paving, the existing one (1) foot width of turf adjacent to the pavement edges shall be peeled back away from the pavement edge to facilitate paving and milling operations. No additional

compensation for this work shall be made, but shall be considered incidental to shoulder adjustment. Prior to construction of shoulder adjustment, the existing turf shall be thoroughly disced or tilled. No additional compensation for this work shall be made, but shall be considered incidental to shoulder adjustment.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the yardage removed or used will be paid for under the respective item of work.

152-2.6 FORMATION OF EMBANKMENTS. Embankments shall be formed of satisfactory materials placed in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross section.

The grading operations shall be conducted, and the various soil strata shall be placed, to produce a soil structure as shown on the typical cross section or as directed. All materials entering the embankment shall be reasonably free of organic matter such as leaves, grass, roots, and other objectionable material. Soil, granular material, shale, and any other material permitted for use in embankment shall be spread in successive layers as specified.

Operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing weather, or other unsatisfactory conditions of the field. The Contractor shall drag, blade, or slope the embankment to provide proper surface drainage.

The material in the layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Wetting or drying of the material and manipulation when necessary to secure a uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. Sprinkling shall be done with approved equipment that will sufficiently distribute the water. Sufficient equipment to furnish the required water shall be available at all times. Samples of all embankment materials for testing, both before and after placement and compaction, will be taken at frequent intervals. From these tests, corrections, adjustments, and modifications of methods, materials, and moisture content will be made to construct the embankment.

Rolling operations shall be continued until the embankment is compacted to not less than the percentage of the maximum density, at optimum moisture, shown in TABLE 1. The Contractor shall have a nuclear density gauge and qualified operator onsite for purposes of quality control (QC) testing. When the Contractor is satisfied that a lift has been compacted in accordance with the percentage of the maximum density as specified herein, the Resident Engineer shall be informed that the lift is ready for acceptance testing. The Contractor shall not proceed to construct another lift of embankment until the previous lift has been accepted by the Resident Engineer. Any areas deemed unacceptable to the Resident Engineer shall be reworked and re-compacted at no additional cost to the contract.

Below proposed and future pavements: Embankment placed shall not contain more than 120 percent nor less than 90 percent of optimum moisture determined in accordance with ASTM D 2216.

All soft and yielding materials or materials which displace or "pump" under construction traffic shall be re-worked or replaced as directed by the Engineer. The cost of re-working shall be considered incidental to this item.

All shoulder embankment shall be constructed using topsoil or other acceptable excavated material. Moisture and density control will not be required for shoulder embankment less than six inches in compacted thickness or for topsoil, but such embankment shall be compacted by a minimum of three passes of a sheepfoot roller to the satisfaction of the Engineer.

During construction of the embankment, the Contractor shall route his/her equipment at all times, both when loaded and when empty, over the layers as they are placed and shall distribute the travel evenly over the entire width of the embankment. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

In the construction of embankments, starting layers shall be placed in the deepest portion of the fill; as placement progresses, layers shall be constructed approximately parallel to the finished pavement grade line.

When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the embankment and the other material shall be incorporated under the future paved areas. Stones or fragmentary rock larger than 4 inches in their greatest dimension will not be allowed in the top 6 inches of the subgrade. Rockfill shall be brought up in layers as specified or as directed and every effort shall be exerted to fill the voids with the finer material to form a dense, compact mass. Rock or boulders shall not be disposed of outside of the excavation or embankment areas, except at places and in the manner designated by the Resident Engineer.

Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material.

The Contractor shall be responsible for the stability of all embankments made under the contract and shall replace any portion which, in the opinion of the Resident Engineer, has become displaced due to carelessness or negligence on the part of the Contractor.

There will be no separate measurement or payment for compacted embankment, and all costs incidental to placing in layers, compacting, diskings, watering, mixing, sloping, and other necessary operations of the embankments will be included in the contract price for excavation, borrow, or other items.

152-2.7 PREPARATION AND PROTECTION OF THE TOP OF THE SUBGRADE. On areas to be paved, the specified depth in cut areas and the top of embankment shall be compacted to the density specified. When completed, the surface shall be true to the lines, grades, and cross section shown on the plans or as directed by the Resident Engineer. After all drains, structures, ducts, and other underground appurtenances under the pavement have been completed, the subgrade shall be compacted to the density specified. Any irregularities or depressions that develop under rolling shall be corrected by loosening the material at these places and adding, removing, or replacing material until the surface is smooth and uniform. Any portion of the area which is not accessible to a roller shall be compacted to the required density by approved mechanical tampers. The material shall be sprinkled with water during rolling or tamping, when directed by the Resident Engineer.

All soft and yielding material and material which will not compact readily when rolled or tamped shall be removed as directed by the Resident Engineer and replaced with suitable material. After grading operations are complete, all loose stones larger than 2 inches in their greatest dimension shall be removed from the surface of all proposed graded paving areas and disposed of as directed by the Resident Engineer.

At all times, the top of the subgrade shall be kept in such condition that it will drain readily and effectively. In handling materials, tools, and equipment, the Contractor shall protect the subgrade from damage by laying planks when directed and shall take other precautions as needed. In no case will vehicles be allowed to travel in a single track. If ruts are formed, the subgrade shall be reshaped and rolled. Storage or stockpiling of materials on the top of the subgrade will not be permitted. Until the subgrade has been checked and approved, no subbase, base, surface course, or pavement shall be laid thereon.

152-2.8 HAUL. No payment will be made separately or directly for haul on any part of the work. All hauling will be considered a necessary and incidental part of the work and its cost shall be considered by the Contractor and included in the contract unit price for the pay items of work involved.

The Contractor shall take special precautions when hauling excavated material so as not to create deep ruts in the hauling areas designated by the Project Engineer. All existing graded, turfed, sodded and/or farmed areas which are disturbed or rutted by the Contractor, during all of his/her hauling operations, shall be regraded, returfed and refinished at his/her own expense and to the satisfaction of the Engineer. No claim for haul will be allowed the Contractor.

The Contractor will not be allowed to haul any materials across areas which are currently in crops and are designated by the Airport Management to be used for agriculture or which have been recently seeded under this or a previous contract.

152-2.9 TOLERANCES. In those areas upon which a subbase or base course is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a 16-foot straightedge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of 1/2 inch, or shall not be more than 0.05 foot from the true grade as established by grade hubs or pins. Any deviation in excess of these amounts shall be corrected by loosening, adding, or removing materials, reshaping, and recompacting by sprinkling and rolling.

On safety areas, turf landing strips, intermediate and other designated areas, the surface shall be of such smoothness that it will not vary more than 0.10 of a foot from true grade as established by grade hubs. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-2.10 TOPSOIL. When topsoil is specified or required, as shown on the plans or under Item 905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item 905 or shall be approved by the Resident Engineer. If, at the time of excavation or stripping, the topsoil cannot be placed in its proper and final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall not be placed within 50 feet of pavement areas and shall not be placed on areas which subsequently will require any excavation or embankment.

Upon completion of grading operations as specified, topsoil shall be handled and placed as directed, or as required in Item 905. The Contractor shall set grade stakes for grading operations in both cut and fill so that the topsoil will be placed at the finished plan elevation.

No direct payment will be made for topsoil as such under Item 152. The quantity removed and placed or stockpiled shall be paid for at the contract unit price per cubic yard for "Unclassified Excavation".

When topsoil is paid for under Item 152, as excavation, no payment shall be made for the same work under Item 905.

Any excess topsoil material shall be hauled to an onsite stockpile location determined by the Airport Management at no additional cost to the contract.

All stockpiles left in place as directed by the Resident Engineer shall be shaped to non-uniform, smooth, site-complimentary lines prior to seeding. The cost of seeding stockpiles shall be incidental to Unclassified Excavation.

Debris or other materials not suitable for use in earth embankment, as determined by the Resident Engineer, shall be disposed of off the airport property.

Excavation shall be paid for only once. Stockpiling of topsoil for later reuse and redistribution shall be done at the Contractor's expense. Stockpiling necessary for respreading on shoulders, embankments, cut or borrow areas shall be considered incidental to the unit price bid for excavation.

152-2.11 STRIPPING. All vegetation such as brush, heavy sods, heavy growth of grass, decayed vegetable matter, rubbish, and any other unsuitable material within the area upon which embankment is to be placed shall be stripped or otherwise removed before the embankment is started, and in no case shall such objectionable material be allowed in or under the embankment.

Obviously compressible and/or organic materials shall be removed down to dense material as directed by the Resident Engineer, and replaced with suitable embankment material. The cost of this work, should it occur, will be measured and be paid for as Unclassified Excavation.

Stripping of vegetation and crop root structures shall not be measured separately for payment, but shall be considered incidental to UNCLASSIFIED EXCAVATION. Portions of the excavation acceptable to the Engineer may be reused as shoulder fill outside of the proposed pavement limits, as shown on the typical sections in the plans. Material accepted as shoulder fill shall be free of heavy sods, crop root structures, decayed vegetative matter, rubbish and other unsuitable material. All other excavated material shall be used in earth berms or disposed of as directed by the Resident Engineer.

152-2.12 EQUIPMENT. The Contractor may use any type of earth-moving compaction, and watering equipment he may desire or has at his/her disposal, provided the equipment is in a satisfactory condition and is of such capacity that the construction schedule can be maintained as planned by the Contractor and as approved by the Project Engineer in accordance with the total calendar days or working days bid for the construction. The Contractor shall furnish, operate, and maintain such equipment as is necessary to control uniform density, layers, section, and smoothness of grade.

152-2.13 FIELD TILE. Any farm drain tile or other underground construction encountered in the work shall be located and staked and reported to the Resident Engineer in writing. Any drainage lines which are cut or damaged by grading, trenching, excavation or other construction activities shall be repaired and connected to the proposed storm sewer system, where practical, by the Contractor at his/her expense in such manner as to render the lines usable for the purpose intended.

152-2.14 WORK AREA CONDITIONS. If work area conditions become such that the health and safety of the Contractor's workers, the engineers, or the public are affected, the Contractor shall rectify the condition through watering, disking or blading of the work area or other suitable method, as approved by the Resident Engineer. This maintenance cost shall be considered incidental to the contract. As a minimum, Federal, State and Local laws, rules and regulations concerning construction safety and health standards shall be enforced.

METHOD OF MEASUREMENT

152-3.1 The yardage paid for shall be the number of cubic yards measured in its original position. Pay quantities shall be computed to the neat lines staked, by the method of average end areas of materials acceptably excavated and stripped as specified.

Measurement shall not include the yardage of material excavated without authorization beyond normal slope lines, or the yardage of material used for purposes other than those directed.

Before any work is started which would affect the measurements, the earthwork Contractor shall verify all earthwork quantities shown in the plans are in agreement with earthwork quantities from his/her own calculations. The Contractor shall notify the Engineer of any discrepancies in quantities.

When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans and the Contractor and the Resident Engineer have agreed in writing by the use of form AER-981 that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the Plans have been altered or when disagreement exists between the Contractor and the Resident Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured as herein specified.

152-3.2 All borrow excavation to be paid for, with the exception of borrow excavation required for shoulder adjustment, shall be the number of cubic yards measured in its final compacted position and pay quantities shall be computed by the method of average end areas.

When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans and the Contractor and the Resident Engineer have agreed in writing by the use of form AER-981 that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the Plans have been altered or when disagreement exists between the Contractor and the Resident Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to perform surveys and average end area calculations in order to verify actual quantities.

152-3.3 Shoulder adjustment measured for payment shall be the number of square yards measured in its final position at the locations shown in the plans or as directed by the Engineer. No measurement

for payment shall be made for topsoil stripping, spreading and excavation associated with the shoulder adjustment.

BASIS OF PAYMENT

152-4.1 Payment shall be made at the contract unit price per cubic yard for "Unclassified Excavation." This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

Payment for "Unclassified Excavation" shall also include removal of unsuitable materials, if any, at the discretion of the Engineer and required excavation of onsite stockpiles for shoulder fill.

152-4.2 Payment will be made at the contract unit price per cubic yard measured in initial position for "Unclassified Excavation". This price shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to satisfactorily complete the item.

152-4.3 Payment will be made at the contract unit price per cubic yard measured in its final position for "Borrow Excavation" and "Offsite Borrow Excavation". This price shall be full compensation for furnishing all materials, labor, equipment, tools and incidentals necessary to satisfactorily complete the item.

152-4.4 Payment shall be made at the contract unit price per square yard for "Shoulder Adjustment". This price shall be full compensation for topsoil stripping, stockpiling and spreading, excavation and for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item.

ITEM 152540 SOIL STABILIZATION FABRIC

DESCRIPTION

152-1.1 This work shall consist of placing a soil stabilization fabric on a prepared subgrade prior to the placement of aggregate base as shown in the plans.

MATERIALS

152-2.1 Geotextile Fabric for Soil Stabilization. Fabric for soil stabilization shall consist of woven or nonwoven filaments of polypropylene, polyester, or polyethylene. Nonwoven fabric may be needle punched, heat-bonded, resin-bonded, or combination thereof. The fabric shall be resistant to ultraviolet radiation and shall comply with the following physical properties.

Physical Properties	Ground Stabilization
Grab Tensile Strength (lbs), ASTM D 4632 ^{1/}	200 min.
Grab Elongation @ Break (%), ASTM D 4632 ^{1/}	12 min.
Burst Strength (psi) – ASTM D 3786 ^{2/}	250 min.
Trapezoidal Tear Strength (lb), ASTM D 4533 ^{2/}	75
Weight (oz/sq yd.) - ASTM D 3776	4.0 min.

Physical Properties (Metric)	Ground Stabilization
Grab Tensile Strength (N), ASTM D 4632 ^{1/}	900 min.
Grab Elongation @ Break (%), ASTM D 4632 ^{1/}	12 min.
Burst Strength (kPa) – ASTM D 3786 ^{2/}	1720 min.
Trapezoidal Tear Strength (N), ASTM D 4533 ^{2/}	335
Weight (g/sq m) – ASTM D 3776	135 min.

1/ For woven fabric, test results shall be referenced to orientation with warp or weave, whichever the case may be. Both woven and nonwoven fabric shall be tested wet.

2/ Test results may be obtained by manufacturer's certification.

CONSTRUCTION METHODS

152-3.1 The soil stabilization fabric shall be installed in conformance with the applicable requirements of the IDOT Standard Specifications for Road and Bridge Construction, latest edition.

Soil Stabilization fabric will comply with construction methods in the applicable section of the IDOT Standard Specifications for Road and Bridge Construction, latest edition, titled Fabric for Ground Stabilization.

METHOD OF MEASUREMENT

152-4.1 The area of soil stabilization fabric shall be the square yards of soil stabilization fabric satisfactorily placed and accepted by the Engineer.

BASIS OF PAYMENT

152-5.1 Payment shall be made at the contract unit price for soil stabilization fabric installed on the project. These prices shall be full compensation for furnishing all materials, labor, equipment and any incidentals necessary to install the soil stabilization fabric shown on the plans

ITEM 155 LIME TREATED SUBGRADE

DESCRIPTION

155-1.1 This item shall be considered as lime modified subgrade and all references to lime treated subgrade in Item 155 shall be construed as lime modified subgrade.

This item shall consist of constructing one or more courses of a mixture of soil, lime, and water mixture in accordance with this specification, and in conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans. The lime modified subgrade will be completed prior to the placement of the proposed pavements.

155-1.2 It is the Contractor's responsibility to account for any "fluff" in the lime modified subgrade. The Contractor will account for it in the pre-cutting of the subgrade and the final grading of the subgrade. Excess material will be disposed of on the airport site as directed by the Resident Engineer. Excess material shall not be placed within 6 inches of finished grade.

Prior to delivering lime to the project, the Contractor shall submit to the Engineer certification from the lime supplier that the lime provided to the project conforms to the requirements herein and that the producer is an IDOT Division of Highways approved source for the type of lime supplied.

MATERIALS

155-2.1 HYDRATED LIME. Hydrated lime shall be according to ASTM C 207, Type N with the following modifications:

- A. Total calcium and magnesium oxides (nonvolatile basis) = 90% minimum (ASTM C 25).
- B. Free calcium oxide (as-received basis) = 5% maximum (ASTM C 25).
- C. Free moisture (as-received basis) = 4% maximum (ASTM C 25).
- D. Sieve Analysis:

ILLINOIS MODIFIED AASHTO T 27	
Sieve	Maximum % Retained
No. 4 (4.75 mm)	0
No. 30 (600 µm)	2.5
No. 100 (150 µm)	15

155-2.2 BY-PRODUCT, HYDRATED LIME. By-product, hydrated lime shall be according to the following:

- A. Total calcium and magnesium oxides (nonvolatile basis) = 90% minimum (ASTM C 25).
- B. Available calcium hydroxide (rapid sugar test, ASTM C 25) plus total MgO content calculated to be equivalent Ca(OH)_2 = 70% minimum (ASTM C 25).
- C. As-received loss on ignition (carbon dioxide plus moisture, combined and free) = 5% maximum (ASTM C 25).
- D. Free moisture (as-received basis) = 4% maximum (ASTM C 25).
- E. SO_3 = 10% maximum.

F. Sieve Analysis:

ILLINOIS MODIFIED AASHTO T 27	
Sieve	Maximum % Retained
No. 4 (4.75 mm)	0
No. 30 (600 μm)	10
No. 100 (150 μm)	60

155-2.3 BY-PRODUCT, NON-HYDRATED LIME. By-product, non-hydrated lime shall be according to the following:

- A. Total calcium and magnesium oxides (nonvolatile basis) = 60% minimum (ASTM C 25).
- B. Available calcium hydroxide (rapid sugar test, ASTM C 25) plus total MgO content calculated to be equivalent Ca(OH)_2 = 30% minimum (ASTM C 25).
- C. As-received loss on ignition (carbon dioxide plus moisture, combined and free) = 40% maximum (ASTM C 25).
- D. Free moisture (as-received basis) = 4% maximum (ASTM C 25).
- E. SO_3 = 10% maximum
- F. Sieve Analysis:

ILLINOIS MODIFIED AASHTO T 27	
Sieve	Maximum % Retained
No. 4 (4.75 mm)	5
No. 30 (600 μm)	10
No. 100 (150 μm)	30

155-2.4 LIME SLURRY. The lime used in the slurry shall be either hydrated lime according to the requirements of ASTM C 207, Type N, or quicklime according to the requirements for calcium lime as stated in ASTM C 5. The quantity of lime in the slurry shall be a minimum of 35% and a maximum of 45% by total weight (mass) of slurry.

155-2.5 WATER. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product. Water of questionable quality shall be tested in accordance with and shall meet the suggested requirements of AASHTO T 26. Water known to be of potable quality may be used without testing.

155-2.6 SOIL. The soil for this work shall consist of embankment or existing soil materials which are in-place at the location shown for the lime modified soil in the typical sections, or as directed by the Resident Engineer. The soil shall be free of roots, sod, weeds, and stones larger than 2 1/2 inches.

COMPOSITION

155-3.1 LIME. Lime shall be applied at the rate specified on the plans for the depth of subgrade treatment shown.

Lime shall be applied at an approximate rate of 5 percent lime by dry soil weight, based on maximum theoretical density. For the assumed subgrade soil types, this would equate to approximately 4.0 pounds of lime per square yard per inch of depth. The actual proportions of lime, soil and water will be set by the Contractor before work begins. The Engineer reserves the right to make such adjustments of lime proportioning as are considered necessary during the progress of the work within a range of $\pm 2\%$, without additional compensation to the Contractor. Source of type of lime shall not be changed during the progress of the work without permission of the Engineer. The right is reserved by the Engineer to make such changes in proportions during the progress of the work, as he may consider necessary.

The optimum moisture content and maximum dry density of the lime-modified soil shall be determined in accordance with ASTM D 698 for aircraft weighing less than 60,000 lbs. and in accordance with ASTM D 1557 for aircraft weighing 60,000 lbs. and more by the Contractor.

155-3.2 TOLERANCES. At final compaction, the lime and water content for each course of subgrade treatment shall conform to the following tolerances:

Material	Tolerance
Lime	+ 0.5%
Water	+ 2%, -0%

WEATHER LIMITATIONS

155-4.1 WEATHER LIMITATIONS. Lime shall not be applied or mixed while the atmospheric temperature is below 40° F. or when conditions indicate that temperatures may fall below 40° F. within 24 hours, when it is foggy or rainy, or when soil or subgrade is frozen.

The amount of lime modified soil constructed shall be limited to that which can be covered within the same construction season, unless otherwise permitted by the Engineer.

EQUIPMENT

155-5.1 EQUIPMENT. The equipment required shall include all equipment necessary to complete this item such as: grading and scarifying equipment, a spreader for the lime or lime slurry, mixing or pulverizing equipment, sheepsfoot and pneumatic or vibrating rollers, sprinkling equipment, trucks, and truck scales. All machinery, tools, and equipment shall be on the site and approved by the Resident Engineer prior to the beginning of construction operations and shall be maintained in a satisfactory working condition throughout the construction period.

Equipment shall meet the following requirements:

- A. Three Wheel Roller - The roller shall be self-propelled; capable of being operated smoothly and without jerking when starting, stopping, or reversing directions; and free from backlash, loose link motion, faulty steering mechanism and worn king bolts. The steering mechanism shall have no lost motion, shall operate readily, and permit the roller to be directed on the alignment desired.

Roller wheels shall be smooth and free from openings or projections that could mar the surface on which the roller is operated. Motor rollers shall be equipped with drip pans designed to prevent oil, grease or gasoline from dropping upon the surface. The roller shall be provided with adjustable scrapers that shall be used when necessary to keep the surface of the wheels clean.

The rear wheels of three wheel rollers may be crowned at the rate of not more than 1/16 inch in 20 inches and shall be propelled with a differential gear. The front wheel shall be divided into at least two sections, shall show no noticeable crown, and shall overlap the compression area of each rear wheel by not less than 2-1/2 inches. The roller shall weigh not less than 6 tons nor more than 12 tons and shall have a compression on the drive wheels of not less than 190 pounds nor more than 400 pounds per inch width of roller.

The Contractor shall provide means for determining the weight of the roller as distributed on each axle. Ballast will be included in determining the weight.

- B. Tandem Roller - The roller shall be self propelled; capable of being operated smoothly and without jerking when starting, stopping or reversing directions; and free from backlash, loose link motion, faulty steering mechanism and worm king bolts. The steering mechanism shall have no lost motion, shall operate readily, and permit the roller to be directed on the alignment desired. Roller wheels shall be smooth and free from openings or projections that could mar the surface on which the roller is operated. Motor rollers shall be equipped with drip pans designed to prevent oil, grease or gasoline from dropping upon the surface. The roller shall be provided with adjustable scrapers that shall be used when necessary to keep the surface of the wheels clean.

The rear wheel may be crowned at the rate of not more than 3/16 inch in 4-1/2 feet. The front wheel shall be divided into at least two sections and shall show no noticeable crown. The roller shall weigh not less than 6 tons nor more than 12 tons and shall have a compression on the drive wheels of not less than 190 pounds nor more than 400 pounds per inch width of roller.

The Contractor shall provide means for determining the weight of the roller as distributed on each axle. Ballast will be included in determining the weight.

- C. Tamping Roller - The roller, under working conditions, shall have a minimum weight of 90 pounds per inch width of drum, and each individual tamper shall develop a compression of not less than 100 pounds per square inch of its tamping face area. The width of the tamping roller shall be not less than 8 feet, and it shall be constructed in two or more sections in such a manner that each section is free to oscillate or move independently. It shall be equipped with cleaning teeth at the rear. It shall also be equipped with a vibratory mode with 1600 vibrations per minute (VPM).
- D. Pneumatic Tire Roller - the roller shall consist of not less than 9 pneumatic tires revolving on 2 axles. The tires on the front and rear wheels shall be staggered so that they will cover the entire area over which the roller travels. Under working conditions, the roller shall develop a compression of not less than 225 pounds per inch width of tire tread.
- E. Vibratory Roller - The roller shall be self-propelled and meet the following minimum requirements: drum diameter 48 inches, length of drum 66 inches, vibrators 1600 vibrations per minute (VPM), unit static force on vibrating drum(s) 125 pounds per linear inch (PLI), total applied force 325 pounds per linear inch (PLI), adjustable eccentrics, reversible eccentrics on nondriven drum(s). The total applied force for various combinations of VPM and eccentric positions shall be shown on decals on the vibrating roller or on a chart maintained with the roller.
- F. Disk Harrow - the disk harrow shall be the tandem type and shall meet the approval of the Resident Engineer prior to its use. It shall be of sufficient size and weight to perform the manipulation required.
- G. Rotary Speed Mixer - Rotary speed mixers shall be either the power takeoff or the self powered type, equipped with a hydraulic lift. Worn scarifying and mixing parts shall be replaced and extra parts shall be available for replacement.
- H. Traveling Mixing Plant - All traveling mixing plants shall meet the approval of the Resident Engineer. The plants shall be either of the type that will pulverize the material to be modified and mix the material and cement with the proper amount of water without picking the materials up from the roadway, or of the pugmill type which elevates the material into a pugmill for mixing. The plant shall be equipped with a device that will accurately control and measure the quantity of water used. Worn scarifying and mixing parts shall be replaced and extra parts shall be available for replacement.
- I. Distributor - Distributor for spreading lime shall be cyclone, screw-type or pressure manifold type, as approved by the Engineer.

CONSTRUCTION METHODS

155-6.1 GENERAL. It is the primary requirement of this specification to secure a completed subgrade containing a uniform lime mixture, free from loose or segregated areas, of uniform density and moisture content, well bound for its full depth, and with a smooth surface suitable for placing subsequent courses. It shall be the responsibility of the Contractor to regulate the sequence of his/her work, to use the proper amount of lime, maintain the work, and rework the courses as necessary to meet the above requirements.

Prior to beginning any lime treatment, the subgrade shall be constructed and brought to grade as specified in Item 152 "Excavation and Embankment" and shall be shaped to conform to the typical sections, lines, and grades as shown on the plans or as established by the Resident Engineer. Prior to beginning any lime treatment in the area designated for the lime modified subgrade, the area shall be trimmed to grade (+0.00' to -0.10') by means approved by the Engineer as specified in Item 152.

155-6.2 APPLICATION. Lime shall be spread only on that area where the first mixing operations can be completed during the same working day. The application and mixing of lime with the soil shall be accomplished by the methods hereinafter described as "Dry Placing" or "Slurry Placing." When hydrated lime is specified, the Contractor may use either method.

- Dry placing. The lime shall be spread uniformly over the top of the subgrade by an approved screw-type spreader box or other approved spreading equipment. The amount of lime spread shall be the amount required for mixing to the specified depth which will result in the percentage determined in the job mix formula.

The lime shall be distributed in such manner that scattering by wind will be minimal. Lime shall not be applied when wind conditions, in the opinion of the Resident Engineer, are detrimental to a proper application. A motor grader shall not be used to spread the lime. The material shall be sprinkled, as directed by the Resident Engineer, until the proper moisture content has been reached.

The surface of the grade shall be lightly scarified or disked prior to distribution of the lime. The lime shall then be distributed uniformly over the surface. The Engineer may reject any procedure which does not provide even distribution of lime. In the event that rain intervenes, causing cessation of work and exposure of the lime to washing or blowing, the Engineer may require additional lime to be spread at no cost to the Contract.

The lime shall be disked, if required, to prevent dusting as directed by the Engineer.

During the interval of time between application and mixing, lime that has been exposed to the open air for a period of 6 hours or more, or to excessive loss due to washing or blowing, shall be replaced by the Contractor at his/her expense.

155-6.3 MIXING. The use of a rotary speed mixer or traveling mixing plant is required. The lime, existing soil and water shall be thoroughly mixed and blended by approved mixers or other equipment approved by the Engineer, and the mixing continued until, in the opinion of the Engineer, a homogenous mixture is obtained. The Contractor shall demonstrate to the Engineer that the equipment is capable of mixing to the full depth specified prior to beginning full production.

155-6.4 COMPACTION. Compaction of the mixture shall begin immediately after final mixing. The material shall be aerated or sprinkled as necessary to provide optimum moisture. Compaction shall be started immediately after mixing, unless approved by the Engineer. If compaction is to be delayed, the surface of the lime modified soil shall be sealed by light rolling immediately after mixing.

Compaction shall begin at the bottom and shall continue until the entire depth is uniformly compacted. The entire thickness of the modified subgrade shall be compacted to a density of not less than 95% of the standard dry density. The standard dry density of the lime-modified soil shall be determined in accordance with ASTM D 698 for aircraft weighing less than 60,000 lbs. and in accordance with ASTM D 1557 for aircraft weighing 60,000 lbs. and more. Field density shall be determined in accordance with ASTM D 1556, D 2167, D 2922 or other methods approved by the Engineer. If proper compaction and stability are not achieved, the Contractor will reprocess and compact the failing areas.

The material shall be sprinkled and rolled as directed by the Resident Engineer. All irregularities, depressions, or weak spots which develop shall be corrected immediately by scarifying the areas affected, adding or removing material as required, and reshaping and recompacting by sprinkling and rolling. The surface of the course shall be maintained in a smooth condition, free from undulations and ruts, until other work is placed thereon or the work is accepted.

In addition to the requirements specified for density, the full depth of the material shown on the plans shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section is completed, tests will be made by the Resident Engineer. If the material fails to meet the density requirements, it shall be reworked to meet these requirements. Throughout this entire operation, the shape of the course shall be maintained by blading, and the surface upon completion shall be smooth and shall conform with the typical section shown on the plans and to the established lines and grades. Should the material, due to any reason or cause, lose the required stability, density, and finish before the next course is placed or the work is accepted, it shall be recompacted and refinished at the sole expense of the Contractor.

155-6.5 FINISHING AND CURING. After the final layer or course of lime-treated subgrade has been compacted, it shall be brought to the required lines and grades in accordance with the typical sections. The completed section shall then be finished by rolling, as directed, with a pneumatic or other suitable roller sufficiently light to prevent hair cracking. The finished surface shall not vary more than 3/8 inch when tested with a 16-foot straightedge applied parallel with and at right angles to the pavement centerline. Any variations in excess of this tolerance shall be corrected by the Contractor, at his/her own expense, in a manner satisfactory to the Resident Engineer.

Once the specified density of the lime-soil mixture is achieved, the Contractor may start final trimming operations and placement of the overlying course if the compacted lime modified layer is not rutted or distorted by the equipment.

The Contractor shall keep the lime-soil mixture moist cured for a minimum of seven (7) days by watering or by placement of the overlying course.

The surface shall be maintained in a moist condition by means of a fine spray during all finishing operations and throughout the curing period.

Upon completion of compaction operations the Contractor shall be required to trim the lime modified soil to finish subgrade elevations.

Subsequent courses shall be applied within 14 days after the lime-treated subgrade is cured.

155-6.6 THICKNESS. The thickness of the lime-treated subgrade shall be determined by depth tests or cores taken at intervals so that each test shall represent no more than 300 square yards. When the base deficiency is more than 1/2 inch, the Contractor shall correct such areas in a manner satisfactory to the Resident Engineer. The Contractor shall replace, at his/her expense, the subgrade material where borings are taken for test purposes.

155-6.7 MAINTENANCE. The Contractor shall maintain, at his/her own expense, the entire lime-treated subgrade in good condition from the start of work until all the work has been completed, cured, and accepted by the Engineer.

METHOD OF MEASUREMENT

155-7.1 The quantity of lime to be paid for shall be the number of tons of material placed, blended, and accepted in the completed subbase but not in excess of 105 percent of the amount specified. The lime shall be weighed either at the place of loading in the trucks, at the place of unloading of the trucks, or at such other point as the Resident Engineer may designate. The Contractor shall furnish approved duplicate load tickets upon which is recorded the net weight of the lime in each truck. The Contractor shall submit one (1) load ticket to the Resident Engineer, or his/her duly authorized representative, at the job site when the truck load is incorporated into the subbase.

The Contractor shall furnish or arrange for the use of scales of a type approved by the Resident Engineer.

The yardage of soil processing of the depth shown on the plans to be paid for shall be the number of square yards processed, completed and accepted.

Measurement shall not include the quantities used in areas outside the limits shown in the plans or designated by the Engineer.

BASIS OF PAYMENT

155-8.1 Payment will be made at the contract unit price per ton for the lime; at the contract unit price per square yard for the lime processing of the thickness specified. These prices shall be full compensation for furnishing all material, water, lime, and for all mobilization, preparation, delivering, placing and mixing these materials, and all labor, equipment, tools and incidentals necessary to complete this item.

ITEM 156000 EROSION CONTROL

DESCRIPTION

156-1.1. This item shall consist of constructing temporary and permanent erosion control systems as shown on the plans or as ordered by the Resident Engineer during the life of the contract to control erosion and sediment damage to the adjacent properties and water resources through the use of ditch checks, inlet sedimentation control, erosion control silt filter fence and temporary seeding.

As part of this item, the Contractor shall be required to comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) Storm Water Permit for construction site activities.

Information on the above-referenced permits may be obtained from:

Illinois Environmental Protection Agency
Division of Water Pollution Control
1021 North Grand Avenue East
Springfield, Illinois 62702

MATERIALS

156-2.1 SILT FENCE. This fence shall either be a prefabricated silt fence meeting the dimensional requirements and details shown in the plans or shall be a silt fence fabricated on site conforming to the requirements contained in Item 161 for 7-bar, 26 inch woven wire fence with metal "T" posts except that no special corner posts, bracing or P.C.C. will be required and a 36" width of filter fabric shall be secured to the bottom of the fence on its upstream side as shown in the plans.

The fabric for silt filter fence shall be a woven fabric meeting the requirements of AASHTO M 288 for unsupported silt fence with less than 50 percent geotextile elongation.

156-2.2 BALE STAKES. Shall be four feet minimum length each and be either of sound wood 1" square (minimum) or #4 rebar.

156-2.3 HAY OR STRAW BALES. Bales shall be either hay or straw, approved by the Resident Engineer, compacted and adequately bound by wire to the approximate size of 12 x 18 x 36 in. (300 x 400 x 900 mm). The Contractor is responsible for following current Environmental Protection Agency standards to obtain acceptance for a National Pollutant Discharge Elimination System (NPDES) permit. The Contractor is responsible for any changes to the materials in order to approve the permit.

156-2.4 TEMPORARY MULCH. The temporary mulch cover shall meet the requirements of Item 908.

156-2.5 TEMPORARY SEED. Temporary grass seed shall be a quick growing species (such as cereal grain of wheat, rye or oats) suitable to the area to provide a temporary cover.

156-2.6 TEMPORARY DITCH CHECKS. Temporary ditch checks shall be constructed with products from the Department's approved list, rolled excelsior, or with aggregate placed on filter fabric when specified.

156-2.7 INLET AND PIPE PROTECTION. The protection shall be constructed with hay or straw bales, silt filter fence, or inlet filters.

CONSTRUCTION METHODS

156-3.1 GENERAL. The Contractor shall conduct his/her construction operations in accordance with the latest revision of the Illinois Environmental Protection Agency publication "Standards and Specifications for Soil Erosion and Sediment Control".

Erosion control must be considered by the Contractor prior to exposing any erodible material. Erosion protection for Contractor-furnished borrow pits, equipment storage sites, plant sites and haul roads shall be provided by the Contractor.

The Contractor has the responsibility to limit the surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and embankment operations and to provide immediate permanent or temporary pollution control measures. Cut slopes shall be permanently seeded and mulched as the excavation proceeds to the extent considered desirable and practical.

Slopes that erode easily shall be temporarily seeded as the work progresses with a cereal grain of wheat, rye or oats obtained from a local supplier or seed store. The cereal grains may be planted by a hand seeder or other acceptable method and covered by a drag or harrow to provide a quick cover crop. Inspection of the cereal grain seed will not be required. The intent of using cereal grains as temporary erosion control is to permit the Contractor to quickly seed potential areas as the need arises with on-site personnel and equipment.

156-3.2 TEMPORARY EROSION CONTROL. The installation and maintenance temporary erosion control systems shall be as shown on the plans, or as directed by the Resident Engineer, and where appropriate, according to the manufacturer's specifications. Specific requirements for the various systems shall be as follows.

- A. Temporary Ditch Checks. Manufactured ditch checks shall be installed according to manufacturers specifications. Spacing of ditch checks shall be such that the low point in the center of one ditch check is at the same elevation as the base the ditch check immediately upstream. Temporary ditch checks shall be sufficiently long enough that the top of the device in the middle of the ditch is 6 inches lower than the bottom of the terminating ends of the ditch side slopes.

When rolled excelsior is used, each ditch check shall be installed and maintained such that the device is no less than 10 inches high at the point of overflow. Units installed at a spacing requiring a height greater than 10 inches shall be maintained at the height for the spacing at which they were originally installed.

- B. Inlet and Pipe Protection. When inlet filters are specified, they shall be installed either directly on the drainage structure or under the grate of the drainage structure resting on the lip of the frame. The fabric bag shall be hang down into the drainage structure. Prior to ordering materials, the Contractor shall determine the size and shape of the various drainage structures being protected.
- C. Temporary Erosion Control Seeding. Seed bed preparation will not be required if the soil is in a loose condition. Light disking shall be done if the soil is hard packed or caked. Fertilizer nutrients will not be required.

The original seed bags shall be opened in the presence of the Resident Engineer. The seed shall be applied by hand broadcasting to achieve a reasonably uniform coverage at a rate of 100 lb/acre. Seed shall be applied to all bare areas every seven days, regardless of weather conditions or progress of work. The Resident Engineer may require that critical locations be seeded immediately and the Contractor shall seed these areas within 48 hours of such a directive.

- D. Temporary Mulch. The temporary mulch cover shall be installed according to Item 908.
- E. Straw Bale Barrier. The installation and control of straw bale barriers shall be at the location shown on the plans, or as directed by the Resident Engineer.

156-3.3 SILT FENCE. The installation and maintenance of silt fence shall be at the locations shown on the plans, or as directed by the Resident Engineer.

The Contractor shall maintain the alignment and condition of the silt fence, as necessary, throughout its use on the project. Upon completion and/or as directed, the Contractor shall remove the silt fence from the project.

156-3.4 DUST CONTROL. The Contractor shall employ construction methods and means that will keep flying dust to the minimum as directed by the Resident Engineer. The Contractor shall provide for the laying of water on the project, and on roads, streets, aprons and other areas immediately adjacent

to the project limits, wherever traffic, or buildings that are occupied or in use, are affected by such dust caused by hauling or other operations. The cost of carrying out the foregoing provisions shall be incidental to the contract.

156-3.5 MAINTENANCE AND REMOVAL OF TEMPORARY EROSION CONTROL SYSTEM. The temporary erosion control systems installed by the Contractor shall be properly maintained as directed by the Resident Engineer to control siltation at all times during the life of the contract. Any additional material and work required by the Resident Engineer will be measured and paid as herein specified. If the Contractor fails to maintain the temporary erosion control systems as directed by the Resident Engineer, the Resident Engineer may at the expiration of a period of 48 hours, after having given the Contractor written notice, proceed to maintain the systems as deemed necessary, and the cost thereof shall be deducted from any compensation due, or which may become due the Contractor under this contract.

156-3.6 REMOVAL OF EROSION CONTROL. The Contractor shall remove temporary erosion control structures when ordered to do so by the Resident Engineer. The costs associated with the removals shall be incidental to this item. In the event that temporary erosion and pollution control measures are ordered by the Resident Engineer due to the Contractor's negligence or carelessness, the work shall be performed by the Contractor at his/her own expense.

METHOD OF MEASUREMENT

156-4.1. The footage of silt fence to be paid for shall be the number of lineal feet of silt fence measured in-place, satisfactorily installed and maintained throughout the duration of the contract.

156-4.2. The number of hay or straw bales to be paid for shall be the number of hay or straw bales shown in the plans or ordered by the Resident Engineer used to control erosion.

156-4.3. Temporary seeding to be paid for shall be the number of acres seeded and mulched, measured on the ground surface. Temporary mulching shall not be measured for payment, but shall be considered incidental to temporary seeding.

156-4.4. Temporary ditch checks to be paid shall be the number of lineal feet measured along the long axis of the device in place.

156-4.5. Inlet and pipe protection to be paid shall be the number of individual items shown in the plans or ordered by the Resident Engineer.

BASIS OF PAYMENT

156-5.1. Payment will be made at the contract unit price per linear foot of silt fence and temporary ditch checks. Payment will be made at the contract unit price per each for bales and inlet and pipe protection. This price shall be full compensation for furnishing all materials for all preparation and installation of these materials, including excavation, placement, tie-down stakes, staples, maintenance and removal and for all labor, equipment, tools, and incidentals necessary to complete this item.

ITEM 156513 SEPARATION FABRIC

DESCRIPTION

156-1.1 This item shall consist of placing a separation fabric on a prepared subgrade prior to the placement of aggregate base as shown in the plans.

MATERIALS

156-2.1 SEPARATION FABRIC The separation fabric material shall consist of nonwoven filaments formed from a plastic yarn of a long-chain synthetic polymer composed of at least 85 percent by weight of polyolefins, or polyesters, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. After forming, the fabric shall be processed so that the filaments retain their relative positions with respect to each other. The fabric shall be free of defects or flaws which significantly affect its physical and/or filtering properties.

The separation fabric shall be formed in widths of not less than 6 feet. Sheets of fabric may be sewn together with thread of a material meeting the chemical requirements given for the plastic yarn to form fabric widths as required. The sheets of filter fabric shall be sewn together at the point of manufacturer or another approved location.

The separation fabric shall have a high dimensional stability when set, have good soil filtration characteristics, have a high resistance to tear propagation in all directions, and meet the following minimum conditions and ASTM Tests.

PHYSICAL PROPERTIES	Minimum Value
Weight of Fabric (oz/sq yd), ASTM D 3776 (Mod.)	6.0
Burst Strength (psi), ASTM D 3786 ^{1/}	250
Trapezoidal Tear Strength (lbs), ASTM D 5733 ^{2/}	60
Grab Tensile Strength (lbs), ASTM D 4632 ^{2/}	160
Grab Tensile Elongation (%), ASTM D 4632 ^{2/}	20

PHYSICAL PROPERTIES (METRIC)	Minimum Value
Weight of Fabric (g/m ²), ASTM D 3776 (Mod.)	200
Burst Strength (kPa), ASTM D 3786 ^{1/}	1720
Trapezoidal Tear Strength (N), ASTM D 5733 ^{2/}	265
Grab Tensile Strength (N), ASTM D 4632 ^{2/}	700
Grab Tensile Elongation (%), ASTM D 4632 ^{2/}	20

1/ Manufacturer's certification of fabric to meet requirements.

2/ Test sample shall be tested wet.

The vendor shall furnish certified test reports with each shipment of material attesting that the fabric meets the above requirements.

The separation fabric shall meet the requirements noted in the following and provide an apparent opening size (AOS) determined by the Engineer after an on site investigation of the soil to be protected, based on the following criteria.

A. Piping Resistance. (soil retention) (Note 1)

1. Soil with 50 percent or less particles by weight (mass) passing U.S. No. 200 Sieve. AOS less than 0.6 mm (greater than No. 30 Sieve) TF25 Method 6.
2. Soil with more than 50 percent particles by weigh (mass) passing U.S. No. 200 Sieve. AOS less than 0.3 mm (greater than No. 50 Sieve) TF25 Method 6.

B. Permeability. (cm/sec) (Note 1). K of fabric greater than 10 K of soil - ASTM D 4491.

Note 1. Certification from the manufacturer of fabric is required stating that the product meets the piping resistance and permeability requirements.

CONSTRUCTION METHODS

156-3.1 The separation fabric shall be installed in conformance with the applicable requirements of the IDOT Standard Specifications for Road and Bridge Construction, latest edition.

Separation fabric will comply with construction methods outlined in the IDOT Standard Specifications for Road and Bridge Construction, latest edition, titled Fabric for Ground Stabilization.

METHOD OF MEASUREMENT

156-4.1 The area of separation fabric shall be the square yards of separation fabric satisfactorily placed and accepted by the Engineer.

BASIS OF PAYMENT

156-5.1 Payment shall be made at the contract unit price for separation fabric installed on the project. These prices shall be full compensation for furnishing all materials, labor, equipment and any incidentals necessary to install the separation fabric shown on the plans.

ITEM 156540 RIPRAP

DESCRIPTION

156-1.1 This item shall consist of furnishing, transporting, and placing a protective course of stone, minimum 12 inches depth, laid as riprap on filter fabric in the areas designated and as detailed on the construction plans. Specific locations requiring riprap are identified on the construction plans.

MATERIALS

156-2.1 RIPRAP: The stone material shall meet the requirements of the latest edition of the IDOT Standard Specifications for Road and Bridge Construction. The stone used for the riprap shall meet the gradation shown on the plans

156-2.2 FILTER FABRIC: The filter fabric material shall consist of nonwoven filaments formed from a plastic yarn of a long-chain synthetic polymer composed of at least 85 percent by weight of polyolefins, or polyesters, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. After forming, the fabric shall be processed so that the filaments retain their relative positions with respect to each other. The fabric shall be free of defects or flaws which significantly affect its physical and/or filtering properties.

The filter fabric shall be formed in widths of not less than 6 feet (2 m). Sheets of fabric may be sewn together with thread of a material meeting the chemical requirements given for the plastic yarn to form fabric widths as required. The sheets of filter fabric shall be sewn together at the point of manufacturer or another approved location.

The texture of the fabric shall be such that the bedding and riprap will remain in an equilibrium state and not slip or slide. The filter fabric shall have a high dimensional stability when set, have good soil filtration characteristics, have a high resistance to tear propagation in all directions, and be according to the following:

PHYSICAL PROPERTIES	Gradation 4 & 5	Gradation 6 & 7
Weight of Fabric (oz/sq yd),ASTM D 3776 (Mod.)	6.0	8.0
Burst Strength (psi),ASTM D 3786 ^{1/}	250	300
Trapezoidal Tear Strength (lbs),ASTM D 5733 ^{2/}	60	75
Grab Tensile Strength (lbs),ASTM D 4632 ^{2/}	160	200
Grab Tensile Elongation (%),ASTM D 4632 ^{2/}	20	20

PHYSICAL PROPERTIES (METRIC)	Gradation 4 & 5	Gradation 6 & 7
Weight of Fabric (g/m ²),ASTM D 3776 (Mod.)	200	270
Burst Strength (kPa),ASTM D 3786 ^{1/}	1720	2070
Trapezoidal Tear Strength (N),ASTM D 5733 ^{2/}	265	335
Grab Tensile Strength (N),ASTM D 4632 ^{2/}	700	900
Grab Tensile Elongation (%),ASTM D 4632 ^{2/}	20	20

1/ Manufacturer's certification of fabric to meet requirements.

2/ Test sample shall be tested wet.

The vendor shall furnish certified test reports with each shipment of material attesting that the fabric meets the above requirements.

The fabric shall meet the requirements noted in the following and provide an apparent opening size (AOS) determined by the Engineer after an on-site investigation of the soil to be protected, based on the following criteria.

A. Piping Resistance. (soil retention) (Note 1)

1. Soil with 50 percent or less particles by weight (mass) passing U.S. No. 200 (75 µm) Sieve. AOS less than 0.6 mm (greater than No. 30 (600 µm) Sieve) TF25 Method 6.
2. Soil with more than 50 percent particles by weight (mass) passing U.S. No. 200 (75 µm) Sieve. AOS less than 0.3 mm (greater than No. 50 (300 µm) Sieve) TF25 Method 6.

B. Permeability. (cm/sec)(Note 1). K of fabric greater than 10 K of soil - ASTM D 4491.

Note 1. Certification from the manufacturer of fabric is required stating that the product meets the piping resistance and permeability requirements.

CONSTRUCTION METHODS

156-3.1 Prior to placement of the riprap material, the Contractor will undercut the designated area twelve (12") in. below finish grade. The undercut material will be used as embankment fill material. The riprap course will be 12 in. total depth.

The riprap shall be placed in such a manner as to produce a reasonably well-graded mass of rock with the minimum practicable percentage of voids. Placing of materials shall begin at the lower elevations and progress up the slope. The larger pieces shall be well distributed and the entire mass in its final position shall be roughly graded and shall present an even, close surface true to line and grade. Desired distribution of various sizes shall be obtained by selective loading or by controlled dumping methods which will produce the specified results.

METHOD OF MEASUREMENT

156-4.1 The quantity of riprap to be paid for shall be the number of square yards of riprap material placed and accepted by the Resident Engineer.

BASIS OF PAYMENT

156-5.1 Payment shall be made at the contract unit price bid per square yard for riprap. This price shall be full compensation for labor, equipment, material, including fabric and all incidentals associated with undercutting, shaping, and placing the riprap in accordance with the special provisions and the construction drawings.

PAVEMENT SURFACE PREPARATION

ITEM 201661 CLEAN & SEAL BITUMINOUS CRACKS

DESCRIPTION

201-1.1 This item shall consist of cleaning, routing, and sealing designated joints and cracks in existing bituminous pavements. This item shall include the proper routing and/or cleaning of all cracks to be sealed and furnishing and installing hot pour crack sealer in accordance with these specifications. Wherever the word "cracks" is used, it shall be construed to mean cracks to be sealed.

MATERIALS

201-2.1 GENERAL All materials proposed for use shall be approved prior to installation.

201-2.2 CRACK SEALANT The crack sealant shall meet the requirements of ASTM D 5329 and ASTM D 6690.

201-2.3 BACKER ROD Backer rod shall be a closed cell non-absorptive polyolefin material compatible with hot pour. Backer rod shall be of sufficient diameter to be compressed in the routed crack or joint.

EQUIPMENT

201-3.1 GENERAL All machines, tools and equipment used in the performance of work required by these specifications will be subject to approval and maintained in a satisfactory working condition at all times.

201-3.2 CRACK ROUTING/CLEANING MACHINE The crack routing machine shall be portable and capable of routing the existing bituminous pavement surfaces along and adjacent to the crack. The unit shall be capable of following random cracks. The unit shall have an adjustable depth control and be capable of cutting width modification. The machine shall be capable of routing cracks to sufficient depths for installation of a backer rod and joint sealant in accordance with the details in the attachments.

CONSTRUCTION METHODS

201-4.1 PREPARATION OF CRACKS

General: The cracks shall be routed and/or cleaned to provide a sealant reservoir of a width to depth ratio of 1:1 with a minimum width of 3/8" and a depth equal to the width plus 1/4". No crack sealer material shall be placed until the cracks have been cleaned of all loose dirt and material. Following the initial routing and cleaning operation, all cracks will be blown out with compressed air. The cracks shall be inspected and approved prior to placing the sealer material. Any and all loose materials shall be disposed of by the Contractor off site. The Contractor may use any combination of joint/crack rakes, plows, routers, wire wheels and air compressors to clean the crack/joint of all laitance, sealant debris and dust film.

Crack/Joint Sealing (5/8" to 1" Wide): Cracks and joints in this width range shall be cleaned of all dirt, existing sealant and debris to a depth sufficient to allow for a backer rod and the new joint sealant at the thickness specified in Section 201-4.2.

Crack/Joint Sealing (3/8" to 5/8" Wide): These cracks and joints shall be cleaned of all dirt, debris, and old sealant. Routing shall be as necessary to shape the sealant reservoir and provide adequate depth for backer rod and sealant.

Crack/Joint Sealing (Less Than 3/8" Wide): These cracks and joints shall be routed to a minimum of 3/8" wide and to a sufficient depth to provide the backer rod and joint sealant. The routed reservoir shall be cleaned and sealed.

201-4.2 APPLICATION OF CRACK SEALING MATERIAL Final cleaning will not proceed in advance of sealing by more than one (1) working day, except as otherwise approved by the Resident Engineer.

The crack routing shall provide a width to depth ratio of 1:1 for sealant material.

The crack sealant shall be applied uniformly solid from bottom to top and shall be filled without formation of entrapped air or voids. The heating kettle shall be an indirect heating type, constructed as a double boiler. A positive temperature control and mechanical agitation shall be provided. The sealant shall not be heated to more than 20° F above the safe heating temperature. The safe heating temperature can be obtained from the manufacturer's shipping container. A direct connecting pressure type extruding device with nozzles shaped for insertion into the joint shall be provided. Sealing material should be used sparingly. Only enough material shall be poured into the opening to fill the crevice to within 1/4" of the pavement surface. Overfilling will not be permitted.

METHOD OF MEASUREMENT

201-5.1 The linear feet of cleaning and sealing of cracks to be paid for shall be the number of linear feet of each crack or joint routed, cleaned, sealed and accepted as complete. Measurement of linear feet of crack cleaning and sealing for payment shall be to the nearest foot.

BASIS OF PAYMENT

201-6.1 This item will be paid for at the contract unit price per linear foot of cleaning and sealing cracks in the pavement, complete; which price and payment shall constitute full compensation for all routing, cleaning, preparation and disposal of all loose materials; and for all materials, labor, equipment, tools and incidentals necessary to complete this item.

ITEM 201663 SAND MIX CRACK REPAIR

DESCRIPTION

201-1.1 This item shall consist of cleaning out designated cracks of 1" minimum width and placement and compaction of a bituminous sand mix in the void. Locations for the sand mix crack repair shall be designated by the Resident Engineer. Wherever the word "cracks" is used, it shall be construed to mean the cracks or joints to be sealed.

MATERIALS

201-2.1 CRACK/JOINT FILLER A bituminous sand mix shall be approved by the Division prior to any placement. The bituminous sand mix shall conform to the following requirements:

Sieve	% Passing
3/8"	100
No. 4	94 - 100
No. 16	45 - 85
No. 50	10 - 30
No. 100	0 - 10
(IDOT FA-2)	
Asphalt	4 - 7

The ingredients shall be heated and combined in such a manner as to produce a Hot -Mix Asphalt, which when discharged from the mixer shall not be more than 350° F.

EQUIPMENT

201-3.1 CRACK CLEANING EQUIPMENT The crack cleaning equipment shall consist of hand tools, compressors and nozzles with sufficient air pressure to dislodge dirt, laitance and loose bituminous material and rock to prepare the crack for sealing. All machines, tools, equipment and methods used in the performance of work required by these specifications will be subject to the approval of the Engineer and Owner. The equipment or method used shall result in no damage to existing surfaces. Prior to placement of the bituminous sand mixture, the cracks and joints shall be blown out with compressed air at a pressure of at least 90 psi with 150 cubic feet per minute at the nozzle.

CONSTRUCTION METHODS

201-4.1 PREPARATION OF CRACKS No crack filler material shall be placed until the cracks have been cleaned of all loose dirt, joint material and debris.

A tack coat shall be applied to the cleaned joint prior to installation of the bituminous sand mix.

Cleaning will not proceed in advance of filling by more than one (1) working day, except as otherwise approved by the Resident Engineer.

The crack shall be filled with the bituminous mixture and the top lift compacted with a self-propelled vibratory "pup" roller or other means approved by the Resident Engineer.

Mixture shall be placed in courses no greater than 3 inches and compacted by approved hand tools.

Mixture for cracks and joints delivered to the work site which has cooled to 200° F shall be considered unsatisfactory to the work and shall not be used.

METHOD OF MEASUREMENT

201-5.1 The linear feet of bituminous pavement crack filler to be paid for shall be the number of linear feet of cracks cleaned and filled as specified in the plans and as directed by the Resident Engineer and accepted by the Engineer.

BASIS OF PAYMENT

201-6.1 This item will be paid for at the contract unit price per linear foot of sand mix crack repair, which price and payment shall constitute full compensation for all cleaning, preparation and disposal of all loose materials; and for all materials, labor, equipment, tools and incidentals necessary to complete this item.

ITEM 201671 CRACK CONTROL FABRIC

DESCRIPTION

201-1.1 This item shall consist of constructing reflective crack control treatment of the type shown on the plans. This work shall be performed in accordance with the Illinois Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

MATERIALS

201-2.1 REFLECTIVE CRACK CONTROL SYSTEM A. The reinforcing fabric shall be a nonwoven polypropylene or other approved plastic fabric having the following properties:

Weight (ASTM D 3776) oz./sq yd (g/sq m), min.	4.0 (135)
Grab Tensile Strength (ASTM D 4632) lb (N), min.	90.0 (400)
Grab Elongation at Break (ASTM D 4632) %, min. - max.	40-100
Asphalt Retention gal/sq yd (L/sq m), min.	0.20 (0.9)

The asphalt binder shall be PG58-22 or PG64-22 meeting the requirements of ASTM D 6373.

201-2.2 REFLECTIVE CRACK CONTROL SYSTEM B. Waterproofing membrane interlayer shall incorporate a high strength fabric embedded in a layer of self-adhesive suitably plasticized asphalt with the following properties:

Property	Value	Test Method
Thickness	0.065 in., min.	ASTM E 96
Permeance-Perms	0.10 max.	Procedure B
Tensile Strength	50 lb/in., min.	ASTM D 882 (modified for 1 inch opening)
Puncture Resistance (fabric)	200 lb, min.	ASTM E 154
Pliability -1/2 in. - mandrel	No cracks in fabric or plasticized bitumen	ASTM D 146

CONSTRUCTION METHODS

201-3.1 This work shall be performed in accordance with the Illinois Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

METHOD OF MEASUREMENT

201-4.1 Crack control fabric will be measured in place and the area computed in square yards.

BASIS OF PAYMENT

201-5.1 This item shall be paid for at the contract unit price per square yard for Crack Control Fabric. This price shall be payment for completing all work.

FLEXIBLE BASE COURSES

ITEM 208 AGGREGATE BASE COURSE

DESCRIPTION

208-1.1 This item shall consist of a granular base course composed of coarse aggregate as specified. It shall be constructed on a prepared underlying course in accordance with these specifications and shall conform to the dimensions and typical cross section shown on the plans and with the lines and grades established by the Resident Engineer.

MATERIALS

208-2.1 UNCRUSHED COARSE AGGREGATE. The base course material shall consist of hard, durable particles or fragments of stone or gravel mixed or blended with sand, stone dust, or other similar binding or filler materials produced from approved sources. All oversized stones, rocks and boulders occurring in the pit or quarry material shall be wasted; those of acceptable quality may be crushed and become a part of the base material, provided the blend meets the specified gradations. The aggregate shall be free from vegetation, lumps, or excessive amounts of clay and other objectionable substances.

If approved by the Engineer, uncrushed coarse aggregate may be produced by blending aggregates from more than one source, provided the method of blending results in a uniform product. The components of this blend need not be of the same kind of material. The source of material shall not be changed during the progress of work without written permission from the Engineer. Where natural aggregate is deficient in fines, the material added to make up deficiencies shall be a material approved by the Engineer.

The uncrushed coarse aggregate shall also conform to the following quality requirements:

QUALITY TEST (IDOT D Quality)	PERCENT
Na ₂ SO ₄ Soundness 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104), Max. % Loss	25
Los Angeles Abrasion, ASTM C 131, Max. % Loss	45

208-2.2 CRUSHED COARSE AGGREGATE. The crushed coarse aggregate shall be crushed stone, crushed gravel, partially crushed gravel, crushed slag, or crushed concrete as described below:

- A. Crushed Stone. Crushed stone shall be the angular fragments resulting from crushing by, mechanical means the following types of rocks quarried from undisturbed consolidated deposits: granite and similar phanerocrystalline igneous rocks, limestone, dolomite, massive metamorphic quartzite, or similar rocks. Dolomite shall be a carbonate rock containing 11.0 percent or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0 percent magnesium oxide (MgO).
- B. Crushed Gravel. Crushed gravel shall be the product resulting from crushing, by mechanical means, and shall consist entirely of particles obtained by crushing gravel, all of which before crushing will be retained on a 1 inch screen. If approved by the Engineer, final product gradations may be obtained by screening or blending various sizes of crushed gravel material.
- C. Partially Crushed Gravel. Partially crushed gravel shall consist of crushed gravel mixed or blended with sand or other similar binding or filler materials produced from approved materials of the same source.

If approved by the Engineer, partially crushed gravel may be produced by blending of aggregates from more than one source, provided the method of blending results in a uniform product. The components of this blend need not be of the same kind of material. The source of material shall

not be changed during the progress of the work without written permission from the Engineer. Where natural aggregate is deficient in fines, the material added to make up deficiencies shall be a material approved by the Engineer.

- D. Crushed Slag. Crushed slag shall be the graded product resulting from the processing of air cooled blast furnace slag. Air cooled blast furnace slag shall be the nonmetallic product, consisting essentially of silicates and alumino-silicates of lime and other bases, which is developed in a molten condition simultaneously with iron in a blast furnace. It shall be air cooled and shall have a compact weight (ASTM C 29) of not less than 70 lb/cu. ft. (1100 kg/m³).
- E. Crushed Concrete. Crushed concrete shall be the angular fragments resulting from crushing Portland cement concrete by mechanical means. The acceptance and use of crushed concrete shall be according to the latest Bureau of Materials and Physical Research policy memorandum. Evidence of this acceptance must be provided to the Resident Engineer.

The crushed coarse aggregate shall also conform to the following quality requirements:

QUALITY TEST(IDOT D Quality)	PERCENT
Na ₂ SO ₄ Soundness 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104) Max. % Loss ^{1/}	25
Los Angeles Abrasion, ASTM C 131, Max. % Loss	45

^{1/} Does not apply to crushed concrete.

The aggregate shall be free from vegetation, lumps, or excessive amounts of clay and other objectionable substances.

All material passing the No. 4 mesh (4.75 mm) sieve produced in the crushing operation of either stone, slag, or gravel shall be incorporated in the base material to the extent permitted by the gradation requirements.

208-2.3 GRADATION. The gradation of the partially crushed or crushed material shall meet the requirements of one of the gradations given in TABLE 1 when tested in accordance with ASTM C 117 and C 136.

TABLE 1. REQUIREMENTS FOR GRADATION OF AGGREGATE

Sieve Designation	Percentage by weight passing sieves		
	A	B	C
	2" maximum	1 1/2" maximum	1" maximum
2 inch	100	--	--
1-1/2 inch	90-100	100	--
1 inch	75-95	90-100	100
3/4 inch	--	--	90-100
1/2 inch	45-75	60-90	65-95
No. 4	30-50	30-56	40-60
No. 16	5-35	10-40	15-45
No. 200	4-12	4-12	5-13
IDOT Gradations	(CM-4)	(CM-6)	(CA-10)

The gradations in the table represent the limits which shall determine suitability of aggregate for use from the sources of supply. The final gradations decided on within the limits designated in the table shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieves, or vice versa.

The amount of the fraction of material passing the No. 200 mesh sieve shall not exceed one-half the fraction passing the No. 16 mesh sieve. The portion of the filler and binder, including any blended material passing the No. 16 mesh sieve shall have a plasticity index not more than 6 for uncrushed aggregate and not more than 4 for crushed aggregate when tested in accordance with ASTM D 4318.

The selection of any of the gradations shown in the table shall be such that the maximum size aggregate used in any course shall be not more than two-thirds the thickness of the layer of the course being constructed.

208-2.4 FILLER FOR BLENDING. If filler, in addition to that naturally present in the base course material, is necessary for satisfactory bonding of the material or for correcting the gradation to the limitations of the specified gradation, it shall be uniformly blended with the base course material at the crushing plant or at the mixing plant. The material for such purpose shall be obtained from sources approved by the Engineer and shall be of a gradation necessary to accomplish the specified gradation in the finally processed material.

The additional filler may be composed of sand, but the amount of sand shall not exceed 20% by weight of the total combined base aggregate. All the sand shall pass a No. 4 mesh sieve and not more than 5% by weight shall pass a No. 200 mesh sieve.

CONSTRUCTION METHODS

208-3.1 OPERATIONS IN PITS AND QUARRIES. All work involved in clearing and stripping pits and quarries, including handling of unsuitable material, shall be performed by the Contractor. All material shall be handled in a manner that shall secure a uniform and satisfactory base product. The base course material shall be obtained from sources that have been approved.

208-3.2 PREPARING UNDERLYING COURSE. The underlying course shall be checked and accepted by the Resident Engineer before placing and spreading operations are started. Any ruts or soft, yielding places due to improper drainage conditions, hauling, or any other cause, shall be corrected and rolled to the required density before the base course is placed thereon.

Grade control between the edges of the pavement shall be accomplished by grade stakes, steel pins, or forms placed in lanes parallel to the centerline of the pavement at intervals sufficiently close that string lines or check boards may be placed between the stakes, pins, or forms.

To protect the underlying course and to insure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

208-3.3 METHODS OF PRODUCTION.

- A. Plant Mix. When provided in the proposal, or when selected by the Contractor and approved by the Engineer, the base material shall be uniformly blended or mixed in an approved plant. The mixing plant shall include bins for storage and batching of the aggregate, pump and tanks for water, and batch mixers of either the pugmill or drum type. All mineral aggregates shall be batched into the mixer by weight. The agitation shall be such that a thorough dispersion of moisture is obtained. The size of the batch and the time of mixing shall be fixed by the Engineer and shall produce the results and requirements specified. The base course material produced by combining two or more materials from different sources shall be mixed in a mixing plant described herein. The mixture material shall be at a satisfactory moisture content to obtain maximum density.
- B. Travel Plant. When the use of a traveling plant is allowed, the plant shall blend and mix the materials to meet these specifications. It shall accomplish a thorough mixing in one trip. The agitation shall be such that the dispersion of the moisture is complete. The machine shall move at a uniform rate of speed and this speed shall be regulated to fix the mixing time. If a windrow-type of travel plant is employed for mixing, the aggregate shall be placed in windrows parallel to the pavement centerline.

The windrow volume shall be sufficient to cover exact areas as planned. The windrow contents shall produce a mixture of the required gradation and bonding qualities. If a travel plant is used which is of the type that mixes previously spread aggregates in-place, the material shall have been spread in such thickness and proportions as may be handled by the machine to develop a base course of the thickness of each layer and of the gradation required. With either type of equipment, the mixed material shall be at a satisfactory moisture content to obtain the maximum density.

- C. Materials of Proper Gradation. When the entire base course material from coarse to fine is secured in a uniform and well-graded condition and contains approximately the proper moisture, such approved material may be handled directly to the spreading equipment. The material may be obtained from gravel pits, stockpiles, or produced from a crushing and screening plant with the proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. The intent of this section of these specifications is to secure materials that will not require further mixing. The base material shall be at a satisfactory moisture content to obtain maximum density. Any minor deficiency or excess of moisture may be corrected by surface sprinkling or by aeration. In such instances some mixing or manipulation may be required immediately preceding the rolling to obtain the required moisture content. The final operation shall be blading or dragging, if necessary, to obtain a smooth uniform surface true to line and grade.

208-3.4 PLACING.

- A. The aggregate base material that is correctly proportioned, or has been processed in a plant, shall be placed on the prepared underlying course and compacted in layers of the thickness shown on the plans. The depositing and spreading of the material shall commence where designated and shall progress continuously without breaks. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer shall have the required thickness. The base aggregate shall be spread by spreader boxes or other approved devices having positive thickness controls that shall spread the aggregate in the required amount to avoid or minimize the need for hand manipulation. Dumping from vehicles in piles which require rehandling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.
- B. The aggregate base material that has been processed in a traveling plant shall be spread in a uniform layer of required depth and width and to the typical cross section. The spreading shall be by a self-powered blade grader, mechanical spreader, or other approved method. In spreading, care shall be taken to prevent cutting into the underlying layer. The material shall be bladed until a smooth, uniform surface is obtained, true to line and grade.
- C. The base course shall be constructed in a layer not less than 2-1/2 inches nor more than 4-1/2 inches of compacted thickness. The aggregate as spread shall be of uniform grading with no pockets of fine or coarse materials. The aggregate, unless otherwise permitted by the Resident Engineer, shall not be spread more than 2,000 square yards in advance of the rolling. Any necessary sprinkling shall be kept within these limits. No material shall be placed in snow or on a soft, muddy, or frozen course.

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

The base material shall be at a satisfactory moisture content when rolling is started and any minor variation prior to or during rolling shall be corrected by sprinkling or by aeration if necessary.

During the mixing and spreading process, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material in the base course mixture.

208-3.5 FINISHING AND COMPACTING. After spreading, the aggregate shall be thoroughly compacted by rolling. The rolling shall progress gradually from the sides to the center of the lane under construction, or from one side toward previously placed material by lapping uniformly each preceding rear-wheel track by one half the width of such track. The rolling shall continue until the entire area of the course has been rolled by the rear wheels. The rolling shall continue until the aggregate is thoroughly set, the interstices of the material reduced to a minimum, and until creeping of the material ahead of the roller is no longer visible. Rolling shall continue until the base material has been compacted to not less than 100% density as determined by the compaction control tests specified in Division VII. Blading and rolling shall be done alternately, as required or directed, to obtain a smooth, even, and uniformly compacted base.

The Contractor shall provide a qualified nuclear gauge and operator for Quality Control (QC) testing for density. The Contractor shall provide recent (within the same year that the aggregate base course is constructed) representative proctor(s) for each aggregate source and gradation approved for use on

the project. If in the opinion of the Resident Engineer, the proctor(s) are determined to be non-representative of the material used to construct the aggregate base course, the Contractor, at his/her expense, shall obtain a representative sample of the aggregate in question and have it retested and a new proctor curve developed. The aggregate base course shall be tested and accepted for density by the Resident Engineer or his/her representative. The in-place field density shall be determined in accordance with ASTM D 1556, D 2167 or D 2922. The acceptance testing frequency is a minimum of one random density test per 1500 square yards per lift of aggregate. The Contractor shall not proceed to the next lift of aggregate base course until the previous lift has been accepted by the Resident Engineer.

The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the base course. When the rolling develops irregularities that exceed 3/8 inch when tested with a 16-foot straightedge, the irregular surface shall be loosened, refilled with the same kind of material as that used in constructing the course, and rolled again as required.

In areas inaccessible to rollers, the base course material shall be tamped thoroughly with mechanical tampers.

The sprinkling during rolling, if necessary, shall be in the amount and by equipment approved by the Resident Engineer.

208-3.6 RESERVED

208-3.7 SURFACE GRADE ACCURACY. After the course has been completely compacted, the surface shall be checked for accuracy of grade and crown and shall not vary by more than 3/16 inch from the surface elevations shown on the plans or authorized by the Engineer. Any failing areas shall be scarified, re-compacted, and otherwise manipulated as the Resident Engineer may direct until the required accuracy is obtained.

208-3.8 THICKNESS CONTROL. The aggregate base course shall be constructed to the thickness shown in the plans. One determination of thickness shall be made for each lot of material placed. The lot size shall consist of a maximum of 600 square yards or one days production, whichever is less. Where more than 600 square yards are placed in a day, that day's production shall be divided into equal lots not to exceed 600 square yards per lot. One test shall be made for each lot. Sampling locations will be determined by the Engineer on a random basis. Where the thickness is deficient by more than 1/2", the Contractor shall correct such areas at no additional cost by excavating to the required depth and replacing with new material; however, the surface elevation of the completed aggregate base course shall not exceed by more than 3/16 inch the surface elevation shown on the plans or authorized by the Engineer. Additional tests may be required to identify the limits of the deficient areas.

208-3.9 PROTECTION. Work on the base course shall not be accomplished during freezing temperatures nor when the subgrade is wet. When the aggregates contain frozen materials or when the underlying course is frozen, the construction shall be stopped.

Hauling equipment may be routed over completed portions of the base course, provided no damage results and provided that such equipment is routed over the full width of the base course to avoid rutting or uneven compaction. However, the Resident Engineer in charge shall have full and specific authority to stop all hauling over completed or partially completed base course when, in his/her opinion, such hauling is causing damage. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at his/her own expense.

208-3.10 MAINTENANCE. Following the completion of the base course, the Contractor shall perform all maintenance work necessary to keep the base course in a condition satisfactory for priming. After priming, the surface shall be kept clean and free from foreign material. The base course shall be properly drained at all times. If cleaning is necessary, or if the prime coat becomes disturbed, any work or restitution necessary shall be performed at the expense of the Contractor.

Before preparations begin for the application of a surface treatment or for a surface course, the base course shall be allowed to partially dry until the average moisture content of the full depth of base is less than 80% of the optimum moisture of the base mixture. The drying shall not continue to the extent that the surface of the base becomes dusty with consequent loss of binder. If during the curing period,

the surface of the base dries too fast, it shall be kept moist by sprinkling until such time as the prime coat is applied as directed.

208-3.11 EQUIPMENT. All equipment necessary for the proper construction of this work shall be on the project, in first-class working condition, and approved by the Resident Engineer before construction is permitted to start.

METHOD OF MEASUREMENT

208-4.1 When specified or shown in the plans, the quantity of aggregate base course to be paid for shall be the number of tons of base course material placed and accepted. The aggregate shall be weighed either at the place of loading in the trucks, at the place of unloading from the trucks, or at such other points that the Resident Engineer may designate. The Contractor shall furnish approved duplicate load tickets upon which is recorded the net weight of the aggregates in each truck. The Contractor shall submit one (1) load ticket to the Resident Engineer, or his/her duly authorized representative, at the job site when the truck load is incorporated into the base. If at the time the aggregates are weighed they contain more than six (6) percent of absorbed and free moisture by weight, a deduction for the moisture in excess of this amount shall be made in determining the pay quantity.

The Contractor shall furnish or arrange for the use of scales of a type approved by the Resident Engineer.

208-4.2 When specified or shown in the plans, the aggregate base course will be measured by the square yard of the thickness specified in place, completed and accepted. The Contractor shall furnish approved duplicate load tickets upon which is recorded the net weight of the aggregates in each truck. The Contractor shall submit one (1) load ticket to the Resident Engineer, or his/her duly authorized representative, at the job site when the truck load is incorporated into the base.

208-4.3 Measurement for payment will not be made for any aggregate base course in excess of 108 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.)

BASIS OF PAYMENT

208-5.1 Payment shall be made at the contract unit price per ton or per square yard as specified per the plans for aggregate base course. This price shall be full compensation for furnishing all materials and for all operations, hauling, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

ITEM 209 CRUSHED AGGREGATE BASE COURSE

DESCRIPTION

209-1.1. This item shall consist of a base course composed of crushed aggregates. It shall be constructed on a prepared underlying course in accordance with these specifications and shall conform to the dimensions and typical cross section shown on the plans and with the lines and grades established by the Resident Engineer.

MATERIALS

209-2.1 CRUSHED COARSE AGGREGATE. The crushed coarse aggregate shall be crushed stone, crushed gravel, or crushed concrete as described below:

- A. Crushed Stone. Crushed stone shall be the angular fragments resulting from crushing by mechanical means the following types of rocks quarried from undisturbed consolidated deposits: granite and similar phanerocrystalline igneous rocks, limestone, dolomite, massive metamorphic quartzite, or similar rocks. Dolomite shall be a carbonate rock containing 11.0 percent or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0 percent magnesium oxide (MgO).
- B. Crushed Gravel. Crushed gravel shall be the product resulting from crushing by mechanical means, and shall consist entirely of particles obtained by crushed gravel, all of which before crushing will be retained on a 1 inch screen. If approved by the Engineer, final product gradations may be obtained by screening or blending various sizes of crushed gravel material.
- C. Crushed Concrete. Crushed concrete shall be the angular fragments resulting from crushing Portland cement concrete by mechanical means. The acceptance and use of crushed concrete shall be according to the latest Bureau of Materials and Physical Research policy memorandum. Evidence of this acceptance must be provided to the Resident Engineer.

The crushed stone shall consist of hard, durable particles or fragments of stone, free from dirt or other objectionable matter.

The crushed coarse aggregate shall conform to the following quality requirements:

QUALITY TEST(IDOT D Quality)	PERCENT
Na ₂ SO ₄ Soundness 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104), Max. % Loss ^{1/}	25
Los Angeles Abrasion, ASTM C 131, Max. % Loss	45

1/ Does not apply to crushed concrete.

The aggregate shall be free from vegetation, lumps, or excessive amounts of clay and other objectionable substances.

All material passing the No. 4 mesh sieve produced in the crushing operation of the stone shall be incorporated in the base material unless there is an excessive amount which, if included, would not meet the gradation requirements.

The crushed aggregate shall meet the requirements of one of the gradations given in TABLE 1 when tested in accordance with ASTM C 117 and ASTM C 136.

TABLE 1. REQUIREMENTS FOR GRADATION OF AGGREGATE

Sieve Designation	Percentage by weight passing sieves		
	A	B	C
	2" maximum	1 1/2" maximum	1" maximum
2 inch	100	--	--
1-1/2 inch	90-100	100	--
1 inch	75-95	90-100	100
3/4 inch	--	--	90-100
1/2 inch	45-75	60-90	65-95
No. 4	30-50	30-56	40-60
No. 16	5-35	10-40	15-45
No. 200	4-12	4-12	5-13
IDOT Gradations	(CM-4)	(CM-6)	(CA-10)

The gradations in the table represent the limits which shall determine suitability of aggregate for use from the sources of supply. The final gradations decided on within the limits designated in the table shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieves or vice versa.

The amount of the fraction of material passing the No. 200 mesh sieve shall not exceed one half the fraction passing the No. 16 mesh sieve.

The portion of the base aggregate, including any blended material, passing the No. 16 mesh sieve shall have a plasticity index of not more than 4 when tested in accordance with ASTM D 4318.

The selection of any of the gradations shown in the table shall be such that the maximum size aggregate used in any course shall not be more than two thirds the thickness of the layer of course being constructed.

209-2.2 ADDITIONAL FINE MATERIAL. If additional fine material, in excess of that naturally present in the base course material, is necessary for correcting the gradation to the limitations of the specified gradation or for the satisfactory bonding of the base material, then it shall be uniformly blended and mixed with the base course material at the crushing plant or by an approved plant.

There shall be no reworking of the base course material in-place to obtain the specified gradation. The additional fine material for this purpose shall be obtained from the crushing of stone, and when used, shall be of a gradation as necessary to accomplish the specified gradation in the final mixed base course material.

CONSTRUCTION METHODS

209-3.1 PREPARING UNDERLYING COURSE. The underlying course shall be checked and accepted by the Resident Engineer before placing and spreading operations are started. Any ruts or soft, yielding places caused by improper drainage conditions, hauling, or any other cause, shall be corrected and rolled to the required compaction before the base course is placed thereon.

Grade control between the edges of the runways shall be accomplished by grade stakes, steel pins, or forms placed in lanes parallel to the centerline of the pavement and at intervals sufficiently close that string lines or check boards may be placed between the stakes, pins, or forms.

To protect the underlying course and to insure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

209-3.2 PLANT MIX. The base material shall be uniformly blended during crushing operations or mixed in an approved plant. The type of plant may be either a central proportioning and mixing plant or

a traveling plant. The plant shall blend and mix the materials to meet these specifications and to secure the proper moisture content for compaction.

209-3.3 PLACING AND SPREADING. The crushed aggregate base course material shall contain the optimum amount of moisture prior to placement. The amount of moisture required shall be that determined by the Engineer for the material and compaction methods being used. The water and aggregate shall be mixed at a central mixing plant. The plant shall be equipped with a mechanical mixing device, and aggregate and water measuring devices, meeting the approval of the Engineer.

The aggregate shall be free from vegetation, lumps, or excessive amounts of clay and other objectionable substances.

- A. Central Plant. The crushed aggregate base material that has been proportioned in a crushing and screening plant, or proportioned and processed in a central mixing plant, shall be placed on the prepared underlying course and compacted in layers of the thickness shown on the plans. The depositing and spreading of the material shall commence where designated and shall progress without breaks. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer shall have the required thickness. The base aggregate shall be spread by spreader boxes or other approved devices or methods that shall spread the aggregate in the required amount to avoid or minimize the need for rehandling the material and to prevent the rutting of the underlying course. The spreader boxes or other devices shall be equipped with strike-off templates or screeds that can be adjusted or controlled to secure the required thickness of the material. Dumping from vehicles in piles on the underlying course which will require rehandling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.
- B. Traveling Plant. If a traveling plant is used for mixing, the base material shall be placed on the underlying course in such condition to provide a base mixture conforming to the specified gradation and moisture content, and in such quantity to develop the thickness of the layer of the base and the density after compaction. The material shall be shaped to a uniform section. The Resident Engineer shall examine the mixture to determine that the mixing is complete and satisfactory and that the proper moisture content is maintained before compaction is started. No spreading shall be done except when authorized. Care shall be taken that no material from the underlying course is mixed with the base material.

If necessary, the base course shall be bladed until a smooth, uniform surface is obtained that is true to line, grade, and cross section and until the mix is in condition for compacting.

- C. Method of Placing. The base course shall be constructed in a layer not less than 2 ½ inches nor more than 4 ½ inches of compacted thickness. The aggregate, as spread, shall be of uniform gradation with no segregation or pockets of fine or coarse materials. Unless otherwise permitted by the Resident Engineer, the aggregate shall not be spread more than 2,000 square yards in advance of the rolling. Any necessary sprinkling shall be kept within these limits. No material shall be placed in snow or on a soft, muddy, or frozen underlying course.

When more than one layer is required, the construction procedure described herein shall apply similarly to each layer.

The base material shall have a satisfactory moisture content when rolling is started, and any minor variations prior to or during rolling shall be corrected by sprinkling or aeration, if necessary.

During the placing and spreading, sufficient caution shall be exercised to prevent the incorporation of subgrade, subbase, or shoulder material in the base course mixture.

209-3.4 FINISHING AND COMPACTING. After spreading, the crushed aggregate shall be thoroughly compacted by rolling. The rolling shall progress gradually from the sides to the center of the lane under construction, or from one side toward previously placed material by lapping uniformly each preceding rear wheel track by one-half the width of such track. Rolling shall continue until the entire area of the course has been rolled by the rear wheels. The rolling shall continue until the stone is thoroughly set, the interstices of the material reduced to a minimum, and until creeping of the stone ahead of the roller is no longer visible. Rolling shall continue until the base material has been compacted to not less than

100% density, as determined by the compaction control tests specified in Division VII. Blading and rolling shall be done alternately, as required or directed, to obtain smooth, even, and uniformly compacted base.

The Contractor shall provide a qualified nuclear gauge and operator for Quality Control (QC) testing for density. The Contractor shall provide recent (within the same year that the aggregate base course is constructed) representative proctor(s) for each aggregate source and gradation approved for use on the project. If in the opinion of the Resident Engineer, the proctor(s) are determined to be non-representative of the material used to construct the aggregate base course, the Contractor, at his/her expense, shall obtain a representative sample of the aggregate in question and have it retested and a new proctor curve developed. The aggregate base course shall be tested and accepted for density by the Resident Engineer or his/her representative. The in-place field density shall be determined in accordance with ASTM D 1556, D 2167 or D 2922. The acceptance testing frequency is a minimum of one random density test per 1500 square yards per lift of aggregate. The Contractor shall not proceed to the next lift of aggregate base course until the previous lift has been accepted by the Resident Engineer.

The course shall not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the base course. When the rolling develops irregularities that exceed 3/8 inch when tested with a 16-foot straightedge, the irregular surface shall be loosened, refilled with the kind of material as that used in constructing the course, and rolled again as required.

In areas inaccessible to rollers, the base course material shall be tamped thoroughly with mechanical tampers.

The sprinkling during rolling, if necessary, shall be in the amount and by equipment approved by the Resident Engineer.

209-3.5 RESERVED

209-3.6 RESERVED

209-3.7 SURFACE GRADE ACCURACY. After the course has been completely compacted, the surface shall be checked for accuracy of grade and crown and shall not vary by more than 3/16 inch from the surface elevations shown on the plans or authorized by the Engineer. Any failing areas shall be scarified, reshaped, re-compacted, and otherwise manipulated as the Resident Engineer may direct until the required accuracy is obtained.

209-3.8 THICKNESS CONTROL. The aggregate base course shall be constructed to the thickness shown in the plans. One determination of thickness shall be made for each lot of material placed. The lot size shall consist of a maximum of 600 square yards or one days production, whichever is less. Where more than 600 square yards are placed in a day, that day's production shall be divided into equal lots not to exceed 600 square yards per lot. One test shall be made for each lot. Sampling locations will be determined by the Engineer on a random basis. Where the thickness is deficient by more than 1/2", the Contractor shall correct such areas at no additional cost by excavating to the required depth and replacing with new material; however, the surface elevation of the completed aggregate base course shall not exceed by more than 3/16 inch the surface elevation shown on the plans or authorized by the Engineer. Additional tests may be required to identify the limits of the deficient areas.

209-3.9 MAINTENANCE. Following the completion of the base course, the Contractor shall perform all maintenance work necessary to keep the base course in a condition satisfactory for priming. After priming, the surface shall be kept clean and free from foreign material. The base course shall be properly drained at all times. If cleaning is necessary, or if the prime coat becomes disturbed, any work or restitution necessary shall be performed at the expense of the Contractor.

209-3.10 PROTECTION. Work on the base course shall not be accomplished during freezing temperatures nor when the subgrade is wet. When the aggregates contain frozen materials or when the underlying course is frozen, the construction shall be stopped.

Hauling equipment may be routed over completed portions of the base course, provided no damage results and provided that such equipment is routed over the full width of the base course to avoid

rutting or uneven compaction. However, the Resident Engineer in charge shall have full and specific authority to stop all hauling over completed or partially completed base course when, in his/her opinion, such hauling is causing damage. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at his/her own expense.

209-3.11 OPERATION AT SOURCES OF SUPPLY. All work involved in clearing and stripping of quarries and pits, including the handling of unsuitable material, shall be performed by the Contractor at his/her own expense. The base material shall be obtained from approved sources. The material shall be handled in a manner that shall secure a uniform and satisfactory product.

209-3.12 EQUIPMENT. All equipment necessary for the proper construction of this work shall be on the project, in first-class working condition, and approved by the Resident Engineer before construction is permitted to start.

METHOD OF MEASUREMENT

209-4.1 When specified or shown in the plans, the quantity of crushed aggregate base course to be paid for shall be the number of tons of base course material placed and accepted. The aggregate shall be weighed either at the place of loading in the trucks, at the place of unloading from the trucks, or at such other points that the Resident Engineer may designate. The Contractor shall furnish approved duplicate load tickets upon which is recorded the net weight of the aggregates in each truck. The Contractor shall submit one (1) load ticket to the Resident Engineer, or his/her duly authorized representative, at the job site when the truck load is incorporated into the base. If at the time the aggregates are weighed, they contain more than six (6) percent of absorbed and free moisture by weight, a deduction for the moisture in excess of this amount shall be made in determining the pay quantity.

The Contractor shall furnish or arrange for the use of scales of a type approved by the Resident Engineer.

209-4.2 When specified or shown in the plans, the crushed aggregate base course will be measured by the square yard of the thickness specified in place, completed and accepted. The Contractor shall furnish approved duplicate load tickets upon which is recorded the net weight of the aggregates in each truck. The Contractor shall submit one (1) load ticket to the Resident Engineer, or his/her duly authorized representative, at the job site when the truck load is incorporated into the base.

209-4.3 Measurement for payment will not be made for any crushed aggregate base course in excess of 108 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.)

BASIS OF PAYMENT

209-5.1 Payment shall be made at the contract unit price per ton or per square yard as specified per the plans for crushed aggregate base course. This price shall be full compensation for furnishing all materials and for all preparation, hauling, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

ITEM 217 AGGREGATE-TURF PAVEMENT

DESCRIPTION

217-1.1 This item shall consist of an aggregate-turf pavement composed of a base course of soil-bound crushed stone, soil-bound gravel, or soil-bound sand, and a seedbed of suitable soil or combination of soil and aggregate, constructed on a prepared subgrade or a previously constructed underlying course in accordance with these specifications, and shall conform to the dimensions and typical cross section shown on the plans and with the lines and grades established by the Project Engineer.

This item may include the furnishing and applying of fertilizer, lime, topsoil, or other plant nutrients; the furnishing and planting of seed; and the furnishing and spreading of mulch. When any of these turfing materials are required, the quality, quantity, and construction methods shall be in accordance with applicable FAA Turf Specifications. When turf is to be established, the seedbed soil or topsoil shall be a natural friable soil, possessing characteristics of the best locally obtainable soils, which can produce a fairly heavy growth of crops, grass, or other vegetation.

The prepared composite mixture of aggregates used for the base course shall be Type A, B, or C of TABLE 1, or stabilizer aggregate of TABLE 2 mixed with in-place materials, whichever is specified in the bid schedule.

MATERIALS

217-2.1 STABILIZED MIXES. The designated stabilized base course mixtures shall conform to the following requirements.

Type A - The materials shall be natural or artificial mixtures of clay or soil binder and gravel, stone or sand, as screenings proportioned to meet the requirements specified.

Type B or C - The materials shall be natural or artificial mixtures of gravel, stone, or slag and soil so proportioned as to meet the requirement specified. The aggregate shall consist of clean, hard durable particles of crushed or uncrushed gravel, stone, or slag, and shall be free from soft, thin, elongated, or laminated pieces, and vegetable or other deleterious substances.

The prepared composite mixture used shall meet one of the applicable gradation requirements as follows when tested in accordance with ASTM C 136.

TABLE 1. REQUIREMENTS FOR GRADATION OF MIXTURE

Sieve Designation	Percentage by weight passing sieves		
	A	B	C
2 inch	0	0	100
1 inch	100	100	70-95
3/4 inch	0	70-100	
No. 4	0	40-70	
No. 10	60-100	40-70	32-60
No. 20	50-90	0	0
No. 40	40-75	20-45	20-40
No. 200	12-30	10-20	10-20

The fraction of the composite mixture passing the No. 200 mesh sieve shall be less than two-thirds of the fraction passing the No. 40 mesh sieve. The fraction passing the No. 40 mesh sieve shall have a liquid limit not greater than 30 and a plasticity index not greater than 8 when tested in accordance with ASTM D 4318.

217-2.2 STABILIZER AGGREGATE. Stabilizer aggregate conforming to one of the gradations specified in TABLE 2, when tested in accordance with ASTM C 136, shall be placed upon the existing soil or base course in the specified quantity per square yard. The aggregate shall be uniformly blended with the soil or base course material to the depth required or as shown on the plans. The aggregate

shall consist of crushed stone, crushed or uncrushed gravel, and it shall have a percent of wear not more than 60 at 500 revolutions as determined by ASTM C 131. The aggregate shall be free from soft, thin, elongated, or laminated pieces, disintegrated material, or other deleterious substances.

Where sand, as existing subgrade or base, requires stabilization, it shall be secured by the addition of clay or lime rock. The operations of spreading and mixing shall be handled as stated under construction methods.

TABLE 2. REQUIREMENTS FOR GRADATION OF STABILIZER AGGREGATE

Sieve Designation	Percentage by weight passing sieves		
	D	E	F
2 inch		100	
1-1/2 inch	100		
1 inch	90-100		
1/2 inch		0-15	100
No. 4	20-50		85-100
No. 10	0-10		
No. 100			0-30

CONSTRUCTION METHODS

217-3.1 OPERATION IN PITS. All work involved in clearing and stripping pits, including handling of unsuitable material, shall be performed by the Contractor at his/her own expense. The base or binder material shall be obtained from approved sources. The material in the pits shall be excavated and handled in a manner that will secure a uniform and satisfactory product.

217-3.2 EQUIPMENT. All equipment necessary for the proper construction of this work shall be on the project in first-class working condition and approved by the Engineer before construction is permitted to start.

217-3.3 PREPARING SUBGRADE. Before any base course material is placed, the subgrade or underlying course shall be prepared and conditioned as specified. The underlying course shall be checked and accepted by the Engineer before placing and spreading operations are started.

Grade control between the edges of the pavement shall be accomplished by grade stakes, steel pins, or forms placed in lanes parallel to the centerline of the pavement and at intervals sufficiently close that string lines or check boards may be placed between the stakes, pins, or forms.

To protect the underlying course and to insure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

217-3.4 PLACING MATERIALS.

- A. All new material shall be placed on the prepared course and compacted in layers of the thickness shown on the plans. The depositing and spreading of the material on the prepared and completed layer shall commence where designated and shall progress without breaks. The material shall be deposited and spread in lanes in a uniform layer and without segregation of size to such loose depth that, when compacted, the layer will have the required thickness. The material shall be spread with approved equipment. When it is necessary to combine materials from different sources, it may be done either at the pits, in a processing plant prior to delivery of the material, or on the course in the proper proportions and in successive spreadings that give the required gradation and thickness of layer. If the combining is done on the course, the mixing shall be as specified hereinafter.
- B. When it is necessary to blend new material with material on the existing surface, the existing surface shall first be scarified lightly and bladed to uniform grade and cross section as shown on the plans. After blading, and when necessary, the existing surface shall be further scarified and/or

pulverized to provide sufficient loose material of the required depth to be mixed with the added material.

217-3.5 SPREADING AND MIXING.

- A. Materials that have been mixed and processed in a processing plant at the pits, or elsewhere, shall be delivered and spread by specified equipment to the required depth.
- B. Following the placing of the required materials being combined on the base course, the total base material shall be thoroughly pulverized and mixed by approved rotary-pulverizing mixers. The moisture content of the aggregate and soil binder shall be as specified by the Project Engineer to secure thorough mixing and the required compaction. The mixing shall produce a homogeneous mass of the specified gradation and soil characteristics to form a base course of the desired qualities. When the mixing is completed, the material shall be spread in a uniform layer which, when compacted, shall meet the requirements for thickness and typical cross section.

217-3.6 ROLLING. Immediately following final spreading, the material shall be compacted to full width by rolling with approved compacting equipment. Rolling shall progress gradually from the sides to the center of the lane under construction, or from one side toward previously placed material, and shall continue until the entire surface has been rolled and compacted. Rolling shall continue until the base material has been compacted to 70-90% density as determined by the compaction control test specified in Division VII.

Any irregularities or depressions that develop under rolling shall be corrected by loosening the material at these places and adding or removing materials until the surface is smooth and uniform.

217-3.7 SURFACE TEST, THICKNESS, AND MAINTENANCE. The surface shall not deviate more than ½ inch when tested with a 16-foot straightedge applied parallel with, and at right angles to, the centerline. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing material, reshaping, and recompacting.

The thickness of the base course shall be determined by depth tests or cores taken at intervals in such manner that each test shall represent not more than 500 square yards. When the base deficiency exceeds ½ inch, it shall be corrected. The Contractor shall replace, at his/her expense, the base material where borings have been taken for test purposes.

The surface of the base course shall be maintained and kept in a well drained condition until the construction of another course. Sprinkling, blading, and rolling shall be performed when necessary to prevent the base material from becoming unbonded.

217-3.8 TURF-SURFACING. Following the construction of the soil-aggregate base, the Contractor shall prepare the seedbed for the turf. If topsoil is to be placed, the surface of the base course shall be loosened slightly, as directed by the Resident Engineer. If seeding is to be done without topsoiling, the surface of the base shall be loosened sufficiently to prepare a seedbed. This can be accomplished by disking, harrowing, rotary-tilling, or other approved methods, and should be to a depth not less than 1 inch nor greater than 3 inches. Any topsoil shall be spread to the depth as required. The seedbed preparation, applying lime, fertilizer and water, seeding, rolling and mulching, shall be performed in accordance with the respective turfing specification requirements.

METHOD OF MEASUREMENT

217-4.1 The quantities of aggregate-turf pavement base course to be paid for shall be the number of square yards of material placed, bonded, and accepted in the completed base course. The quantity shall be measured in final position of the completed work.

BASIS OF PAYMENT

217-5.1 Payment shall be made at the contract unit price per square yard for Aggregate-Turf Pavement. This price shall be full compensation for furnishing all stabilizer aggregate, the conditioning operation, topsoiling, liming, fertilizing, seeding, watering, mulching and for all preparation, hauling, and placing of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

RIGID BASE COURSE

ITEM 302 ASPHALT TREATED PERMEABLE SUBBASE

(Central Plant Hot Mix)

DESCRIPTION

302-1.1. This item shall consist of an asphalt treated permeable subbase composed of crushed granular materials stabilized with an asphalt binder constructed on a prepared subgrade or subbase in accordance with these specifications, and in conformity with the dimensions and typical cross sections shown on the plans, and to the lines and grades established by the Engineer.

The Contractor shall be responsible for the quality control in the production and construction of the Asphalt Treated Permeable Subbase (ATPS).

MATERIALS

302-2.1 AGGREGATE. Aggregate shall be crushed gravel or crushed stone as defined below:

- A. Crushed Stone: Crushed stone shall be the angular fragments resulting from crushing by mechanical means the following types of rocks quarried from undisturbed consolidated deposits: granite and similar phanerocrystalline igneous rocks, limestone, dolomite, massive metamorphic quartzite, or similar rocks. Dolomite shall be a carbonate rock containing 11.0 percent or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0 percent magnesium oxide (MgO).
- B. Crushed Gravel: Crushed gravel shall be the product resulting from crushing by mechanical means, and shall consist entirely of particles obtained by crushing gravel, all of which before crushing will be retained on a screen with openings equal to or larger than the maximum nominal size of the resulting crushed material. If approved by the Engineer, final product gradations may be obtained by screening or blending various sizes of crushed gravel material.

Coarse aggregate shall consist of sound, tough, durable particles conforming to the following quality requirements:

QUALITY TEST(IDOT B Quality)	PERCENT
Na ₂ SO ₄ Soundness 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104), Max. % Loss	15
Los Angeles Abrasion, ASTM C 131, Max. % Loss	40

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	2.0
Clay Lumps %	0.5
Soft & Unsound Frag. %	6.0
Other Deleterious %	3.0
<i>Total Deleterious Allowed %</i>	<i>6.0</i>

302-2.2 BITUMINOUS MATERIAL. The bituminous material for the ATPS shall be PG58-22.

COMPOSITION

302-3.1 JOB MIX FORMULA (JMF). The sources of materials used for establishing the approved JMF shall be selected by the Contractor and submitted in writing to the Engineer for approval. The Contractor shall indicate the producer name, producer location, IDOT producer/supplier number, and IDOT material code number, for all proposed aggregates, asphalt cements, and anti-strip additives to be used. No ATPS mixture for pavement shall be produced until a JMF has been approved and issued

by the Illinois Division of Aeronautics' Engineer of Construction & Materials. The JMF shall indicate the definite percentage of each sieve fraction of aggregate, the percentage of bitumen, and the recommended temperature of the completed mixture when discharged from the mixer. A minimum of four (4) hours before the production of any mix, the Contractor shall provide access to the plant by the Resident Engineer and Quality Control Manager in order to set up the mix. Should there be a change in sources of materials, a new JMF shall be established before the new materials are used.

The ATPS mixture shall be a combination of the specified aggregate gradation and asphalt cement as stated herein:

Requirements for Gradation of Aggregates

Sieve	% Passing (by weight) (IDOT CA-11)	% Passing (by weight) (IDOT CA-16)
1 inch	100	----
¾ inch	84-100	----
½ inch	30-60	100
No. 4	0-12	15-45
No. 16	0-6	0-8
Asphalt Cement	2.0-3.0	

The IDOT CA-16 aggregate gradation will be required when directed by the Engineer.

The Engineer shall establish the percent of asphalt cement to be used. The Contractor shall use an approved heat-stable anti-strip additive. The anti-strip additive shall be added to the asphalt tank at the dosage of 1.0 percent by weight of asphalt cement and shall be thoroughly mixed by circulation of the asphalt for at least 4 hours prior to being incorporated into the mix. An in-line blender may be used as an alternative to the procedure described above.

302-3.2 TEST SECTION. Prior to full production, the Contractor shall prepare a quantity of ATPS mixture according to the approved JMF. The amount of mixture should be sufficient to construct a test section of at least 400 square yards and shall be of the same depth for the construction of the course which it represents. The underlying grade or pavement structure, upon which the test section is to be constructed, shall be the same as the remainder of the course represented by the test section. The underlying grade or pavement structure shall be prepared with a bituminous prime coat or a tack coat in accordance with Items 602 or 603.

The test section may remain as part of the proposed work if approved by the Engineer. A mix sample shall be taken and tested using the IDOT approved Ignition Method for Determining Asphalt Content. The tests shall be completed and the results reported to the Engineer. The gradation and asphalt content must meet the JMF within the minimum and maximum percentages specified on the JMF. Production paving of the ATPS mixture may continue past the limits of the test section when final approval is given by the Engineer. If the test section should prove to be unsatisfactory, the necessary adjustments to the mix design, plant operations, and/or rolling procedures shall be implemented. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. When test sections do not conform to the specification requirements, the pavement shall be removed and replaced at the Contractor's expense.

302-3.3 WEATHER LIMITATIONS. The ATPS mixture shall not be placed during foggy, windy (greater than 15 mph), and/or rainy weather. The ambient air temperature must be 60° F and rising two days before and the day of paving. The ATPS mixture shall not be placed on a wet surface or when the surface temperature of the underlying course is less than that specified below.

Mat Thickness	Base Temperature °F
3" or greater	40
Less than 3", but greater than 1"	45

302-3.4 HMA PLANT. The ATPS shall be manufactured in a Hot-Mix Asphalt plant that has been calibrated and approved in accordance with the current Standard Specifications for Road and Bridge Construction by the IDOT Division of Highways for the manufacture of Class I mixtures.

302-3.5 HAULING EQUIPMENT. Vehicles used in transporting the ATPS mixtures shall have clean and tight beds. The beds shall be sprayed with asphalt release agents which have been tested and approved for use by the Department. After spraying, the bed of the vehicle shall be in a completely raised position and it shall remain in this position until all excess asphalt release agent has been drained. When the air temperature is below 60° F, the bed, including the end, end gate, sides and bottom shall be insulated with fiberboard, plywood or other approved insulating material and shall have a thickness of not less than ¾ inch. When the insulation is placed inside the bed, the insulation shall be covered with sheet steel approved by the Engineer. Each vehicle shall be equipped with a cover of canvas or other suitable material meeting the approval of the Engineer which shall be used if any one of the following conditions are present:

- A. Ambient air temperature is below 60° F.
- B. The weather is inclement (such as rainy or foggy conditions as determined by the Resident Engineer).
- C. The temperature of the ATPS mixture immediately behind the paver screed is below 250° F.

302-3.6 HMA PAVERS. HMA pavers shall meet the requirements of Section 403-4.4.

302-3.7 ROLLERS. A steel wheel tandem roller weighing not less than 8 tons nor more than 12 tons and having a unit compression on the drive wheels of not less than 250 nor more than 400 pounds per inch of roller width, shall be used to compact the mix.

302-3.8 PREPARATION OF THE ATPS MATERIAL. The ATPS material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of asphalt cement material to the mixer at a uniform temperature. The temperature of the asphalt cement material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 300° F.

302-3.9 PREPARATION OF ATPS MIXTURE. The aggregates and the asphalt cement material shall be measured or gauged and introduced into the mixer in the amount specified by the JMF.

The temperature of the aggregate before adding the asphalt cement shall not be less than 250° F nor more than 350° F unless authorized by the Engineer. The combined materials shall be mixed until a complete uniform coating of the particles and a thorough distribution of the asphalt cement throughout the aggregate are secured. Wet mixing time shall be approved by the Engineer for each plant and each type of aggregate used. Normally, the mixing time after introduction of asphalt cement should not be less than 30 seconds.

302-3.10 TRANSPORTING, SPREADING AND FINISHING. The mixture shall be transported from the mixing plant to the job site in vehicles conforming to the requirements of Section 302-3.5. Deliveries shall be scheduled so that paving and rolling of all mixture prepared for one day's run can be completed during the day light unless adequate artificial lighting is provided. Hauling over freshly laid material shall not be permitted until the material has been compacted, as specified, allowed to cool to atmospheric temperature, and approval is received from the Resident Engineer.

Immediately before placing the ATPS mixture, the underlying course shall be cleaned of all loose or deleterious material with power blowers, power brooms or hand brooms as directed.

The mixture shall be placed at a temperature of not less than 250° F. The moisture content of the mixture shall not exceed 0.5 percent.

The mixture shall be spread to the width specified in the plans by an approved HMA paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the specified thickness and shall conform to the grade and contours specified in the plans. The speed of the paver shall be regulated to eliminate pulling and tearing of the mat. Placing shall begin along the centerline of areas to be paved on a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet, except where edge lanes require strips less than 10 feet to complete the area.

Transverse joints in adjacent lanes shall be offset a minimum of ten (10) feet.

In areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread raked and luted using hand tool methods.

The first lane of the ATPS shall be started at the center of the pavement with a taut stringline (guide wire) set to grade at both sides of the paver. The automatic grade control system of the paver shall be used to control grade of both sides of the paver from these reference stringlines. The grade control for the adjacent lanes of pavement shall be maintained by using a matching shoe with the previous laid pavement and a stringline on the outer edge of the next lane. A stringline and a matching shoe shall be used to pave all remaining lanes of the ATPS.

302-3.11 COMPACTION OF MIXTURE. After spreading, the mixture shall be thoroughly and uniformly compacted using approved rollers. Three (3) or four (4) complete passes should be sufficient to compact the mixture, but compaction shall be to the satisfaction of the Engineer. Rolling will be withheld until the mixture has cooled to approximately 150° F. Rolling shall be initiated with the drive wheel toward the paving machine. The sequence of rolling for the first paving lane shall be to first roll the lower edge (with reference to the transverse slope of the lane) and then roll the upper edge. The interior of the lane should then be rolled from the lower side toward the upper with overlapping roller paths. On adjoining paving lanes, rolling shall begin by starting 6 to 8 inches from the longitudinal joint and then overlapping the joint on the second pass (pinching).

The speed of the roller shall at all times be sufficiently slow to avoid displacement of the hot mixture. The rollers shall not travel faster than the manufacturer's recommended speed and in no case faster than 3 mph. Any displacement occurring as a result of reversing the direction of the roller or from any other cause, shall be corrected at once by rakes and fresh mixture. The roller shall not be permitted to stand static on the hot material.

Sufficient rollers shall be furnished to handle the output of the plant. The Contractor shall take measures in order to prevent mix from adhering to the rollers during the rolling operations. In areas not accessible to the rollers, the mix shall be compacted with hand tampers.

Any mixture which becomes loose and broken, mixed with dirt, or in any way defective shall be removed and replaced with fresh, hot mixture and immediately compacted to conform to the surrounding area. After compaction and acceptance of the ATPS, the Contractor shall protect the surface from all damage and/or contamination. If at any time prior to placement of the succeeding pavement course, the integrity of the ATPS is disturbed, the affected area shall be removed and immediately replaced at the Contractor's expense.

302-3.12 JOINTS. The formation of all joints shall be made in such a manner (approved by the Resident Engineer) as to ensure a continuous bond between old and new sections of the course.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width to expose a vertical face. In both cases, all contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint. Longitudinal joints which are damaged, or otherwise defective, shall be cut back to expose a clean, sound vertical face for the full depth of the course. All repaired contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

302-3.13 SHAPING EDGES. While the surface is being compacted and finished, the Contractor shall carefully trim the outside edges of the pavement to the proper alignment. Edges so formed, shall be beveled while still hot with the back of a rake or lute.

302-3.13 SURFACE TESTS. The finished surface shall not vary more than 3/16 inch when tested with a 16 foot straight edge applied parallel with, or at right angles to, the centerline. ATPS with a surface higher than 0.02 foot above the proposed grade shall be removed and replaced at the Contractor's expense with ATPS which complies with these specifications. When permitted by the Engineer, the high spots may be removed to within specified tolerances by any method that does not produce contaminating fines nor damage the ATPS to remain in place. Grinding will not be permitted.

Finished ATPS with a surface lower than 0.05 foot below the grade specified shall be removed and replaced with ATPS at the Contractor's expense.

METHOD OF MEASUREMENT

302-4.1. The area of asphalt treated permeable subbase shall be the square yards of asphalt treated permeable subbase completed and accepted by the Engineer.

BASIS OF PAYMENT

302-5.1. Payment shall be made at the contract unit price per square yard for asphalt treated permeable subbase and at the contract unit price per each for ATPS test section. These prices shall be full compensation for furnishing all materials, labor, equipment and any incidentals necessary to complete item as shown on the plans and specified herein.

FLEXIBLE SURFACE COURSES

ITEM 401 BITUMINOUS SURFACE COURSE

(Central Plant Hot Mix)

DESCRIPTION

401-1.1. This work shall consist of a Hot-Mix Asphalt (HMA) surface course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. The term "Hot Mix Asphalt" or "HMA" shall refer to this mixture in various combinations and uses.

Each course shall be constructed to the depth, typical section, or elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course. The Contractor shall be responsible for the Quality Control in the production and construction of the Hot-Mix Asphalt (HMA) surface course. The surface course shall be laid in a maximum of two (2) inch lifts. Thicker lifts not to exceed three (3) inches may be authorized by the Resident Engineer provided a continuous paving operation is maintained.

For all IDOT Division of Aeronautics projects, the production, placement, and acceptance of flexible (HMA) pavements is performed by either Method I or Method II, when indicated. The two Methods are differentiated by the quantity of material placed. Refer to the plans and project Special Provisions for which method is used for each pay item. In all cases, Method I refers to quantities less than 2,500 tons, while Method II refers to quantities greater than or equal to 2,500 tons.

MATERIALS

401-2.1 AGGREGATE. Aggregates shall consist of crushed stone or crushed gravel, blended with crushed or natural sand(s) and/or mineral filler.

Crushed Stone: Crushed stone shall be the angular fragments resulting from crushing by, mechanical means the following types of rocks quarried from undisturbed consolidated deposits: granite and similar phanerocrystalline igneous rocks, limestone, dolomite, massive metamorphic quartzite, or similar rocks. Dolomite shall be a carbonate rock containing 11.0 percent or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0 percent magnesium oxide (MgO).

Crushed Gravel: Crushed gravel shall be the product resulting from crushing by mechanical means, and shall consist entirely of particles obtained by crushing gravel, all of which before crushing will be retained on a screen with openings equal to or larger than the maximum nominal size of the resulting crushed material. If approved by the Engineer, final product gradations may be obtained by screening or blending various sizes of crushed gravel material.

Mineral Filler: Mineral filler shall consist of dry limestone dust, or other material approved by the Engineer and shall meet the requirements of ASTM D 242.

The portion of the materials retained on the No. 8 sieve shall be known as coarse aggregate, the portion passing the No. 8 sieve and retained on the No. 200 sieve as fine aggregate, and the portion passing the No. 200 sieve as mineral filler.

A. Coarse Aggregate. Coarse aggregate shall consist of sound, tough, durable particles conforming to the following quality requirements:

QUALITY TEST(IDOT B Quality)	PERCENT
Na ₂ SO ₄ Soundness 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104), Max. % Loss	15
Los Angeles Abrasion, ASTM C 131, Max. % Loss	40

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	2.0
Clay Lumps %	0.5
Soft & Unsound Frag. %	6.0
Other Deleterious %	2.0
<i>Total Deleterious Allowed %</i>	<i>6.0</i>

B. Fine Aggregate. Fine aggregate shall be defined as follows:

1. Sand: Sand shall be the fine granular material resulting from the natural disintegration of rock. Sand produced from deposits simultaneously with and by the same operations as gravel coarse aggregate may contain crushed particles in the quantity resulting normally from the crushing and screening of oversize particles.
2. Stone Sand: Stone sand shall be produced by washing or processing by air separation the fine material resulting from crushing rock quarried from undisturbed consolidated deposits.
3. Slag Sand: Slag sand shall be the graded product resulting from the screening of air cooled blast furnace slag. Air cooled blast furnace slag shall be the nonmetallic product, consisting essentially of silicates and alumino-silicates of lime and other bases, which is developed in a molten condition simultaneously with iron in a blast furnace.
4. Steel Slag Sand: Steel slag sand shall be the graded product resulting from the screening of crushed steel slag. Crushed steel slag shall be the nonmetallic product which is developed in a molten condition simultaneously with steel in an open hearth, basic oxygen or electric furnace.

The fine aggregate shall also conform to the following quality requirements:

QUALITY TEST (IDOT B Quality)	PERCENT
Na ₂ SO ₄ Soundness 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104), Max. % Loss	15
Minus No. 200 Sieve Mat'l, ASTM C 136, Max. % Loss ^{1/}	6.0 ^{2/}

1/ Fine aggregate shall not contain more than 3 percent clay (2 micron or smaller) particles.

2/ Does not apply to Stone Sand.

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	3.0
Clay Lumps %	3.0
Coal, Lignite & Shells %	3.0
Conglomerate %	3.0
Other Deleterious %	3.0
<i>Total Deleterious Allowed %</i>	<i>5.0</i>

If necessary to obtain the gradation of aggregate blend or workability, natural sand may be used. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification.

- C. Sampling and Testing. All aggregates proposed in the manufacture of the mix will be sampled and tested by the Contractor. ASTM D 75 shall be used in sampling coarse aggregate and fine aggregate, and ASTM C 183 shall be used in sampling mineral filler. The Contractor shall provide the Engineer with aggregate producer (quarry) and Contractor (plant) quality control gradations. No aggregate shall be used in the production of mixture without prior approval.

- D. Sources of Aggregates. All aggregate sources that are approved by the Illinois Department of Transportation, Division of Highways, conforming to the description, gradation and quality specified herein, shall be permitted for use in the manufacture of the surface course. The supplier of

aggregates must participate and meet the requirements of the Illinois Department of Transportation Division of Highways source certification program. The Engineer reserves the right to inspect the source(s) and manufacturing of all aggregates. If satisfactory quality control and production procedures are not being implemented, the Engineer may remove approval of the source(s). Approval of the source(s) of aggregate(s) does not relieve the Contractor in any way of the responsibility for delivery of aggregate to the job site that meet the requirements specified herein.

- E. Samples of Aggregates. All the source(s) of the proposed aggregates for use by the Contractor in the Contractor's proposed HMA design must be approved in writing by the Illinois Division of Aeronautics' Engineer of Construction & Materials prior to use in any design or production of bituminous material.

401-2.2 MINERAL FILLER. If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242.

401-2.3 BITUMINOUS MATERIAL. Performance Graded asphalt PG 64-22 shall be used for all HMA produced unless otherwise specified. When requested, producers shall provide the Engineer with viscosity/temperature relationships for the performance graded asphalt binders delivered and incorporated in the work.

The asphalt binder shall meet the requirements of AASHTO M 320, Table 1 "Standard Specification for Performance Graded Asphalt Binder" for the grade shown on the plans. Elastomers shall be added to the base asphalt binder to achieve the specified performance grade and shall be either a styrene-butadiene diblock or triblock copolymer without oil extension, or a styrene-butadiene rubber. Air blown asphalts, acid modification, and other modifiers will not be allowed. Asphalt modification at hot-mix asphalt plants will not be allowed.

The Contractor shall furnish vendor's certified test reports for each carload or equivalent of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall be the basis for final acceptance.

401-2.4 RESERVED

401-2.5 RESERVED

COMPOSITION

401-3.1 COMPOSITION OF MIXTURE. The HMA shall be composed of a mixture of aggregate, filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula.

401-3.2 JOB MIX FORMULA. The Contractor is responsible for the JMF and no HMA for payment shall be produced until a letter from the Illinois Division of Aeronautics' Engineer of Construction & Materials approving the Contractor's proposed JMF has been issued to the Contractor. The approved JMF shall indicate the definite percentage on each sieve for each aggregate, the percent of bitumen, and the number of Marshall blows specified for the individual project. The Contractor shall provide all laboratory sampling and testing to the Engineer, upon the completion of the proposed JMF. The exact tests and procedures are outlined in the Illinois Division of Aeronautics (IDOA) latest *Policy Memorandum 96-2: "Requirements for Laboratory, Testing, Quality Control and Paving of Bituminous Concrete Mixtures,"* located on the IDOT internet site

The job mix formula for each mixture shall be in effect until modified in writing by the Project Engineer. Should a change in sources of materials be made, a new job mix formula shall be established before the new material is used.

The HMA shall be tested according to the Asphalt Institute, 'Marshall Method of Mix Design', in the current Manual MS-2, *Mix Design Method for Asphalt Concrete*, and shall meet the criteria set forth in TABLES 1 and 2 herein.

TABLE 1. MARSHALL DESIGN CRITERIA

Properties	Over 60,000 lb ^{1/}	Under 60,000 lb
Number of Blows	75	50
Stability (Min.)	1800	1500
Flow	8-16	8-18
Percent Air Voids ^{2/}	1.5 – 4.0	1.5 – 3.5
Voids filled with asphalt (%)	75-90	75-90

- 1/ Stone sand (IDOT Gradation FA20 or FA21) shall be required as part of the fine aggregate portion of the JMF. The exact amount of stone sand will be determined by the Contractor based on preparation of the Mix Design. The percentage of stone sand will be verified as acceptable by the Division of Aeronautics based upon the Contractor's final proposed JMF. The Division reserves the right to request a change in the amount of stone sand at any point in the mix design process, as well as during production, based upon performance of the mix during placement.
- 2/ Contact the Division for optimum target air voids.

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory screens, will conform to the gradation or gradations specified in TABLE 2, when tested in accordance with ASTM Standard C 136 (dry sieve only). The percentage by weight for the bituminous material shall be within the limits specified.

TABLE 2. AGGREGATE BITUMINOUS SURFACE COURSE

Sieve Size	Percentage by Weight Passing Sieves Job Mix Formula (JMF) Gradation B Range 3/4"	Ideal Target
	Maximum	
1 in.	100	100
3/4 in.	100	100
1/2 in.	99 – 100	100
3/8 in.	91 – 97	94
No. 4	56 – 62	59
No. 8	36 – 42	39
No. 16	27 – 32	30
No. 30	19 – 25	22
No. 100	7 – 9	8
No. 200	5 – 7	6
Bitumen %:	5.0 – 7.0	6.0

The gradations in TABLE 2 represent the limits which shall determine the suitability of aggregate for use from the sources of supply. The gradation shown in TABLE 2 is such that the maximum size aggregate used shall not be more than one-half of the thickness of the layer of the course being constructed. The aggregate shall have a gradation within the limits designated in TABLE 4 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be uniformly graded from coarse to fine.

The course and fine aggregate gradations specified in the Illinois Division of Highways Specifications for Road and Bridge Construction, current edition, may be blended to meet the job mix formula.

The job mix tolerances shown in TABLE 3 shall be applied to the job mix formula to establish a job control grading band. The tolerances listed in TABLE 3 will only apply when they cause a grading band within the band listed in TABLE 2. Otherwise, the grading bands listed in TABLE 2 shall apply.

TABLE 3. JOB MIX FORMULA TOLERANCES
(Based on a Single Test)

Material	Tolerances Plus or Minus
Aggregate passing No. 4 sieve or larger	7 percent
Aggregate passing Nos. 8 and 16 sieves	5 percent
Aggregate passing Nos. 30 sieve	4 percent
Aggregate passing Nos. 100 and 200 sieves	2 percent
Bitumen	0.45 percent
Temperature of mixing and placing	20 degrees F.

The aggregate gradation may be adjusted within the limits of TABLE 2, as directed, without adjustments in the contract unit prices.

Should a change in sources of materials be made, a new job mix formula shall be established before the new material is used. Deviation from the approved JMF for bitumen content and gradation of aggregates shall not be greater than the tolerances permitted and shall be based on extraction, or calibrated ignition oven test for aggregate gradations and asphalt content. Results falling outside the set tolerances shall be cause for rejection of all the material placed from the time of testing until a passing test is obtained. The applicable ASTM and IDOT tests are outlined in the current IDOA *Policy Memorandum 96-2: "Requirements for Laboratory, Testing, Quality Control and Paving of Bituminous Concrete Mixtures,"* located at the IDOT internet site. These tests shall be performed by Contractor quality control personnel. Split mix samples shall be maintained by the Contractor for random testing by the Engineer.

401-3.3 RESERVED

401-3.4 TEST SECTION. (For Method II only: Over 2,500 tons/pay item) Prior to the manufacture of mix for the test section, Contractor quality control personnel shall have completed all proportioning and testing in accordance with Policy Memorandum 96-2, to assure that the mix produced will meet the JMF. The Contractor shall then prepare a quantity of HMA surface course in order to construct the test section.

The test section shall have a length of approximately 200 to 300 lineal feet and shall be of the same depth specified for the construction of the course which it represents. The Contractor may place up to 50 tons of mix prior to construction of the test section in order to line-out the plant, the mix, and the paving operation. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented.

A. Construction of the Test Section. The test section shall consist of two parts: Development of a Growth Curve and establishing a Rolling Pattern.

1. Growth Curve

To construct the Growth Curve a self-propelled vibratory roller meeting the following minimum requirements shall be required:

Drum diameter 48 inches, length of drum 66 inches, vibrators 1600 vibrations per minute (VPM) minimum, unit static force on vibrating drum(s) 125 pounds per lineal inch (PLI), total applied force 325 pounds per inch (PLI), adjustable eccentrics, reversible eccentrics on non driven drum(s). The total applied force for various combinations of VPM and eccentric positions shall be shown on decals on the vibrating roller or on a chart maintained with the roller. The vibratory roller shall be equipped with water tanks and sprinkling devices, or other approved methods, which shall be used when necessary to wet the drum to prevent the HMA from sticking. The Contractor shall have a vibrating reed tachometer (hand type) at the job site for checking roller vibrations. The reed tachometer shall have a range of 1000 to 4000 vibrations per minute(vpm). The vibrating reed tachometer shall have two (2) rows of reeds. One row shall range from 1000 to 2000 vpm and the other row shall range from 2000 to 4000 vpm.

The Growth Curve shall be constructed by successive passes of the vibratory roller, in a given area, in order to determine the maximum compactability of the mix. The Growth Curve shall be construed under the supervision of the Engineer, or his/her designated representative, who must validate the Growth Curve results before continuing with the remainder of the Test Section. More than one Growth Curve may be required as part of the test section if adjustments to the mix, plant operation, laydown, etc., are necessary to reach optimum compactability.

2. Rolling Pattern

The Contractor shall then proceed to establish the Rolling Pattern using the equipment that he intends to use for compacting the rest of the HMA course.

B. Test Section Acceptance. The Test Section shall be evaluated and approved based on the following.

1. The completed Test Section (Rolling Pattern area) shall be divided into four (4) subsections with one (1) sample consisting of two (2) cores obtained from each subsection for determination of density. One additional core sample shall be obtained from the Growth Curve.
2. The Contractor shall correlate a nuclear density gauge to the Test Section for Quality Control testing. The nuclear density gauge shall not be used for acceptance testing.
3. The completed Test Section (rolling pattern area) shall have a minimum density of 94.0 percent (6.0 percent air voids) of the maximum theoretical specific gravity of the mix (ASTM D 2041). Individual test (average of two cores) results below 94.0% shall constitute a failing test section.
4. If the test section fails to meet these requirements, the Contractor shall construct a new Test Section meeting these requirements at his/her own expense.
5. Full production shall not be allowed until all tests, Reflux extraction or Ignition Oven, Gradation, Marshall Stability and Flow, Gravities of mix, and Core Densities are completed in order to determine compliance with these specifications.
6. The completed Test Section(s) shall be part of the proposed work. When recommended by the Resident Engineer and approved by the Engineer, test sections that do not conform to the specifications shall be removed and replaced at the Contractor's expense.
7. When a Test Section passes, the Test Section tonnage shall be paid 100%.

The mix used in construction of the Test Section shall be paid for under Section 401-6.1. Construction of the Test Section shall be paid for separately from the mix, but also in accordance with Section 401-6.1. Payment will be made for only one (1) Test Section.

401-3.5 RESERVED

401-3.6 BITUMINOUS AND AGGREGATE MATERIAL CONTRACTOR'S RESPONSIBILITY Samples of the bituminous and aggregate materials that the Contractor proposes to use, together with a statement of their source and character, shall be submitted to the Engineer; approval must be obtained before the use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous and aggregate materials to furnish material subject to this and all other pertinent requirements of the contract. Only those materials that have demonstrated performance under the proposed design requirements will be accepted.

The Engineer or his/her authorized representative shall have access, at all times, to all parts of the paving plant for the purpose of inspecting equipment, conditions and operation of the plant, for verification of weights or proportions and character of materials, and to determine temperatures maintained in the preparation of the mixtures.

The Contractor shall furnish vendor's certified test reports for each carload or equivalent of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall

not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of materials received for use on the project.

CONSTRUCTION METHODS

401-4.1 WEATHER LIMITATIONS. The HMA surface course shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in TABLE 4. The temperature requirements may be waived, but only when so directed by the Engineer.

TABLE 4. BASE TEMPERATURE LIMITATIONS

Mat Thickness	Base Temperature (Minimum)	
	°F	°C
3 in. or greater	40	4
Greater than 1 in. but less than 3 in.	45	7
1 in. or less	50	10

No paving shall commence unless the ambient air temperature is 40°F. and rising. Paving shall halt when the ambient air temperature is 45°F. and falling.

401-4.2 HMA PLANT. The Hot-Mix Asphalt (HMA) plant(s) shall conform to the following requirements, or the Engineer may accept the use of a hot-mix plant approved by the IDOT Division of Highways for the manufacture of Class I HMA mixtures in accordance with the current IDOT Standard Specifications for Road and Bridge Construction. When recyclable asphalt pavement is used, the hot-mix plant shall also conform to the additional IDOT plant requirements for hot-mix recycling, although recycled asphalt pavement is not allowed in any surface course mix without written permission from the Division of Aeronautics.

If the supplier is equipped with an automated plant the automation feature shall be used in the production of bituminous material for the project. If the supplier is equipped with a recodation feature, it also shall be used. Sufficient storage space shall be provided for each size of aggregate. The different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the drier. The storage yard shall be neat and orderly, and the separate stockpiles shall be readily accessible for sampling.

Plants used for the preparation of HMA shall conform to all requirements under A., except that scale requirements shall apply only where weight proportioning is used. In addition, batch mixing plants shall conform to the requirements under B., continuous mixing plants shall conform to the requirements under C., and drum mixers shall conform to the requirements under D.

- A. Requirements for All Plants. Mixing plants shall be of sufficient capacity to adequately produce the quantity of HMA for the proposed construction.
 1. Plant scales. Scales shall be accurate to 0.5 percent of the required load. Poises shall be designed to be locked in any position to prevent unauthorized change of position. In lieu of plant and truck scales, the Contractor may provide an approved automatic printer system to print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by a weigh ticket for each load. Scales shall be inspected for accuracy and sealed as often as the Resident Engineer may deem necessary. The Contractor shall have on hand not less than ten 50-pound weights for testing the scales.
 2. Equipment for preparation of bituminous material. Tanks for storage of bituminous material shall be capable of heating the material under effective and positive control, at all times, to the temperature requirements specified herein. Heating shall be accomplished by steam coils, electricity, or other means that will allow no direct flames to come in contact with the bituminous material or its fumes. The circulating system for the bituminous material shall be of adequate size to insure proper and continuous circulation between storage tank and mixer during the entire operating period. Pipelines and fittings shall be steam-jacketed or otherwise properly heated, if required, or insulated to prevent heat loss. The storage tank capacity shall

be sufficient for at least a one-day run. Provision shall be made for measuring quantities and for sampling the material in the storage tanks.

3. Feeder for drier. The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier to obtain uniform production and temperature. When added mineral filler is specified, a separate bin and feeder shall be furnished with its drive interlocked with the aggregate feeders
4. Drier. The plant shall include a drier(s) which continuously agitates the aggregate during the heating and drying process.
5. Screens. Plant screens, capable of screening all aggregates to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer, shall be provided.
6. Bins. The plant shall include storage bins of sufficient capacity to supply a mixer operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates. When used, separate dry storage shall be provided for filler of hydrated lime, and the plant shall be equipped to feed such material into the mixer. Each bin shall be provided with overflow pipes of such size and at such location to prevent backup of material into the compartments or bins. Each compartment shall be provided with its individual outlet gate to prevent leakage. The gates shall cut off quickly and completely. Bins shall be constructed so that samples may be obtained readily. Bins shall be equipped with adequate tell-tale devices which indicate the position of the aggregates in the bins at the lower quarter points.

Prior to start of production of any mixture, the Contractor shall furnish the Resident Engineer with calibrations showing the rate of feet of each aggregate for the cold bin or silo in which it is to be used. Change of material or change of cold bin or silo will require new calibrations. The calibrations shall show the rate of feed per minute per unit of opening or setting of feed.

7. Bituminous control unit. Satisfactory means shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified by the job mix formula, either by weighing, metering, or volumetric measurements. Suitable means shall be provided, either by steam-jacketing or other methods of insulation, for maintaining the specified temperature of the bituminous material in the pipelines, meters, weigh buckets, spray bars, and other containers or flow lines. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer.
8. Thermometric equipment. An armored thermometer of adequate range shall be fixed in the bituminous feed line at a suitable location near the discharge valve at the mixer unit. The plant shall be further equipped with either an approved recording dial scale, a mercury-actuated thermometer, an electric recording pyrometer, or other thermometric instruments, so placed at the discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregate. When required by the Engineer, additional thermometric equipment shall be placed at the pug mill to control the temperature of the mixture.
9. Dust collector. The plant shall be equipped with a dust collector to waste or return uniformly to the hot elevator all or any part of the material collected as directed. The plant shall have a mixed cover and such additional housing necessary to the control of dust.
10. Truck scales. Unless an automatic batching plant with automatic printers is used, the HMA mixture shall be weighed on approved scales furnished by the Contractor or on public scales at the Contractor's expense. Scales shall be inspected for accuracy and sealed as often as the Resident Engineer deems necessary.
11. Safety requirements. Adequate and safe stairways to the mixer platform and sampling points shall be provided, and guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required. Accessibility to the top of truck bodies shall be provided by suitable device to enable the Resident Engineer to obtain sampling and mixture temperature data. Means shall be provided to raise and lower scale calibration equipment, sampling equipment, and other similar equipment between the ground and the mixer platform.

All gears, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded. Ample and unobstructed passage shall be maintained at all times in and around the truck loading area.

This area shall be kept free of drippings from the mixing platform. Equipment exposed to steam or other lines carrying high temperatures, so located as to endanger workmen or create a fire hazard, shall be properly guarded or insulated as to prevent inadvertent injurious contact by workmen. Surge bins will not be allowed.

12. Testing laboratory. The Contractor or producer shall provide a testing laboratory, meeting the requirements of Illinois Division of Aeronautics' latest Policy Memorandum 96-2/2003-1, located at the IDOT internet site, for Quality Control and acceptance testing during periods of mix production, sampling, and testing, and whenever materials subject to the provision of these specifications are being supplied or tested. The laboratory shall provide adequate equipment, space, and utilities as required for the performance of the specified tests. All labs must be certified to do Marshall or Superpave mix design and testing, as required by design, having AMRL and AASHTO certification for all equipment.
13. Aggregate stockpiles. In preparation of the mineral aggregates, sufficient storage space shall be provided so that such aggregate size can be kept in separate stockpiles. The stockpile will be constructed in uniform layers by use of a clamshell or other approved methods in such manner as to prevent segregation. The use of bulldozers in stockpiling of aggregates will not be permitted. The storage yard shall be neat and orderly and the separate stockpiles readily accessible for sampling.

B. Requirements for Batching Plants.

1. Weigh box or hopper. The equipment shall include means for weighing each bin size of aggregate in a weigh box or hopper suspended on scales, ample size to hold a full batch without hand raking or running over. The assembly, consisting of the weigh box or hopper and the supporting fulcrums and knife edges, shall be so constructed that no part of the assembly will be easily thrown out of alignment or adjustment. The gates on both the bins and hoppers shall be so constructed as to prevent leakage of aggregate when closed. On manually operated plants, an interlocking device shall be provided that will prevent the opening of more than one gate at a time. On automatic plants, designed for simultaneous weighing of all sizes of aggregate, this provision shall not apply while the plant is operating under automatic control.
2. Bituminous control. The equipment used to measure the bituminous material shall be accurate to within +0.5 percent. The bituminous material bucket shall be of a non-tilting type with a loose sheet metal cover. The length of the discharge opening or spray bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer. The bituminous material bucket, its discharge valve(s), and spray bar shall be adequately heated. Steam jackets, if used, shall be efficiently drained, and all connections shall be so constructed that they will not interfere with the efficient operation of the bituminous scales. The capacity of the bituminous material bucket shall be at least 15 percent in excess of the weight of bituminous material required in any batch. The plant shall have an adequately heated, quick-acting non-drip charging valve located directly over the bituminous material bucket.

The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used per batch. The controls shall be constructed to lock at any dial setting and automatically reset to that reading after each additional batch of bituminous material. The dial shall be in full view of the mixer operator. The flow of bituminous material shall be automatically controlled to begin when the dry mixing period is over. All of the bituminous material required for one batch shall be discharged in not more than 15 seconds after the flow has begun. The size and spacing of the spray-bar openings shall provide a uniform application of bituminous material the full length of the mixer. The section of the bituminous line between the charging valve and the spray bar shall have a valve and outlet for checking the meter when a metering device is substituted for a bituminous material bucket.

3. Mixer. The batch mixer shall be an approved type capable of producing a uniform mixture with well-coated aggregate in the prescribed mixing time within the job mix tolerance specified. If

not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust. The clearance of blades from all fixed and moving parts shall not exceed 1 inch.

4. Control of mixing time. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. It shall lock the weigh-box gate after the charging of the mixer and keep it locked until the closing of the mixer gate at the completion of the cycle. It shall lock the bituminous material bucket throughout the dry mixing period and shall lock the mixer gate throughout the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh-box gate and the introduction of bituminous material. The wet mixing period is the interval of time between the introduction of bituminous material and the opening of the mixer gate.

The timing control shall be flexible and shall be capable of settings of 5-second intervals or less throughout a 3-minute cycle. A mechanical batch counter shall be installed as a part of the timing device and shall be designed to register only completely mixed batches.

The setting of time intervals shall be at the direction of the Engineer who shall then lock the case covering the timing device until a change is made in the timing periods.

C. Requirements for Continuous Mix Plants.

1. Aggregate proportioning. The plant shall include means for accurately proportioning each size of aggregate.

The plant shall have a feeder mounted under each compartment bin. Each compartment bin shall have an accurately controlled individual gate to form an orifice for the volumetric measuring of material drawn from each compartment. The feeding orifice shall be rectangular with one dimension adjustable by positive mechanical means and provided with a lock.

Indicators shall be provided for each gate to show the respective gate opening in inches.

2. Weight calibration of aggregate feed. The plant shall include a means for calibration of gate openings by weighing test samples. Provision shall be made so that materials fed out of individual orifices may be bypassed to individual test boxes. The plant shall be equipped to conveniently handle individual test samples of not less than 200 pounds. Accurate scales shall be provided by the Contractor to weigh such test samples.
3. Synchronization of aggregate feed and bituminous material feed. A satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of bituminous material from the meter or other proportioning device. This control shall be by interlocking mechanical means or by any other positive method satisfactory to the Engineer.
4. Mixer. The plant shall include an approved continuous mixer adequately heated and capable of producing a uniform mixture within the job mix tolerances. It shall be equipped with a discharge hopper with dump gates to permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and shall be reversible to retard the flow of the mix. The mixer shall have a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge. Charts shall be provided showing the rate of feed per minute for each aggregate used.

D. Requirements for Drum Mixers.

1. Exclusions. Replace the appropriate sections of 401-4.2.A with the following sections that apply only for drum mixers.
2. Aggregate delivery system. An automatic plant shutoff shall be provided to operate when any aggregate bin becomes empty. Provisions shall be provided for conveniently sampling the full flow of materials from each cold feed and the total cold feed. Total cold feed shall be weighed continuously. The weighing system shall have an accuracy of 0.5 percent when tested for accuracy. The plant shall provide positive weight control of the cold aggregate feed by use of a belt scale, or other appropriate device, which will automatically regulate the feed gate and

permit instant correction of variations in load. The cold feed flow shall be automatically coupled with the asphalt flow to maintain the required proportions of each material. Provisions shall be made for introducing the moisture content of the cold feed aggregates into the belt weighing signal and correcting wet aggregate weight to dry aggregate weight. Screens or other suitable devices which will reject oversize particles or lumps of aggregate that have been cemented together shall be installed in the feeder mechanism between the bins and the dryer drum.

Dry weight of the aggregate flow shall be displayed digitally in appropriate units of weight and time and totalized.

3. Bituminous material and additive delivery systems. Satisfactory means of metering shall be provided to introduce the proper amount of bituminous material and additives into the mix. Delivery systems shall prove accurate to plus or minus 1 percent when tested for accuracy. The bituminous material and additive delivery shall be interlocked with the aggregate weight. The bituminous material and additive flow shall be displayed digitally in appropriate units of volume (or weight) and time shall be totalized.
4. Thermometric equipment. A recording thermometer of adequate range shall be located to indicate the temperature of the bituminous material in storage. The plant shall also be equipped with approved recording thermometers, pyrometers, or other approved recording thermometric instruments at the discharge chute of the drum mixer.
5. Drum mixer. A drum mixer of satisfactory design shall be provided. It shall be capable of drying and heating the aggregate to the moisture and temperature requirements set forth in the paving mixture requirements and capable of producing a uniform mixture. If the quality requirements of Section 401-3.2 cannot be met, the Contractor will be required to utilize either batch or continuous mix plants.
6. Temporary storage of HMA mixture. Use of surge bins or storage bins for temporary storage of HMA mixtures will be permitted as follows:
 - a. The HMA mixture may be stored in surge bins for a period of time not to exceed 3 hours.
 - b. The HMA mixture may be stored in insulated and heated storage bins for a period of time not to exceed 12 hours, provided an inert gas atmosphere is maintained in the bin during the storage period.

If the Engineer determines that there is an excessive amount of heat loss, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

- E. Inspection of Plant. The Engineer or his/her authorized representative shall have access, at all times, to all parts of the paving plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking the temperatures maintained in the preparation of the mixtures.

401-4.3 HAULING EQUIPMENT. Trucks used for hauling HMA shall have tight, clean, smooth metal beds. To prevent the mixture from adhering to them, the beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, so that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

All trucks used for hauling HMA shall have a tightly closing tailgate to prevent spilling of material on airfield pavements or entrance roads used for haul roads. Prior to leaving the placing site, the end of the truck beds shall be cleaned of all loose material which may spill onto the pavements and the tail gate shall be secured.

401-4.4 HMA PAVERS. HMA pavers shall be self-contained, power-propelled units with an activated screed capable of vibrating at approximately 3000 VPM or strike-off assembly, heated if necessary, and shall be capable of spreading and finishing courses of HMA plant mix material which will meet the

specified thickness, smoothness, and grade. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of HMA plant mix material in widths shown on the plans. All width extensions required to place material shall have the same placement features and equipment functions as provided on the main body of the paver. Augers shall be extended as additional sections of screed are bolted on or automatically adjustable screeds are extended. The augers need not be extended when the screed extensions on either side of the machine are one foot or less and the finished surface of the mat is uniform. The use of any machine obsolete in design or in poor mechanical condition will not be permitted.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be capable of operating at forward speeds consistent with satisfactory laying of the mixture.

An automatic grade control system shall be used to automatically maintain the screed elevation as specified herein.

The controls shall be capable of working in conjunction with any of the following attachments, as specified by the Project Engineer:

- A. Ski-type device of not less than 30 feet in length or as directed by the Engineer.
- B. Taut stringline (wire) set to grade.
- C. Short ski or shoe.

401-4.5 ROLLERS. Rollers may be of the vibratory, steel wheel, or pneumatic-tired type. They shall be in good condition, capable of reversing without backlash, and operating at slow speeds to avoid displacement of the HMA. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density without detrimentally affecting the compacted material.

401-4.6 PREPARATION OF BITUMINOUS MATERIAL. The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. The temperature of the bituminous material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed the applicable maximum temperature set forth in AASHTO M 320 and not be more than 25° F above the temperature of the aggregate as specified in Section 401-4.7.

401-4.7 PREPARATION OF MINERAL AGGREGATE. The aggregate for the mixture shall be dried and heated to the temperature designated by the job formula within the job tolerance specified. Immediately after heating, the surface course aggregate(s) shall be screened into at least three sizes. This requirement does not apply to drum mixer plants. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregates. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

401-4.8 PREPARATION OF HMA. The aggregates and the bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job mix formula.

The combined materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate are secured. Wet mixing time shall be approved by the Engineer for each plant and for each type aggregate used. Normally, the mixing time after introduction of bituminous material should not be less than 30 seconds. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer.

$$\text{Mixing time (seconds)} = \frac{\text{Pugmill dead capacity in pounds}}{\text{Pugmill output in pounds per second}}$$

401-4.9 RESERVED

401-4.10 TRANSPORTING, SPREADING, AND FINISHING. The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Section 401-4.3. Deliveries shall be scheduled so that spreading and rolling of all mixture prepared for one day's run can be completed during daylight, unless adequate artificial lighting is provided. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature. A bituminous tack coat shall be applied on all underlying courses, as well as between any subsequent lifts of HMA.

Immediately before placing the HMA, the underlying course shall be cleared of all loose or deleterious material with power blowers, power brooms, or hand brooms as directed.

The mix shall be placed at a temperature of not less than 275° F. Moisture content of the mix shall not exceed 0.5 percent.

Upon arrival, the mixture shall be spread to the full width by an approved HMA paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and shall conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the HMA mat. The maximum allowed paver speed is 50 ft/min. Unless otherwise directed, placing shall begin along the centerline of areas to be paved on a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet, except where edge lanes require strips less than 10 feet to complete the area. The longitudinal joint in one layer shall offset that in the layer immediately below by at least 1 foot; however, the joint in the top layer shall be at the centerline of the pavement. Transverse joints in one layer shall be offset by at least 2 feet from transverse joints in the previous layer. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

The first lane of the first lift of the HMA surface course shall be started at the center of the pavement with a taut stringline (guide wire) set to grade at both sides of the paver. The automatic grade control system of the paver shall be used to control grade of both sides of the paver from these reference stringlines. The grade control for the adjacent lanes of pavement shall be maintained by using a matching shoe with the previous laid pavement and a stringline on the outer edge of the next lane. A stringline and matching shoe shall be used to pave all remaining lanes of the first lift of surface course. If grade is established on the first lift, succeeding lifts shall be laid with a traveling ski on both sides of the paver for the center lane with matching shoe and traveling ski on adjacent lanes. If grade is not established on the first lift, the Resident Engineer shall require taut stringline references until satisfactory grade is established.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted by hand tools.

401-4.11 COMPACTION OF MIXTURE. After spreading, the mixture shall be thoroughly and uniformly compacted with power rollers as directed by the Resident Engineer. Rolling of the mixture shall begin as soon after spreading as it will bear the roller without undue displacement or hair checking. On the first strip spread, rolling shall start at the low edge and progress toward the high edge. When adjoining lanes are placed, the same rolling procedure should be followed, but only after compaction of fresh mix at the longitudinal joint with 6 to 8 inches of the vibrating roller width overlapping on the previously compacted lane. Vibratory rollers will be operated so as to obtain a minimum of 10 impacts per foot. If a static roller is being used, 6 to 8 inches should be on the fresh mix at the longitudinal joint with the remainder of the roller width on the previously compacted lane. Rollers operated in static mode shall not exceed 3 mph(264 ft/min).

Initial rolling shall be done longitudinally. The rollers shall overlap on successive trips. Alternate trips of the roller shall be of slightly different lengths, and cross rolling shall not exceed more than one half the width of the pavement on crowned sections. The speed of the roller shall, at all times, be slow to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once by rakes and fresh mixture.

A self-propelled pneumatic-tire roller meeting the following requirements shall be required on the top lift of surface course mixture.

The roller shall be of the oscillating wheel type consisting of not less than 7 pneumatic-tired wheels revolving on 2 axles, and capable of being ballasted to the mass (weight) required. The front and rear wheels shall be staggered so that the tire sidewalls will have a minimum overlap of 1/2 inch. The roller shall provide for a smooth operation when starting, stopping or reversing direction. The tires shall withstand inflation pressures between 60 and 120 psi. The roller shall be equipped with an adequate scraping or cleaning device on each tire to prevent the accumulation of material on the tires. When used for the compaction of HMA, the roller shall be equipped with a water system which will keep all tires uniformly wet to prevent material pickup. The Contractor shall provide means for determining the mass (weight) of the roller as distributed on each wheel. Ballast shall be included in determining the mass (weight). The maximum speed for pneumatic-tired rollers is 3.5 mph(308 ft/min).

Sufficient rollers shall be used to handle the output of the plant. Rolling shall continue until all roller marks are eliminated producing a surface of uniform texture true to grade and cross section.

The Contractor shall provide, at all times, an approved Troxler (or equal) nuclear density gauge with a qualified operator to maintain quality control of the density as specified herein.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers.

Any mixture which becomes loose and broken, mixed with dirt, or in any way defective prior to the application of the finish coat shall be removed and replaced with fresh hot mixture and immediately compacted to conform with the surrounding area. This shall be done at the Contractor's expense.

401-4.12 JOINTS. The formation of all joints shall be made in such a manner as to ensure a continuous bond between old and new sections of the course. All joints shall present the same texture, density, and smoothness as other sections of the course.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. In both methods all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

All longitudinal joints constructed are to be compacted in such a manner that they are "pinched" to provide adequate density at the joint. When laying the HMA adjacent to a previously placed lane, the first pass of the roller shall be along the longitudinal joint on the fresh mixture with the compression wheel not more than 6 in. from the joint. The second pass of the roller shall overlap the longitudinal joint not more than 12 in. on the previously placed lane, after which the rolling shall proceed uniformly. Each stop shall be regulated to prevent trapping of water on the rolled surface. The steel wheeled rollers shall be operated with the compression wheels toward the direction of paving. The Contractor shall cut two cores per 2,500 tons at a random location over the longitudinal construction joint. The cores shall be delivered to the Resident Engineer for density testing and the two results will be used to obtain an average density. This average density at the joint shall be a minimum of 90%.

Density results below an average of 90% shall result in an immediate suspension of paving operations until a sufficient investigation and solution to the density problem is agreed to by the Engineer. The result of this deficiency will be a 5% penalty on all production done on the day the core was taken or represents.

401-4.13 RESERVED

401-4.14 SHAPING EDGES. While the surface is being compacted and finished, the Contractor shall carefully trim the outside edges of the pavement to the proper alignment. Edges so formed shall be beveled while still hot with the back of a rake or a smoothing iron and thoroughly compacted by tampers or by other satisfactory methods.

401-4.15 ACCEPTANCE TESTING OF HMA MIXES FOR DENSITY. (For Method I only: Under 2,500 tons/pay item) After the completion of compaction, the pavement will be tested for acceptance by the Resident Engineer and accepted on the basis of percent air voids in the final compacted mat.

The HMA surface course shall be compacted to a minimum density of 93 percent (7 percent air voids) and a maximum of 99 percent (1 percent air voids) of the Maximum Theoretical Specific Gravity (ASTM D 2041). If, during construction, the density test falls below 93 percent, additional approved rollers shall be required. Failure to achieve density within these limits shall be cause for rejection of the material, as determined by the Division of Aeronautics.

Two random nuclear density tests shall be taken for each 500 tons of mix placed. Each nuclear density test shall be the average of five (5) nuclear tests taken as a cross-section of the pavement. The Resident Engineer shall have a nuclear gauge and qualified operator on the project when constructing this item. One random mix sample shall be taken from each 1,000 tons of mix laid, for Marshall, Extraction, Maximum Specific Gravity, and Air Void tests.

(For Method II only: Over 2,500 tons/pay item) After the completion of compaction, the pavement will be tested and accepted on the basis of percent air voids in the final compacted mat.

The HMA surface course shall be compacted to a minimum density of 93 percent (7 percent air voids) and a maximum of 99% density (1% air voids) of the maximum theoretical specific gravity (ASTM D 2041) and accepted by the following statistical procedure. When more than one surface course mix design is used on the same project, each mix will be evaluated separately under the statistical acceptance procedure specified herein.

A. Lot Size. The plant-produced mixture shall be tested on a lot basis. A lot shall consist of 4 sublots. End or final lots may contain between 3 and 6 sublots.

A subplot shall consist of 500 tons for each type of mix.

One density sample shall be taken randomly from each subplot. Each density sample shall be the average of two cores extracted from the sample location.

The Contractor shall take one random mix sample from each 1,000 tons of mix laid. This sample shall be split into two samples with one half tested by the Contractor for Marshall, Extraction or Ignition oven for Gradation and Nuclear Asphalt Gauge for asphalt content, Maximum Specific Gravity, Gradation, and Air Void tests. The other sample half shall be appropriately marked and retained by the Contractor until the Engineer requests the mix for testing or directs the Contractor in writing to dispose of the mix.

All tests shall be completed and reported to the Engineer no later than the morning of the day following production.

B. Lot Early Termination. When less than 3 sublots are produced, such as at the end of construction of the surface course or at the end of the construction season, the final subplot data shall be included with the previous lot for payment. The final lot may thus contain up to six (6) sublots.

C. Acceptance Criteria. The acceptance of each lot of HMA surface course shall be based on the **P**ercentage of material **W**ithin specification **L**imits (PWL). The PWL is determined using standard statistical techniques and involves the number of tests in each lot (n) and the quality indexes (Q_L is the Quality Index for the lower limit; Q_U is the Quality Index for the upper limit). The quality indexes are calculated using the following formulae:

$$Q_L = \frac{\bar{X} - 1}{S}$$

$$Q_U = \frac{7 - \bar{X}}{S}$$

Where

Q = Quality Index (lower or upper)

\bar{X} = Mean (average) value of air voids in percent

% Air Voids = (100 - % density)

S = Standard Deviation of test results

For mat in-place air voids, estimate the **Percentage Within Tolerance (PWT)** for the lower and upper tolerance limits by entering TABLE 6 with Q_L and Q_U using the column appropriate to the total number (n) of core samples. The total percent of material between the lower and upper limits is defined as the **Percent Within Limits** and is calculated by the following formula:

$$PWL = [PWT(\text{lower}) + PWT(\text{upper})] - 100$$

Each lot of bituminous material shall be accepted for 100 percent payment when the PWL equals or exceeds 90 percent. When the PWL is below 90 percent for a given lot, the lot tonnage shall be adjusted in accordance with TABLE 5.

TABLE 5 - PAY ADJUSTMENT SCHEDULE ^{1/}

PWL	% ADJUSTMENT IN LOT QUANTITY
90 - 100	100
80 - 89.9	0.5 PWL + 55.0
65 - 79.9	2.0 PWL - 65.0
Below 65	^{2/}

- 1/ All preliminary calculations used in determining the Percent Within Limits should be rounded to a minimum of four digits right of the decimal point. The PWL that is used for TABLE 5 purposes should then be rounded to one digit right of the decimal point to determine the percent of contract quantity to be paid. The final percent pay figure should be rounded to one digit right of the decimal point. The Resident Engineer shall notify the Contractor, in writing, of the final percent pay for each lot as soon as all lot tests are completed.
- 2/ The lot shall be removed and replaced. However, the Engineer may decide to accept the deficient lot. In that case, it will be paid for at 50% adjustment.

D. Mix sampling All mix sampling shall be done on a random basis as determined by the Resident Engineer. Samples that are obviously defective or become defective prior to testing shall be discarded and retaken. New samples shall be considered as if they were initial samples.

401-4.16 SURFACE TESTS. Tests for conformity with the specified crown and grade shall be made by the Contractor immediately after initial compression. Any variation shall be corrected by the removal or addition of materials and by continuous rolling.

After the completion of final rolling, the smoothness of the surface course shall be tested with a 16-foot straightedge applied parallel with the centerline. Any humps or depressions exceeding ¼ inch shall be immediately corrected by removing the defective work and replacing with new material, as directed by the Resident Engineer. This shall be done at the Contractor's expense.

The finished surfaces of HMA courses shall not vary from the gradeline, elevations, and cross sections shown on the contract drawings by more than ½ inch. The Contractor shall correct pavement areas varying in excess of this amount by removing and replacing the defective work. Skin patching will not be permitted.

401-4.17 SAMPLING PAVEMENT. The completed pavement shall be cleaned so that no debris or dirt from coring operations is left on the surface of the pavement. Three (3) cores per lot shall be tested for thickness for any method used.

(For Method II only: Over 2,500 tons/pay item) Cores from each subplot shall be taken at random locations as outlined by the Resident Engineer. No core samples shall be taken within two feet of the edge of pavement. Any core less than 1 ½ inch thickness shall not be used and a new location and sample shall be selected.

Core samples of approximately 4 inches in diameter, for determination of in-place air voids of the completed pavement, shall be obtained by the Contractor at no extra expense. The number and

locations of the samples shall be as determined by the Resident Engineer. The Contractor shall furnish all tools, labor, and materials for sampling and replacing pavement.

All core tests necessary to determine initial conformance with specification requirements will be performed by the Resident Engineer at no cost to the Contractor.

Resampling and Retesting Resampling of a lot may be allowed only under the following conditions:

- A. The Contractor must request, in writing, the resampling and retesting of a complete lot within 48 hours after receiving the written test results of the lot from the Resident Engineer. Only one retest per lot will be permitted.
- B. If the retested lot should result in a higher "Percent Within Limits" figure than the original, based on all lot samples (original and new) the following will apply:
 1. The cost of resampling and retesting will be borne by the Engineer.
 2. The new "Percent Within Limits" figure shall be calculated using all LOT samples, (original and new) for calculating the lot payment.
- C. If the retested lot should result in a "Percent Within Limits" figure equal to or less than the original, based on all the lot samples (original and new), the following will apply:
 1. The cost of resampling and retesting will be borne by the Contractor.
 2. The new "Percent Within Limits" figure shall be calculated using all lot samples, (original and new) for calculating the lot payment.
- D. Procedures in ASTM E 178 shall be used to determine outliers based on all samples taken and a 5% significance level.
- E. Results of the retesting and resampling shall be final.

METHOD OF MEASUREMENT

401-5.1 HMA surface course will be measured by the ton. The tonnage shall be the weight used in the accepted pavement. No deduction will be made for the weight of bituminous material in the mixture. Plant batch weights will be accepted. Loads shall be checked periodically by weighing full truckloads of the HMA on an approved platform scale at the plant or on a commercial scale.

The Contractor shall furnish approved duplicate load tickets upon which is recorded the net weight of the HMA in each truck. The load ticket shall have sufficient space for signatures, identification of the HMA, date of delivery, and any other data which the Project Engineer may require. The Contractor shall submit one load ticket to the Project Engineer, or his/her duly authorized representative, at the plant after the truck is loaded and another load ticket to the Project Engineer, or his/her duly authorized representative, at the construction site when the truck load is incorporated into the pavement.

Measurement for payment will not be made for any HMA surface course in excess of 103 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.)

BASIS OF PAYMENT

401-6.1 The quantity of HMA surface course measured as outlined in Section 401-5.1, shall be adjusted in accordance with Section 401-4.15 herein. Final payment shall be compensation for furnishing all materials, for all preparation, mixing, testing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

(For Method I only: Under 2,500 tons/pay item). Payment shall be based upon the acceptance test results for density. Acceptance test results that do not meet the limits set forth in Section 401-4.13

shall be cause for a payment adjustment, or removal and replacement, of the material placed in the failed subplot(s), as determined by the Division.

(For Method II only: Over 2,500 tons/pay item). Payment shall be calculated by multiplying the contract unit price per ton of HMA surface course by the adjusted tons per lot, as determined using TABLE 5.

The test section shall be paid for at the contract unit price per each, which price shall include the additional specified equipment, labor, Engineering, and testing time necessary to construct this item.

TABLE 6
TABLE FOR ESTIMATING PERCENTAGE OF LOT WITHIN LIMITS (PWL)
(STANDARD DEVIATION METHOD)
QUALITY INDEX (QL or QU)

PERCENT WITHIN TOLERANCE	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362	2.0656	2.0897
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630	1.8828	1.8989
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420	1.7566	1.7684
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454	1.6566	1.6655
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635	1.5721	1.5790
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4716	1.4829	1.4914	1.4981	1.5035
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265	1.4316	1.4358
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670	1.3709	1.3741
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118	1.3148	1.3172
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602	1.2623	1.2640
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115	1.2129	1.2141
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653	1.1661	1.1660
87	1.0597	1.1100	1.1173	1.1191	1.1199	1.1204	1.1208	1.1212	1.1215	1.1218
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789	1.0788	1.0787
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382	1.0377	1.0374
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990	0.9982	0.9976
83	0.9939	0.9900	0.9785	0.9715	0.9672	0.9643	0.9624	0.9610	0.9599	0.9591
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241	0.9228	0.9219
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882	0.8868	0.8857
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533	0.8517	0.8505

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192	0.8175	0.8161
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858	0.7840	0.7826
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531	0.7513	0.7498
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211	0.7192	0.7177
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896	0.6877	0.6861
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587	0.6567	0.6551
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282	0.6262	0.6247
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982	0.5962	0.5947
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686	0.5667	0.5651
70	0.6787	0.6000	0.5719	0.5583	0.5504	0.5454	0.5419	0.5394	0.5375	0.5360
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105	0.5086	0.5072
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820	0.4802	0.4787
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537	0.4520	0.4506
66	0.5563	0.4800	0.4545	0.4424	0.4354	0.4310	0.4280	0.4257	0.4241	0.4227
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4031	0.4001	0.3980	0.3964	0.3951
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705	0.3690	0.3678
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432	0.3418	0.3407
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161	0.3148	0.3137
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892	0.2880	0.2870
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624	0.2613	0.2604
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358	0.2348	0.2339
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2083	0.2084	0.2076
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829	0.1821	0.1814
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566	0.1559	0.1553
55	0.1806	0.1500	0.1406	0.1353	0.1338	0.1322	0.1312	0.1304	0.1298	0.1293
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1048	0.1042	0.1038	0.1034
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0792	0.0786	0.0781	0.0778	0.0775
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521	0.0518	0.0516
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260	0.0259	0.0258
50	0	0	0	0	0	0	0	0	0	0

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260	-0.0259	-0.0258
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521	-0.0518	-0.0516
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781	-0.0778	-0.0775
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042	-0.1037	-0.1034
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304	-0.1298	-0.1293
44	-0.2164	-0.1800	-0.1688	-0.1637	-0.1607	-0.1588	-0.1575	-0.1566	-0.1559	-0.1553
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829	-0.1821	-0.1814
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093	-0.2084	-0.2076
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358	-0.2348	-0.2339
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624	-0.2613	-0.2604
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892	-0.2880	-0.2870
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161	-0.3148	-0.3137
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432	-0.3418	-0.3407
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705	-0.3690	-0.3678
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980	-0.3964	-0.3951
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4354	-0.4310	-0.4280	-0.4257	-0.4241	-0.4227
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537	-0.4520	-0.4506
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820	-0.4802	-0.4787
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105	-0.5087	-0.5072
30	-0.6787	-0.6000	-0.5719	-0.5583	-0.5504	-0.5454	-0.5419	-0.5394	-0.5375	-0.5360
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686	-0.5667	-0.5651
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982	-0.5962	-0.5947
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282	-0.6262	-0.6217
26	-0.7904	-0.7200	-0.6920	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587	-0.6567	-0.6551
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896	-0.6876	-0.6861
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211	-0.7192	-0.7177
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531	-0.7513	-0.7498
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858	-0.7840	-0.7826
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8246	-0.8214	-0.8192	-0.8174	-0.8161
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533	-0.8517	-0.8565

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882	-0.8868	-0.8057
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241	-0.9228	-0.9219
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610	-0.9599	-0.9591
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990	-0.9982	-0.9976
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382	-1.0377	-1.0374
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789	-1.0788	-1.0787
13	-1.0597	-1.1100	-1.1173	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212	-1.1215	-1.1217
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653	-1.1661	-1.1668
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115	-1.2129	-1.2141
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602	-1.2623	-1.2640
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118	-1.3148	-1.3172
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670	-1.3709	-1.3741
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265	-1.4316	-1.4358
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4716	-1.4829	-1.4914	-1.4981	-1.5035
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635	-1.5721	-1.5790
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5872	-1.6127	-1.6313	-1.6454	-1.6566	-1.6655
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6992	-1.7235	-1.7420	-1.7566	-1.7684
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8054	-1.8379	-1.8630	-1.8828	-1.8989
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362	-2.0657	-2.0897

ITEM 401 BITUMINOUS SURFACE COURSE - SUPERPAVE

(Central Plant Hot Mix)

DESCRIPTION

401-1.1. This work shall consist of a Hot-Mix Asphalt (HMA) surface course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. The term "Hot Mix Asphalt" or "HMA" shall refer to this mixture in various combinations and uses.

Each course shall be constructed to the depth, typical section, or elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course. The Contractor shall be responsible for the Quality Control in the production and construction of the Hot-Mix Asphalt (HMA) surface course. The surface course shall be laid in a maximum of two (2) inch lifts. Thicker lifts not to exceed three (3) inches may be authorized by the Resident Engineer provided a continuous paving operation is maintained.

For all IDOT Division of Aeronautics projects, the production, placement, and acceptance of flexible (HMA) pavements is performed by either Method I or Method II, when indicated. The two Methods are differentiated by the quantity of material placed. Refer to the plans and project Special Provisions for which method is used for each pay item. In all cases, Method I refers to quantities less than 2,500 tons, while Method II refers to quantities greater than or equal to 2,500 tons.

MATERIALS

401-2.1 AGGREGATE. Aggregates shall consist of crushed stone or crushed gravel, blended with crushed or natural sand(s) and/or mineral filler.

Crushed Stone: Crushed stone shall be the angular fragments resulting from crushing by, mechanical means the following types of rocks quarried from undisturbed consolidated deposits: granite and similar phanerocrystalline igneous rocks, limestone, dolomite, massive metamorphic quartzite, or similar rocks. Dolomite shall be a carbonate rock containing 11.0 percent or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0 percent magnesium oxide (MgO).

Crushed Gravel: Crushed gravel shall be the product resulting from crushing, by mechanical means, and shall consist entirely of particles obtained by crushing gravel, all of which before crushing will be retained on a screen with openings equal to or larger than the maximum nominal size of the resulting crushed material. If approved by the Engineer, final product gradations may be obtained by screening or blending various sizes of crushed gravel material.

Mineral Filler: Mineral filler shall consist of dry limestone dust, or other material approved by the Engineer and shall meet the requirements of ASTM D 242.

The portion of the materials retained on the No. 8 sieve shall be known as coarse aggregate, the portion passing the No. 8 sieve and retained on the No. 200 sieve as fine aggregate, and the portion passing the No. 200 sieve as mineral filler.

A. Coarse Aggregate. Coarse aggregate shall consist of sound, tough, durable particles conforming to the following quality requirements:

QUALITY TEST(IDOT B Quality)	PERCENT
Na ₂ SO ₄ Soundness, 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104) Max. % Loss	15
Los Angeles Abrasion, ASTM C 131 Max. % Loss	40

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	2.0
Clay Lumps %	0.5
Soft & Unsound Frag. %	6.0
Other Deleterious %	2.0
<i>Total Deleterious Allowed %</i>	<i>6.0</i>

B. Fine Aggregate. Fine aggregate shall be defined as follows:

1. Sand: Sand shall be the fine granular material resulting from the natural disintegration of rock. Sand produced from deposits simultaneously with and by the same operations as gravel coarse aggregate may contain crushed particles in the quantity resulting normally from the crushing and screening of oversize particles.
2. Stone Sand: Stone sand shall be produced by washing or processing by air separation the fine material resulting from crushing rock quarried from undisturbed consolidated deposits.
3. Slag Sand: Slag sand shall be the graded product resulting from the screening of air cooled blast furnace slag. Air cooled blast furnace slag shall be the nonmetallic product, consisting essentially of silicates and alumino-silicates of lime and other bases, which is developed in a molten condition simultaneously with iron in a blast furnace.
4. Steel Slag Sand: Steel slag sand shall be the graded product resulting from the screening of crushed steel slag. Crushed steel slag shall be the nonmetallic product which is developed in a molten condition simultaneously with steel in an open hearth, basic oxygen or electric furnace.

The fine aggregate shall also conform to the following quality requirements:

QUALITY TEST(IDOT B Quality)	PERCENT
Na ₂ SO ₄ Soundness, 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104) Max. % Loss	15
Minus No. 200 Sieve Material, ASTM C 136 Max. % Loss ^{1/}	6.0 ^{2/}

1/ Fine aggregate shall not contain more than 3 percent clay (2 micron or smaller) particles.

2/ Does not apply to Stone Sand.

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	3.0
Clay Lumps %	3.0
Coal, Lignite & Shells %	3.0
Conglomerate %	3.0
Other Deleterious %	3.0
<i>Total Deleterious Allowed %</i>	<i>5.0</i>

If necessary to obtain the gradation of aggregate blend or workability, natural sand may be used. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification.

- C. Sampling and Testing. All aggregates proposed in the manufacture of the mix will be sampled and tested by the Contractor. ASTM D 75 shall be used in sampling coarse aggregate and fine aggregate, and ASTM C 183 shall be used in sampling mineral filler. The Contractor shall provide the Engineer with aggregate producer (quarry) and Contractor (plant) quality control gradations. No aggregate shall be used in the production of mixture without prior approval.
- D. Sources of Aggregates. All aggregate sources that are approved by the Illinois Department of Transportation, Division of Highways, conforming to the description, gradation and quality specified

herein, shall be permitted for use in the manufacture of the HMA surface course. The supplier of aggregates must participate and meet the requirements of the Illinois Department of Transportation Division of Highways source certification program. The Engineer reserves the right to inspect the source(s) and manufacturing of all aggregates. If satisfactory quality control and production procedures are not being implemented, the Engineer may remove approval of the source(s). Approval of the source(s) of aggregate(s) does not relieve the Contractor in any way of the responsibility for delivery of aggregates to the job site that meet the requirements specified herein.

- E. Samples of Aggregates. All the source(s) of the proposed aggregates for use by the Contractor in the Contractor's proposed HMA design must be approved in writing by the Illinois Division of Aeronautics' Engineer of Construction & Materials prior to use in any design or production of bituminous material.

401-2.2 MINERAL FILLER. If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242.

401-2.3 BITUMINOUS MATERIAL. Performance Graded asphalt PG 64-22 shall be used for all HMA produced unless otherwise specified. When requested, producers shall provide the Engineer with viscosity/temperature relationships for the performance graded asphalt binders delivered and incorporated in the work.

The asphalt binder shall meet the requirements of AASHTO M 320, Table 1 "Standard Specification for Performance Graded Asphalt Binder" for the grade shown on the plans. Elastomers shall be added to the base asphalt binder to achieve the specified performance grade and shall be either a styrene-butadiene diblock or triblock copolymer without oil extension, or a styrene-butadiene rubber. Air blown asphalts, acid modification, and other modifiers will not be allowed. Asphalt modification at hot-mix asphalt plants will not be allowed.

The Contractor shall furnish vendor's certified test reports for each carload or equivalent of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall be the basis for final acceptance.

401-2.4 RESERVED

401-2.5 RESERVED

COMPOSITION

401-3.1 COMPOSITION OF MIXTURE. The HMA shall be composed of a mixture of aggregate, filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula.

401-3.2 JOB MIX FORMULA. The Contractor is responsible for the JMF and no HMA mixture for payment shall be produced until a letter from the Illinois Division of Aeronautics' Engineer of Construction & Materials approving the Contractor's proposed JMF has been issued to the Contractor. The approved JMF shall indicate the definite percentage on each sieve for each aggregate, the percent of bitumen, and the number of gyrations specified for the individual project. The Contractor shall provide all laboratory sampling and testing to the Engineer, upon the completion of the proposed JMF. The exact tests and procedures are outlined in the Illinois Division of Aeronautics (IDOA) latest *Policy Memorandum 2003-1: "Requirements for Laboratory, Testing, Quality Control and Paving of Superpave Bituminous Concrete Mixtures for Airports,"* located at the IDOT internet site.

The job mix formula for each mixture shall be in effect until modified in writing by the Project Engineer. Should a change in sources of materials be made, a new job mix formula shall be established before the new material is used.

The HMA shall be tested according to the Asphalt Institute's most current Superpave Series No. 2 (SP-2) manual entitled, "Superpave Mix Design" and shall meet the criteria set forth in TABLES 1 and 2 herein.

TABLE 1 SUPERPAVE DESIGN CRITERIA

TRAFFIC MIX					
Design Parameter	Aircraft over 60,000 lbs. ^{1/}		Aircraft under 60,000 lbs.		Automobile
	Runway or Taxiway	Parking Apron	Runway or Taxiway	Parking Apron	Entrance roads and Parking Lots
N_{ini} ^{2/}	5	7	5	5	5
N_{des} ^{3/}	40	50	30	30	30
N_{max}	58	74	42	42	42
% Air Voids V_a ^{4/}	2-4	2-4	2-4	2-4	2-4
VFA (min %)	75-90	75-90	75-90	75-90	75-90

- 1/ Stone sand (IDOT Gradation FA20 or FA21) shall be required as part of the fine aggregate portion of the JMF. The exact amount of stone sand will be determined by the Contractor based on preparation of the Mix Design. The percentage of stone sand will be verified as acceptable by the Division of Aeronautics based upon the Contractor's final proposed JMF. The Division reserves the right to request a change in the amount of stone sand at any point in the mix design process, as well as during production, based upon performance of the mix during placement.
- 2/ Where N= number of gyrations on an IDOT approved Superpave gyratory compactor.
- 3/ The N_{des} value may be changed in order to obtain an acceptable mix design when approved by the Engineer.
- 4/ Contact the Division for optimum target voids required.

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory screens, will conform to the gradation or gradations specified in TABLE 2, when tested in accordance with ASTM Standard C 136 (dry sieve only). The percentage by weight for the bituminous material shall be within the limits specified.

TABLE 2. AGGREGATE HMA SURFACE COURSE
Percentage by Weight Passing Sieves
Job Mix Formula (JMF)

Sieve Size	Gradation B Range 3/4" Maximum	Ideal Target
1 in.	100	100
3/4 in.	100	100
1/2 in.	99 – 100	100
3/8 in.	91 – 97	94
No. 4	56 – 62	59
No. 8	36 – 42	39
No. 16	27 – 32	30
No. 30	19 – 25	22
No. 100	7 – 9	8
No. 200	5 – 7	6
Bitumen %:	5.0 – 7.0	6.0

The gradations in TABLE 2 represent the limits which shall determine the suitability of aggregate for use from the sources of supply. The gradation shown in TABLE 2 is such that the maximum size aggregate used shall not be more than one-half of the thickness of the layer of the course being constructed. The aggregate shall have a gradation within the limits designated in TABLE 4 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be uniformly graded from coarse to fine.

The course and fine aggregate gradations specified in the Illinois Division of Highways Specifications for Road and Bridge Construction, current edition, may be blended to meet the job mix formula.

The job mix tolerances shown in TABLE 3 shall be applied to the job mix formula to establish a job control grading band. The tolerances listed in TABLE 3 will only apply when they cause a grading band within the band listed in TABLE 2. Otherwise, the grading bands listed in TABLE 2 shall apply.

TABLE 3. JOB MIX FORMULA TOLERANCES

(Based on a Single Test)

Material	Tolerances Plus or Minus
Aggregate passing No. 4 sieve or larger	7 percent
Aggregate passing Nos. 8 and 16 sieves	5 percent
Aggregate passing Nos. 30 sieve	4 percent
Aggregate passing Nos. 100 and 200 sieves	2 percent
Bitumen	0.45 percent
Temperature of mixing and placing	20 degrees F.

The aggregate gradation may be adjusted within the limits of TABLE 2, as directed, without adjustments in the contract unit prices.

Should a change in sources of materials be made, a new job mix formula shall be established before the new material is used. Deviation from the approved JMF for bitumen content and gradation of aggregates shall not be greater than the tolerances permitted and shall be based on extraction, or calibrated ignition oven test for aggregate gradations and asphalt content. Results falling outside the set tolerances shall be cause for rejection of all the material placed from the time of testing until a passing test is obtained. The applicable ASTM and IDOT tests are outlined in the current IDOA *Policy Memorandum 2003-1: "Requirements for Laboratory, Testing, Quality Control and Paving of Superpave Bituminous Concrete Mixtures for Airports,"* located at the IDOT internet site. These tests shall be performed by Contractor quality control personnel. Split mix samples shall be maintained by the Contractor for random testing by the Engineer.

401-3.3 RESERVED

401-3.4 TEST SECTION. (For Method II only: Over 2,500 tons/pay item) Prior to the manufacture of mix for the test section, Contractor quality control personnel shall have completed all proportioning and testing in accordance with Policy Memorandum 2003-1, to assure that the mix produced will meet the JMF. The Contractor shall then prepare a quantity of HMA surface course in order to construct the test section.

The test section shall have a length of approximately 200 to 300 lineal feet and shall be of the same depth specified for the construction of the course which it represents. The Contractor may place up to 50 tons of mix prior to construction of the test section in order to line-out the plant, the mix, and the paving operation. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented.

A. Construction of the Test Section. The test section shall consist of two parts: Development of a Growth Curve and establishing a Rolling Pattern.

1. Growth Curve

To construct the Growth Curve a self-propelled vibratory roller meeting the following minimum requirements shall be required:

Drum diameter 48 inches, length of drum 66 inches, vibrators 1600 vibrations per minute (VPM) minimum, unit static force on vibrating drum(s) 125 pounds per lineal inch (PLI), total applied force 325 pounds per inch (PLI), adjustable eccentrics, reversible eccentrics on nondriven drum(s). The total applied force for various combinations of VPM and eccentric positions shall be shown on decals on the vibrating roller or on a chart maintained with the roller. The vibratory roller shall be equipped with water tanks and sprinkling devices, or other approved methods, which shall be used when necessary to wet the drum to prevent the HMA mixture from sticking. The Contractor shall have a vibrating reed tachometer (hand type) at the job site for checking roller vibrations. The reed tachometer shall have a range of 1000 to 4000 vibrations per minute (vpm). The vibrating reed tachometer shall have two (2) rows of reeds. One row shall range from 1000 to 2000 vpm and the other row shall range from 2000 to 4000 vpm.

The Growth Curve shall be constructed by successive passes of the vibratory roller, in a given area, in order to determine the maximum compactibility of the mix. The Growth Curve shall be construed under the supervision of the Engineer, or his/her designated representative, who must validate the Growth Curve results before continuing with the remainder of the Test Section. More than one Growth Curve may be required as part of the test section if adjustments to the mix, plant operation, laydown, etc., are necessary to reach optimum compactibility.

2. Rolling Pattern

The Contractor shall then proceed to establish the Rolling Pattern using the equipment that he intends to use for compacting the rest of the HMA course.

B. Test Section Acceptance. The Test Section shall be evaluated and approved based on the following.

1. The completed Test Section (Rolling Pattern area) shall be divided into four (4) subsections with one (1) sample, consisting of two (2) cores, obtained from each subsection for determination of density. One additional core sample shall be obtained from the Growth Curve.
2. The Contractor shall correlate a nuclear density gauge to the Test Section for Quality Control testing. The nuclear density gauge shall not be used for acceptance testing.
3. The completed Test Section (rolling pattern area) shall have a minimum density of 94.0 percent (6.0 percent air voids) of the maximum theoretical specific gravity of the mix (ASTM D 2041). Individual test (average of two cores) results below 94.0% shall constitute a failing test section.
4. If the test section fails to meet these requirements, the Contractor shall construct a new Test Section meeting these requirements at his/her own expense.
5. Full production shall not be allowed until all tests, Reflux extraction or Ignition Oven , Gradation, Gravities of mix, and Core Densities are completed in order to determine compliance with these specifications.
6. The completed Test Section(s) shall be part of the proposed work. When recommended by the Resident Engineer and approved by the Engineer, test sections that do not conform to the specifications shall be removed and replaced at the Contractor's expense.
7. When a Test Section passes, the Test Section tonnage shall be paid 100%.

The mix used in construction of the Test Section shall be paid under Section 401-6.1. Construction of the Test Section shall be paid for separately from the mix, but also in accordance with Section 401-6.1. Payment will be made for only one (1) Test Section.

401-3.5 RESERVED

401-3.6 BITUMINOUS AND AGGREGATE MATERIAL CONTRACTOR'S RESPONSIBILITY.

Samples of the bituminous and aggregate materials that the Contractor proposes to use, together with a statement of their source and character, shall be submitted to the Engineer; approval must be obtained before the use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous and aggregate materials to furnish material subject to this and all other pertinent requirements of the contract. Only those materials that have demonstrated performance under the proposed design requirements will be accepted.

The Engineer or his/her authorized representative shall have access, at all times, to all parts of the paving plant for the purpose of inspecting equipment, conditions and operation of the plant, for verification of weights or proportions and character of materials, and to determine temperatures maintained in the preparation of the mixtures.

The Contractor shall furnish vendor's certified test reports for each carload or equivalent of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of materials received for use on the project.

CONSTRUCTION METHODS

401-4.1 WEATHER LIMITATIONS. The HMA shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in TABLE 4. The temperature requirements may be waived, but only when so directed by the Engineer.

TABLE 4. BASE TEMPERATURE LIMITATIONS

Mat Thickness	Base Temperature (Minimum)	
	°F	°C
3 in. or greater	40	4
Greater than 1 in. but less than 3 in.	45	7
1 in. or less	50	10

No paving shall commence unless the ambient air temperature is 40° F. and rising. Paving shall halt when the ambient air temperature is 45° F. and falling.

401-4.2 HMA PLANT. The Hot-Mix Asphalt (HMA) plant(s) shall conform to the following requirements, or the Engineer may accept the use of a hot-mix plant approved by the IDOT Division of Highways for the manufacture of Class I HMA mixtures in accordance with the current IDOT Standard Specifications for Road and Bridge Construction. When recyclable asphalt pavement is used, the hot-mix plant shall also conform to the additional IDOT plant requirements for hot-mix recycling, although recycled asphalt pavement is not allowed in any surface course mix without written permission from the Division of Aeronautics.

If the supplier is equipped with an automated plant the automation feature shall be used in the production of bituminous material for the project. If the supplier is equipped with a recordation feature, it also shall be used. Sufficient storage space shall be provided for each size of aggregate. The different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the drier. The storage yard shall be neat and orderly, and the separate stockpiles shall be readily accessible for sampling.

Plants used for the preparation of HMA shall conform to all requirements under A., except that scale requirements shall apply only where weight proportioning is used. In addition, batch mixing plants shall conform to the requirements under B., continuous mixing plants shall conform to the requirements under C., and drum mixers shall conform to the requirements under D.

- A. Requirements for All Plants. Mixing plants shall be of sufficient capacity to adequately produce the quantity of HMA for the proposed construction.
1. Plant scales. Scales shall be accurate to 0.5 percent of the required load. Poises shall be designed to be locked in any position to prevent unauthorized change of position. In lieu of plant and truck scales, the Contractor may provide an approved automatic printer system to print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by a weigh ticket for each load. Scales shall be inspected for accuracy and sealed as often as the Resident Engineer may deem necessary. The Contractor shall have on hand not less than ten 50-pound weights for testing the scales.
 2. Equipment for preparation of bituminous material. Tanks for storage of bituminous material shall be capable of heating the material under effective and positive control, at all times, to the temperature requirements specified herein. Heating shall be accomplished by steam coils, electricity, or other means that will allow no direct flames to come in contact with the bituminous material or its fumes. The circulating system for the bituminous material shall be of adequate size to insure proper and continuous circulation between storage tank and mixer

during the entire operating period. Pipelines and fittings shall be steam-jacketed or otherwise properly heated, if required, or insulated to prevent heat loss. The storage tank capacity shall be sufficient for at least a one-day run. Provision shall be made for measuring quantities and for sampling the material in the storage tanks.

3. Feeder for drier. The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier to obtain uniform production and temperature. When added mineral filler is specified, a separate bin and feeder shall be furnished with its drive interlocked with the aggregate feeders
4. Drier. The plant shall include a drier(s) which continuously agitates the aggregate during the heating and drying process.
5. Screens. Plant screens, capable of screening all aggregates to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer, shall be provided.
6. Bins. The plant shall include storage bins of sufficient capacity to supply a mixer operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates. When used, separate dry storage shall be provided for filler of hydrated lime, and the plant shall be equipped to feed such material into the mixer. Each bin shall be provided with overflow pipes of such size and at such location to prevent backup of material into the compartments or bins. Each compartment shall be provided with its individual outlet gate to prevent leakage. The gates shall cut off quickly and completely. Bins shall be constructed so that samples may be obtained readily. Bins shall be equipped with adequate tell-tale devices which indicate the position of the aggregates in the bins at the lower quarter points.

Prior to start of production of any mixture, the Contractor shall furnish the Resident Engineer with calibrations showing the rate of feet of each aggregate for the cold bin or silo in which it is to be used. Change of material or change of cold bin or silo will require new calibrations. The calibrations shall show the rate of feed per minute per unit of opening or setting of feed.

7. Bituminous control unit. Satisfactory means shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified by the job mix formula, either by weighing, metering, or volumetric measurements. Suitable means shall be provided, either by steam-jacketing or other methods of insulation, for maintaining the specified temperature of the bituminous material in the pipelines, meters, weigh buckets, spray bars, and other containers or flow lines. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer.
8. Thermometric equipment. An armored thermometer of adequate range shall be fixed in the bituminous feed line at a suitable location near the discharge valve at the mixer unit. The plant shall be further equipped with either an approved recording dial scale, a mercury-actuated thermometer, an electric recording pyrometer, or other thermometric instruments, so placed at the discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregate. When required by the Engineer, additional thermometric equipment shall be placed at the pug mill to control the temperature of the mixture.
9. Dust collector. The plant shall be equipped with a dust collector to waste or return uniformly to the hot elevator all or any part of the material collected as directed. The plant shall have a mixed cover and such additional housing necessary to the control of dust.
10. Truck scales. Unless an automatic batching plant with automatic printers is used, the HMA mixture shall be weighed on approved scales furnished by the Contractor or on public scales at the Contractor's expense. Scales shall be inspected for accuracy and sealed as often as the Resident Engineer deems necessary.
11. Safety requirements. Adequate and safe stairways to the mixer platform and sampling points shall be provided, and guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required. Accessibility to the top of truck bodies shall be provided by suitable device to enable the Resident Engineer to obtain sampling and mixture

temperature data. Means shall be provided to raise and lower scale calibration equipment, sampling equipment, and other similar equipment between the ground and the mixer platform. All gears, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded. Ample and unobstructed passage shall be maintained at all times in and around the truck loading area.

This area shall be kept free of drippings from the mixing platform. Equipment exposed to steam or other lines carrying high temperatures, so located as to endanger workmen or create a fire hazard, shall be properly guarded or insulated as to prevent inadvertent injurious contact by workmen. Surge bins will not be allowed.

12. Testing laboratory. The Contractor or producer shall provide a testing laboratory, meeting the requirements of Illinois Division of Aeronautics' latest Policy Memorandum 96-2/2003-1, located at the IDOT internet site, for Quality Control and acceptance testing during periods of mix production, sampling, and testing, and whenever materials subject to the provision of these specifications are being supplied or tested. The laboratory shall provide adequate equipment, space, and utilities as required for the performance of the specified tests. All labs must be certified to do Marshall or Superpave mix design and testing, as required by design, having AMRL and AASHTO certification for all equipment.
13. Aggregate stockpiles. In preparation of the mineral aggregates, sufficient storage space shall be provided so that such aggregate size can be kept in separate stockpiles. The stockpile will be constructed in uniform layers by use of a clamshell or other approved methods in such manner as to prevent segregation. The use of bulldozers in stockpiling of aggregates will not be permitted. The storage yard shall be neat and orderly and the separate stockpiles readily accessible for sampling.

B. Requirements for Batching Plants.

1. Weigh box or hopper. The equipment shall include means for weighing each bin size of aggregate in a weigh box or hopper suspended on scales, ample size to hold a full batch without hand raking or running over. The assembly, consisting of the weigh box or hopper and the supporting fulcrums and knife edges, shall be so constructed that no part of the assembly will be easily thrown out of alignment or adjustment. The gates on both the bins and hoppers shall be so constructed as to prevent leakage of aggregate when closed. On manually operated plants, an interlocking device shall be provided that will prevent the opening of more than one gate at a time. On automatic plants, designed for simultaneous weighing of all sizes of aggregate, this provision shall not apply while the plant is operating under automatic control.
2. Bituminous control. The equipment used to measure the bituminous material shall be accurate to within +0.5 percent. The bituminous material bucket shall be of a non-tilting type with a loose sheet metal cover. The length of the discharge opening or spray bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer. The bituminous material bucket, its discharge valve(s), and spray bar shall be adequately heated. Steam jackets, if used, shall be efficiently drained, and all connections shall be so constructed that they will not interfere with the efficient operation of the bituminous scales. The capacity of the bituminous material bucket shall be at least 15 percent in excess of the weight of bituminous material required in any batch. The plant shall have an adequately heated, quick-acting non-drip charging valve located directly over the bituminous material bucket.

The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used per batch. The controls shall be constructed to lock at any dial setting and automatically reset to that reading after each additional batch of bituminous material. The dial shall be in full view of the mixer operator. The flow of bituminous material shall be automatically controlled to begin when the dry mixing period is over. All of the bituminous material required for one batch shall be discharged in not more than 15 seconds after the flow has begun. The size and spacing of the spray-bar openings shall provide a uniform application of bituminous material the full length of the mixer. The section of the bituminous line between the charging valve and the spray bar shall have a valve and outlet for checking the meter when a metering device is substituted for a bituminous material bucket.

3. Mixer. The batch mixer shall be an approved type capable of producing a uniform mixture with well-coated aggregate in the prescribed mixing time within the job mix tolerance specified. If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust. The clearance of blades from all fixed and moving parts shall not exceed 1 inch.
4. Control of mixing time. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. It shall lock the weigh-box gate after the charging of the mixer and keep it locked until the closing of the mixer gate at the completion of the cycle. It shall lock the bituminous material bucket throughout the dry mixing period and shall lock the mixer gate throughout the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh-box gate and the introduction of bituminous material. The wet mixing period is the interval of time between the introduction of bituminous material and the opening of the mixer gate.

The timing control shall be flexible and shall be capable of settings of 5-second intervals or less throughout a 3-minute cycle. A mechanical batch counter shall be installed as a part of the timing device and shall be designed to register only completely mixed batches.

The setting of time intervals shall be at the direction of the Engineer who shall then lock the case covering the timing device until a change is made in the timing periods.

C. Requirements for Continuous Mix Plants.

1. Aggregate proportioning. The plant shall include means for accurately proportioning each size of aggregate.

The plant shall have a feeder mounted under each compartment bin. Each compartment bin shall have an accurately controlled individual gate to form an orifice for the volumetric measuring of material drawn from each compartment. The feeding orifice shall be rectangular with one dimension adjustable by positive mechanical means and provided with a lock.

Indicators shall be provided for each gate to show the respective gate opening in inches.

2. Weight calibration of aggregate feed. The plant shall include a means for calibration of gate openings by weighing test samples. Provision shall be made so that materials fed out of individual orifices may be bypassed to individual test boxes. The plant shall be equipped to conveniently handle individual test samples of not less than 200 pounds. Accurate scales shall be provided by the Contractor to weigh such test samples.
3. Synchronization of aggregate feed and bituminous material feed. A satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of bituminous material from the meter or other proportioning device. This control shall be by interlocking mechanical means or by any other positive method satisfactory to the Engineer.
4. Mixer. The plant shall include an approved continuous mixer adequately heated and capable of producing a uniform mixture within the job mix tolerances. It shall be equipped with a discharge hopper with dump gates to permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and shall be reversible to retard the flow of the mix. The mixer shall have a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge. Charts shall be provided showing the rate of feed per minute for each aggregate used.

D. Requirements for Drum Mixers.

1. Exclusions. Replace the appropriate sections of 401-4.2.A with the following sections that apply only for drum mixers.
2. Aggregate delivery system. An automatic plant shutoff shall be provided to operate when any aggregate bin becomes empty. Provisions shall be provided for conveniently sampling the full flow of materials from each cold feed and the total cold feed. Total cold feed shall be weighed continuously. The weighing system shall have an accuracy of 0.5 percent when tested for

accuracy. The plant shall provide positive weight control of the cold aggregate feed by use of a belt scale, or other appropriate device, which will automatically regulate the feed gate and permit instant correction of variations in load. The cold feed flow shall be automatically coupled with the asphalt flow to maintain the required proportions of each material. Provisions shall be made for introducing the moisture content of the cold feed aggregates into the belt weighing signal and correcting wet aggregate weight to dry aggregate weight. Screens or other suitable devices which will reject oversize particles or lumps of aggregate that have been cemented together shall be installed in the feeder mechanism between the bins and the dryer drum.

Dry weight of the aggregate flow shall be displayed digitally in appropriate units of weight and time and totalized.

3. Bituminous material and additive delivery systems. Satisfactory means of metering shall be provided to introduce the proper amount of bituminous material and additives into the mix. Delivery systems shall prove accurate to plus or minus 1 percent when tested for accuracy. The bituminous material and additive delivery shall be interlocked with the aggregate weight. The bituminous material and additive flow shall be displayed digitally in appropriate units of volume (or weight) and time shall be totalized.
4. Thermometric equipment. A recording thermometer of adequate range shall be located to indicate the temperature of the bituminous material in storage. The plant shall also be equipped with approved recording thermometers, pyrometers, or other approved recording thermometric instruments at the discharge chute of the drum mixer.
5. Drum mixer. A drum mixer of satisfactory design shall be provided. It shall be capable of drying and heating the aggregate to the moisture and temperature requirements set forth in the paving mixture requirements and capable of producing a uniform mixture. If the quality requirements of Section 401-3.2 cannot be met, the Contractor will be required to utilize either batch or continuous mix plants.
6. Temporary storage of HMA mixture. Use of surge bins or storage bins for temporary storage of HMA mixtures will be permitted as follows:
 - a. The HMA mixture may be stored in surge bins for a period of time not to exceed 3 hours.
 - b. The HMA mixture may be stored in insulated and heated storage bins for a period of time not to exceed 12 hours, provided an inert gas atmosphere is maintained in the bin during the storage period.

If the Engineer determines that there is an excessive amount of heat loss, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

- E. Inspection of Plant. The Engineer or his/her authorized representative shall have access, at all times, to all parts of the paving plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking the temperatures maintained in the preparation of the mixtures.

401-4.3 HAULING EQUIPMENT. Trucks used for hauling HMA shall have tight, clean, smooth metal beds. To prevent the mixture from adhering to them, the beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, so that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

All trucks used for hauling HMA shall have a tightly closing tailgate to prevent spilling of material on airfield pavements or entrance roads used for haul roads. Prior to leaving the placing site, the end of the truck beds shall be cleaned of all loose material which may spill onto the pavements and the tail gate shall be secured.

401-4.4 HMA PAVERS. HMA pavers shall be self-contained, power-propelled units with an activated screed capable of vibrating at approximately 3000 VPM or strike-off assembly, heated if necessary, and shall be capable of spreading and finishing courses of HMA plant mix material which will meet the specified thickness, smoothness, and grade. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of HMA plant mix material in widths shown on the plans. All width extensions required to place material shall have the same placement features and equipment functions as provided on the main body of the paver. Augers shall be extended as additional sections of screed are bolted on or automatically adjustable screeds are extended. The augers need not be extended when the screed extensions on either side of the machine are one foot or less and the finished surface of the mat is uniform. The use of any machine obsolete in design or in poor mechanical condition will not be permitted.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be capable of operating at forward speeds consistent with satisfactory laying of the mixture.

An automatic grade control system shall be used to automatically maintain the screed elevation as specified herein.

The controls shall be capable of working in conjunction with any of the following attachments, as specified by the Project Engineer:

- A. Ski-type device of not less than 30 feet in length or as directed by the Engineer.
- B. Taut stringline (wire) set to grade.
- C. Short ski or shoe.

401-4.5 ROLLERS. Rollers may be of the vibratory, steel wheel, or pneumatic-tired type. They shall be in good condition, capable of reversing without backlash, and operating at slow speeds to avoid displacement of the HMA. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density without detrimentally affecting the compacted material.

401-4.6 PREPARATION OF BITUMINOUS MATERIAL. The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. The temperature of the bituminous material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed the applicable maximum temperature set forth in AASHTO M 320 and not be more than 25° F above the temperature of the aggregate as specified in Section 401-4.7.

401-4.7 PREPARATION OF MINERAL AGGREGATE. The aggregate for the mixture shall be dried and heated to the temperature designated by the job formula within the job tolerance specified. Immediately after heating, the surface course aggregate(s) shall be screened into at least three sizes. This requirement does not apply to drum mixer plants. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregates. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

401-4.8 PREPARATION OF HMA. The aggregates and the bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job mix formula.

The combined materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate are secured. Wet mixing time shall be approved by the Engineer for each plant and for each type aggregate used. Normally, the mixing time after introduction of bituminous material should not be less than 30 seconds. For

continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer.

$$\text{Mixing time (seconds)} = \frac{\text{Pugmill dead capacity in pounds}}{\text{Pugmill output in pounds per second}}$$

401-4.9 RESERVED

401-4.10 TRANSPORTING, SPREADING, AND FINISHING. The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Section 401-4.3. Deliveries shall be scheduled so that spreading and rolling of all mixture prepared for one day's run can be completed during daylight, unless adequate artificial lighting is provided. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

Immediately before placing the HMA, the underlying course shall be cleared of all loose or deleterious material with power blowers, power brooms, or hand brooms as directed. A bituminous tack coat shall be applied on all underlying courses, as well as between any subsequent lifts of HMA.

The mix shall be placed at a temperature of not less than 275° F. Moisture content of the mix shall not exceed 0.5 percent.

Upon arrival, the mixture shall be spread to the full width by an approved HMA paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and shall conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the HMA mat. The maximum allowed paver speed is 50 ft/min. Unless otherwise directed, placing shall begin along the centerline of areas to be paved on a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet, except where edge lanes require strips less than 10 feet to complete the area. The longitudinal joint in one layer shall offset that in the layer immediately below by at least 1 foot; however, the joint in the top layer shall be at the centerline of the pavement. Transverse joints in one layer shall be offset by at least 2 feet from transverse joints in the previous layer. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

The first lane of the first lift of the HMA surface course shall be started at the center of the pavement with a taut stringline (guide wire) set to grade at both sides of the paver. The automatic grade control system of the paver shall be used to control grade of both sides of the paver from these reference stringlines. The grade control for the adjacent lanes of pavement shall be maintained by using a matching shoe with the previous laid pavement and a stringline on the outer edge of the next lane. A stringline and matching shoe shall be used to pave all remaining lanes of the first lift of surface course. If grade is established on the first lift, succeeding lifts shall be laid with a traveling ski on both sides of the paver for the center lane with matching shoe and traveling ski on adjacent lanes. If grade is not established on the first lift, the Resident Engineer shall require taut stringline references until satisfactory grade is established.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted by hand tools.

401-4.11 COMPACTION OF MIXTURE. After spreading, the mixture shall be thoroughly and uniformly compacted with power rollers as directed by the Resident Engineer. Rolling of the mixture shall begin as soon after spreading as it will bear the roller without undue displacement or hair checking. On the first strip spread, rolling shall start at the low edge and progress toward the high edge. When adjoining lanes are placed, the same rolling procedure should be followed, but only after compaction of fresh mix at the longitudinal joint with 6 to 8 inches of the vibrating roller width overlapping on the previously compacted lane. Vibratory rollers will be operated so as to obtain a minimum of 10 impacts per foot. If a static roller is being used, 6 to 8 inches should be on the fresh mix at the longitudinal joint with the remainder of the roller width on the previously compacted lane. Rollers operated in static mode shall not exceed 3 mph(264 ft/min).

Initial rolling shall be done longitudinally. The rollers shall overlap on successive trips. Alternate trips of the roller shall be of slightly different lengths, and cross rolling shall not exceed more than one half the width of the pavement on crowned sections. The speed of the roller shall, at all times, be slow to

avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once by rakes and fresh mixture.

A self-propelled pneumatic-tire roller meeting the following requirements shall be required on the top lift of surface course mixture.

The roller shall be of the oscillating wheel type consisting of not less than 7 pneumatic-tired wheels revolving on 2 axles, and capable of being ballasted to the mass (weight) required. The front and rear wheels shall be staggered so that the tire sidewalls will have a minimum overlap of ½ inch. The roller shall provide for a smooth operation when starting, stopping or reversing direction. The tires shall withstand inflation pressures between 60 and 120 psi. The roller shall be equipped with an adequate scraping or cleaning device on each tire to prevent the accumulation of material on the tires. When used for the compaction of HMA, the roller shall be equipped with a water system which will keep all tires uniformly wet to prevent material pickup. The Contractor shall provide means for determining the mass (weight) of the roller as distributed on each wheel. Ballast shall be included in determining the mass (weight). The maximum speed for pneumatic-tired rollers is 3.5 mph(308 ft/min).

Sufficient rollers shall be used to handle the output of the plant. Rolling shall continue until all roller marks are eliminated producing a surface of uniform texture true to grade and cross section.

The Contractor shall provide, at all times, an approved Troxler (or equal) nuclear density gauge with a qualified operator to maintain quality control of the density as specified herein.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers.

Any mixture which becomes loose and broken, mixed with dirt, or in any way defective prior to the application of the finish coat shall be removed and replaced with fresh hot mixture and immediately compacted to conform with the surrounding area. This shall be done at the Contractor's expense.

401-4.12 JOINTS. The formation of all joints shall be made in such a manner as to ensure a continuous bond between old and new sections of the course. All joints shall present the same texture, density, and smoothness as other sections of the course.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. In both methods all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

All longitudinal joints constructed are to be compacted in such a manner that they are "pinched" to provide adequate density at the joint. When laying the HMA adjacent to a previously placed lane, the first pass of the roller shall be along the longitudinal joint on the fresh mixture with the compression wheel not more than 6 in. from the joint. The second pass of the roller shall overlap the longitudinal joint not more than 12 in. on the previously placed lane, after which the rolling shall proceed uniformly. Each stop shall be regulated to prevent trapping of water on the rolled surface. The steel wheeled rollers shall be operated with the compression wheels toward the direction of paving. The Contractor shall cut two cores per 2,500 tons at a random location over the longitudinal construction joint. The cores shall be delivered to the Resident Engineer for density testing and the two results will be used to obtain an average density. This average density at the joint shall be a minimum of 90%.

Density results below an average of 90% shall result in an immediate suspension of paving operations until a sufficient investigation and solution to the density problem is agreed to by the Engineer. The result of this deficiency will be a 5% penalty on all production done on the day the core was taken or represents.

401-4.13 RESERVED

401-4.14 SHAPING EDGES. While the surface is being compacted and finished, the Contractor shall carefully trim the outside edges of the pavement to the proper alignment. Edges so formed shall be beveled while still hot with the back of a rake or a smoothing iron and thoroughly compacted by tampers or by other satisfactory methods.

401-4.15 ACCEPTANCE TESTING OF HMA MIXES FOR DENSITY. (For Method I only: Under 2,500 tons/pay item): After the completion of compaction, the pavement will be tested for acceptance by the Resident Engineer and accepted on the basis of percent air voids in the final compacted mat.

The HMA Surface Course shall be compacted to a minimum density of 93 percent (7 percent air voids) and a maximum of 99 percent (1 percent air voids) of the Maximum Theoretical Specific Gravity (ASTM D 2041). If, during construction, the density test falls below 93 percent, additional approved rollers shall be required. Failure to achieve density within these limits shall be cause for rejection of the material, as determined by the Division of Aeronautics.

Two random nuclear density tests shall be taken for each 500 tons of mix placed. Each nuclear density test shall be the average of five (5) nuclear tests taken as a cross-section of the pavement. One random mix sample shall be taken from each 1,000 tons of mix laid, for Extraction or Ignition Oven, Maximum Specific Gravity and Air Void tests. The Resident Engineer shall have a nuclear gauge and qualified operator on the project when constructing this item.

(For Method II only: Over 2,500 tons/pay item): After the compaction is completed, the pavement will be tested and payment made on the basis of percent air voids in the final compacted mat.

The HMA surface course shall be compacted to a minimum density of 93 percent (7 percent air voids) and a maximum of 99 percent (1 percent air voids) of the maximum theoretical specific gravity (ASTM D 2041) and accepted by the following statistical procedure. When more than one surface course mix design is used on the same project, each mix will be evaluated separately under the statistical acceptance procedure specified herein.

- A. Lot Size. The plant-produced mixture shall be tested on a lot basis. A lot shall consist of 4 sublots. End or final lots may contain between 3 and 6 sublots.

A subplot shall consist of 500 tons for each type of mix.

One density sample shall be taken randomly from each subplot. Each density sample shall be the average of two cores extracted from the sample location.

The Contractor shall take one random mix sample from each 1,000 tons of mix placed. This sample shall be split into two samples with one half tested by the Contractor for Extraction or Ignition oven, Maximum Specific Gravity, Gradation, and Air Void tests. The other sample half shall be appropriately marked and retained by the Contractor until the Engineer requests the mix for testing or directs the Contractor in writing to dispose of the mix.

All tests shall be completed and reported to the Engineer no later than the morning of the day following production.

- B. Lot Early Termination. When less than 3 sublots are produced, such as at the end of construction of the surface course or at the end of the construction season, the final subplot data shall be included with the previous lot for payment. The final lot may thus contain up to six (6) sublots.
- C. Acceptance Criteria. The acceptance of each lot of HMA surface course shall be based on the **P**ercentage of material **W**ithin specification **L**imits (PWL). The PWL is determined using standard statistical techniques and involves the number of tests in each lot (n) and the quality indexes (Q_L is the Quality Index for the lower limit; Q_U is the Quality Index for the upper limit). The quality indexes are calculated using the following formulae:

$$Q_L = \frac{\bar{X} - 1}{S}$$

$$Q_U = \frac{7 - \bar{X}}{S}$$

Where

- Q = Quality Index (lower or upper)
- \bar{X} = Mean (average) value of air voids in percent
- % Air Voids = (100-% density)
- S = Standard Deviation of test results

For mat in-place air voids, estimate the **Percentage Within Tolerance (PWT)** for the lower and upper tolerance limits by entering TABLE 6 with Q_L and Q_U using the column appropriate to the total number (n) of core samples. The total percent of material between the lower and upper limits is defined as the **Percent Within Limits** and is calculated by the following formula:

$$PWL = [PWT(lower) + PWT(upper)] - 100$$

Each lot of bituminous material shall be accepted for 100 percent payment when the PWL equals or exceeds 90 percent. When the PWL is below 90 percent for a given lot, the lot tonnage shall be adjusted in accordance with TABLE 5.

TABLE 5. PAY ADJUSTMENT SCHEDULE ^{1/}

PWL	% ADJUSTMENT IN LOT QUANTITY
90 - 100	100
80 - 89.9	0.5 PWL + 55.0
65 - 79.9	2.0 PWL - 65.0
Below 65	^{2/}

1/ All preliminary calculations used in determining the Percent Within Limits should be rounded to a minimum of four digits right of the decimal point. The PWL that is used for TABLE 5 purposes should then be rounded to one digit right of the decimal point to determine the percent of contract quantity to be paid. The final percent pay figure should be rounded to one digit right of the decimal point. The Resident Engineer shall notify the Contractor, in writing, of the final percent pay for each lot as soon as all lot tests are completed.

2/ The lot shall be removed and replaced. However, the Engineer may decide to accept the deficient lot. In that case, it will be paid for at 50% adjustment.

D. Mix sampling All mix sampling shall be done on a random basis as determined by the Resident Engineer. Samples that are obviously defective or become defective prior to testing shall be discarded and retaken. New samples shall be considered as if they were initial samples.

401-4.16 SURFACE TESTS. Tests for conformity with the specified crown and grade shall be made by the Contractor immediately after initial compression. Any variation shall be corrected by the removal or addition of materials and by continuous rolling.

After the completion of final rolling, the smoothness of the surface course shall be tested with a 16-foot straightedge applied parallel with the centerline. Any humps or depressions exceeding ¼ inch shall be immediately corrected by removing the defective work and replacing with new material, as directed by the Resident Engineer. This shall be done at the Contractor's expense.

The finished surfaces of HMA shall not vary from the gradeline, elevations, and cross sections shown on the contract drawings by more than ½ inch. The Contractor shall correct pavement areas varying in excess of this amount by removing and replacing the defective work. Skin patching will not be permitted.

401-4.17 SAMPLING PAVEMENT. The completed pavement shall be cleaned so that no debris or dirt from coring operations is left on the surface of the pavement. Three (3) cores per lot shall be tested for thickness for any methods used.

(For Method II only: Over 2,500 tons/pay item): Cores from each subplot shall be taken at random locations as outlined by the Resident Engineer. No core samples shall be taken within two feet of the

edge of pavement. Any core less than 1 ½ inch thickness shall not be used and a new location and sample shall be selected.

Core samples of approximately 4 inches in diameter, for determination of in-place air voids of the completed pavement, shall be obtained by the Contractor at no extra expense. The number and locations of the samples shall be as determined by the Resident Engineer. The Contractor shall furnish all tools, labor, and materials for sampling and replacing pavement.

All core tests necessary to determine initial conformance with specification requirements will be performed by the Resident Engineer at no cost to the Contractor.

Resampling and Retesting Resampling of a lot may be allowed only under the following conditions:

- A. The Contractor must request, in writing, the resampling and retesting of a complete lot within 48 hours after receiving the written test results of the lot from the Resident Engineer. Only one retest per lot will be permitted.
- B. If the retested lot should result in a higher "Percent Within Limits" figure than the original, based on all lot samples (original and new) the following will apply:
 1. The cost of resampling and retesting will be borne by the Engineer.
 2. The new "Percent Within Limits" figure shall be calculated using all LOT samples, (original and new) for calculating the lot payment.
- C. If the retested lot should result in a "Percent Within Limits" figure equal to or less than the original, based on all the lot samples (original and new), the following will apply:
 1. The cost of resampling and retesting will be borne by the Contractor.
 2. The new "Percent Within Limits" figure shall be calculated using all lot samples, (original and new) for calculating the lot payment.
- D. Procedures in ASTM E-178 shall be used to determine outliers based on all samples taken and a 5% significance level.
- E. Results of the retesting and resampling shall be final.

METHOD OF MEASUREMENT

401-5.1 HMA surface course will be measured by the ton. The tonnage shall be the weight used in the accepted pavement. No deduction will be made for the weight of bituminous material in the mixture. Plant batch weights will be accepted. Loads shall be checked periodically by weighing full truckloads of the HMA on an approved platform scale at the plant or on a commercial scale.

The Contractor shall furnish approved duplicate load tickets upon which is recorded the net weight of the HMA in each truck. The load ticket shall have sufficient space for signatures, identification of the HMA, date of delivery, and any other data which the Project Engineer may require. The Contractor shall submit one load ticket to the Project Engineer, or his/her duly authorized representative, at the plant after the truck is loaded and another load ticket to the Project Engineer, or his/her duly authorized representative, at the construction site when the truck load is incorporated into the pavement.

Measurement for payment will not be made for any HMA surface course in excess of 103 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.)

BASIS OF PAYMENT

401-6.1 The quantity of HMA surface course measured as outlined in Section 401-5.1 shall be adjusted in accordance with Section 401-4.13 herein. Final payment shall be compensation for

furnishing all materials, for all preparation, mixing, testing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

(For Method I only: Under 2,500 tons/pay item). Payment shall be based upon the acceptance test results for density. Acceptance test results that do not meet the limits set forth in Section 401-4.13 shall be cause for a payment adjustment, or removal and replacement, of the material placed in the failed subplot(s), as determined by the Division.

(For Method II only: Over 2,500 tons/pay item). Payment shall be calculated by multiplying the contract unit price per ton of HMA surface course and the adjusted tons per lot, as determined using TABLE 5.

The test section shall be paid for at the contract unit price per each, which price shall include the additional specified equipment, labor, Engineering, and testing time necessary to construct this item.

TABLE 6
TABLE FOR ESTIMATING PERCENTAGE OF LOT WITHIN LIMITS (PWL)
(STANDARD DEVIATION METHOD)
QUALITY INDEX (Q_L or Q_U)

PERCENT WITHIN TOLERANCE	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362	2.0656	2.0897
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630	1.8828	1.8989
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420	1.7566	1.7684
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454	1.6566	1.6655
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635	1.5721	1.5790
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4716	1.4829	1.4914	1.4981	1.5035
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265	1.4316	1.4358
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670	1.3709	1.3741
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118	1.3148	1.3172
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602	1.2623	1.2640
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115	1.2129	1.2141
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653	1.1661	1.1660
87	1.0597	1.1100	1.1173	1.1191	1.1199	1.1204	1.1208	1.1212	1.1215	1.1218
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789	1.0788	1.0787
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382	1.0377	1.0374
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990	0.9982	0.9976
83	0.9939	0.9900	0.9785	0.9715	0.9672	0.9643	0.9624	0.9610	0.9599	0.9591
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241	0.9228	0.9219
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882	0.8868	0.8857
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533	0.8517	0.8505

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192	0.8175	0.8161
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858	0.7840	0.7826
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531	0.7513	0.7498
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211	0.7192	0.7177
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896	0.6877	0.6861
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587	0.6567	0.6551
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282	0.6262	0.6247
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982	0.5962	0.5947
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686	0.5667	0.5651
70	0.6787	0.6000	0.5719	0.5583	0.5504	0.5454	0.5419	0.5394	0.5375	0.5360
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105	0.5086	0.5072
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820	0.4802	0.4787
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537	0.4520	0.4506
66	0.5563	0.4800	0.4545	0.4424	0.4354	0.4310	0.4280	0.4257	0.4241	0.4227
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4031	0.4001	0.3980	0.3964	0.3951
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705	0.3690	0.3678
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432	0.3418	0.3407
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161	0.3148	0.3137
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892	0.2880	0.2870
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624	0.2613	0.2604
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358	0.2348	0.2339
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2083	0.2084	0.2076
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829	0.1821	0.1814
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566	0.1559	0.1553
55	0.1806	0.1500	0.1406	0.1353	0.1338	0.1322	0.1312	0.1304	0.1298	0.1293
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1048	0.1042	0.1038	0.1034
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0792	0.0786	0.0781	0.0778	0.0775
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521	0.0518	0.0516
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260	0.0259	0.0258
50	0	0	0	0	0	0	0	0	0	0

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260	-0.0259	-0.0258
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521	-0.0518	-0.0516
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781	-0.0778	-0.0775
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042	-0.1037	-0.1034
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304	-0.1298	-0.1293
44	-0.2164	-0.1800	-0.1688	-0.1637	-0.1607	-0.1588	-0.1575	-0.1566	-0.1559	-0.1553
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829	-0.1821	-0.1814
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093	-0.2084	-0.2076
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358	-0.2348	-0.2339
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624	-0.2613	-0.2604
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892	-0.2880	-0.2870
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161	-0.3148	-0.3137
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432	-0.3418	-0.3407
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705	-0.3690	-0.3678
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980	-0.3964	-0.3951
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4354	-0.4310	-0.4280	-0.4257	-0.4241	-0.4227
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537	-0.4520	-0.4506
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820	-0.4802	-0.4787
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105	-0.5087	-0.5072
30	-0.6787	-0.6000	-0.5719	-0.5583	-0.5504	-0.5454	-0.5419	-0.5394	-0.5375	-0.5360
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686	-0.5667	-0.5651
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982	-0.5962	-0.5947
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282	-0.6262	-0.6217
26	-0.7904	-0.7200	-0.6920	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587	-0.6567	-0.6551
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896	-0.6876	-0.6861
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211	-0.7192	-0.7177
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531	-0.7513	-0.7498
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858	-0.7840	-0.7826
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8246	-0.8214	-0.8192	-0.8174	-0.8161
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533	-0.8517	-0.8565

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882	-0.8868	-0.8057
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241	-0.9228	-0.9219
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610	-0.9599	-0.9591
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990	-0.9982	-0.9976
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382	-1.0377	-1.0374
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789	-1.0788	-1.0787
13	-1.0597	-1.1100	-1.1173	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212	-1.1215	-1.1217
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653	-1.1661	-1.1668
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115	-1.2129	-1.2141
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602	-1.2623	-1.2640
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118	-1.3148	-1.3172
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670	-1.3709	-1.3741
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265	-1.4316	-1.4358
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4716	-1.4829	-1.4914	-1.4981	-1.5035
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635	-1.5721	-1.5790
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5872	-1.6127	-1.6313	-1.6454	-1.6566	-1.6655
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6992	-1.7235	-1.7420	-1.7566	-1.7684
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8054	-1.8379	-1.8630	-1.8828	-1.8989
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362	-2.0657	-2.0897

ITEM 401640 BITUMINOUS PAVEMENT GROOVING

DESCRIPTION

401-1.1 GENERAL This item shall consist of constructing a skid resistant surface by providing sawcut grooves in the new bituminous pavement surface.

EQUIPMENT

401-2.1 GROOVING EQUIPMENT The equipment used for grooving shall be power saw cutting equipment, equipped with diamond blades mounted on a multi-blade arbor spaced to groove the runway to the dimensions specified herein, and as shown on the plans.

A cutting head width capable of grooving the runway to the specified tolerances shall be maintained.

The grooving equipment shall be equipped with automatic groove depth control which shall automatically adjust the cutting head and maintain groove depth within the specified tolerances. Sensors for depth control shall be located immediately adjacent to the axis of the cutting head.

The grooving equipment shall be equipped to meet the requirements of this item.

The Contractor shall submit a complete list of grooving equipment to be used on the job for approval by the Resident Engineer before start of the work.

CONSTRUCTION METHODS

401-3.1 CURE TIME Grooving operations shall not be initiated until after the specified cure period.

401-3.2 GROOVE DIMENSIONS Transverse grooves saw-cut in the pavement must form a ¼ inch wide by ¼ inch deep by 1-½ inches center to center configuration. The grooves shall be continuous for the entire length of the pavement. They must be saw-cut transversely in the runway pavement to not less than 10 feet from the runway pavement edge to allow adequate space for equipment operation.

The saw-cut grooves must meet the following tolerances. The tolerances apply to each day's production and to each piece of grooving equipment used for production. The Contractor is responsible for all controls and process adjustments necessary to meet these tolerances.

- A. Alignment tolerance.
Plus or minus 1-½ inches in alignment for 75 feet.
- B. Groove tolerance.
Depth. The standard depth is ¼ inch. At least 90 percent of the grooves must be at least 3/16 inch, at least 60 percent of the grooves must be at least ¼ inch, and not more than 10 percent of the grooves may exceed 5/16 inch.

Width. The standard depth is ¼ inch. At least 90 percent of the grooves must be at least 3/16 inch, at least 60 percent of the grooves must be at least ¼ inch, and not more than 10 percent of the grooves may exceed 5/16 inch.
- C. Center-to-center spacing.
The standard spacing is 1-1/2 inches.
Minimum spacing 1-3/8 inches.
Maximum spacing 1-1/2 inches.

Saw-cut grooves must not be closer than 3 inches or more than 9 inches from transverse paving joints. Grooves must not be closer than 6 inches and no more than 18 inches from in-pavement light fixtures. Grooves may be continued through longitudinal joints.

401-3.3 TEST SECTION Before initiating grooving operations on the runway, the Contractor shall demonstrate the performance of his/her operations and machines on a section of pavement designated

by the Resident Engineer of similar construction to the runway. The Contractor shall have on hand each machine and each operator he proposes to use for runway grooving, and each combination groove a test section approximately 30 feet in width and 60 feet in length. The requirements of these specifications must be met before beginning of grooving of the runway. No payment will be made for this test strip.

401-3.4 REMOVAL OF SLURRY The removal of slurry shall be continuous throughout the grooving operations. The grooving equipment shall be equipped with vacuum slurry pick-up equipment which shall continuously pick up water and sawing dust, and pump the slurry to a collection tank.

Clean-up is extremely important and should be continuous throughout the grooving operation. All grooved areas of the runway shall be flushed with clear water as soon as possible to remove any slurry material not collected by the vacuum pickup. Flushing shall be continued until all pavement surfaces are clean to the satisfaction of the Resident Engineer.

The Contractor shall dispose of the slurry at off of airport property. Waste material must not be allowed to enter the airport storm or sanitary sewer, or any natural or constructed waterways.

Grooving operations will not be permitted when freezing conditions prevent the removal of debris and/or drainage of water from the grooved area.

METHOD OF MEASUREMENT

401-4.1 When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans and the Contractor and the Resident Engineer have agreed in writing by the use of form AER 981 that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the Plans have been altered or when disagreement exists between the Contractor and the Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured as herein specified.

The quantity of bituminous pavement grooving to be paid for shall be the number of square yards of grooving, as specified, completed and accepted.

BASIS OF PAYMENT

401-5.1 Payment will be made at the contract unit price per square yard for Bituminous Pavement Grooving, which shall be full compensation for all materials, including water, labor, equipment, tools, runway cleaning, slurry removal and incidentals necessary to complete the work.

ITEM 401650 BITUMINOUS PAVEMENT MILLING

DESCRIPTION

401-1.1 This work shall consist of removing variable depths of existing bituminous pavement surface, as shown in the plans and as directed by the Resident Engineer.

EQUIPMENT

401-2.1 Equipment used shall be subject to approval by the Engineer and shall comply with the following:

Surface removal equipment shall be a power operated mechanical scarifiers, roto-mill, planing machine, grinder or other device capable of removing the surface to the depth indicated leaving a sound, bondable surface.

The equipment shall be in good working condition free from oil or fuel leaks. Power brooms and sweepers, vacuum sweepers and air compressors shall be in good working condition and shall be used in sufficient numbers or combinations to remove dust and debris from the milled surface.

CONSTRUCTION METHODS

401-3.1 The Contractor shall remove the pavement surface to the limits shown in the plans and as directed by the Resident Engineer. The material removed shall be disposed of off Airport property. The roughened surface shall be free of dirt and loose material prior to subsequent paving. If power brooms or sweepers are used, the surface shall be cleaned with high pressure air to remove dust and debris.

The temperature at which the work is performed, the nature and condition of the equipment and the manner of performing the work shall be such that the milled surface is not torn, gouged, shoved or otherwise injured by the milling operation. Sufficient cutting passes shall be made so that all irregularities or high spots are eliminated to the satisfaction of the Engineer.

METHOD OF MEASUREMENT

401-4.1 The yardage to be paid for shall be the number of square yards of bituminous pavement milling as measured in the field, completed and accepted. Pavement milling required for butt joint construction will not be measured for payment under this item.

BASIS OF PAYMENT

401-5.1 The accepted quantities of bituminous pavement milling will be paid for at the contract unit price per square yard which price and payment shall be full compensation for furnishing all materials, equipment, labor, hauling, and all other incidental items necessary to complete the work to the satisfaction of the Engineer.

ITEM 401655 BUTT JOINT CONSTRUCTION

DESCRIPTION

401-1.1 This work shall consist of removing existing bituminous pavement or PCC pavement surface to a variable depth to construct a butt joint for the transition of the proposed HMA overlay at the locations as shown in the plans.

EQUIPMENT AND MATERIALS

401-2.1 The Contractor may use mill machines or other approved devices for removal of existing bituminous or PCC pavement at the locations and to the depths shown on the plans.

401-2.2 Bituminous tack coat shall conform to Item 603.

CONSTRUCTION METHODS

401-3.1 The Contractor shall construct the butt joint to the dimensions shown on the plans. The material removed shall be disposed of off the airport property by the Contractor. The minimum area for removal is shown on the plans.

The edge of the butt joint shall be sawed to the minimum depth prior to any surface removal as shown on the plans. The joint must be straight and perpendicular to the taxiway, runway or service road centerlines or appropriate baselines.

Before placement of the new bituminous material, the joint surface and vertical edges shall be bituminous tack coated in accordance with Item 603.

METHOD OF MEASUREMENT

401-4.1 The butt joint construction to be paid for shall be measured by the square yard.

BASIS OF PAYMENT

401-5.1 Payment for butt joint construction shall be made at the contract unit price per square yard. This price shall include full compensation for sawing, removal, prime coat, and disposal including furnishing all labor, tools, equipment and incidentals necessary to complete this item of work.

ITEM 401900 REMOVE BITUMINOUS PAVEMENT

DESCRIPTION

401-1.1 This item of work shall consist of removing bituminous pavement structure as described herein.

The Contractor shall remove bituminous pavement of the thickness shown in the plans.

Typical construction details are shown in the plans. Exact locations of bituminous pavement removal shall be determined by the Resident Engineer.

CONSTRUCTION METHODS

401-2.1 The Contractor shall sawcut the existing pavement structure full depth as shown in the plans at locations determined by the Resident Engineer. Sawcutting shall provide a vertical surface.

After completion of sawcutting, the Contractor shall remove the pavement structure using methods which will allow a vertical surface along all sides of the removal area.

Material obtained from removal operations shall be hauled to a disposal site off of airport property by the Contractor. No additional compensation will be made for hauling and disposal of the removed material. Existing aggregate base shall be compacted in accordance with Item 209. Existing subgrade shall be compacted in accordance with Item 152.

Any damage to the existing pavement made by the Contractor beyond the limits shown on the plans shall be removed and replaced by the Contractor at his/her own expense, when identified by the Resident Engineer. These areas shall be saw cut as directed by the Resident Engineer.

METHOD OF MEASUREMENT

401-3.1 The yardage to be paid for shall be the number of square yards of bituminous pavement removal as measured in the field, completed and accepted.

BASIS OF PAYMENT

401-4.1 The accepted quantities of bituminous pavement removal will be paid for at the contract unit price per square yard which price and payment shall be full compensation for furnishing all materials, equipment, labor, hauling, disposal and all other incidental items necessary to complete the work to the satisfaction of the Engineer.

ITEM 402 POROUS FRICTION COURSE

(Central Plant Hot Mix)

DESCRIPTION

402-1.1 This item shall consist of an open-graded, bituminous paving mixture composed of mineral aggregate and bituminous material, mixed in a central mixing plant, and placed on a prepared surface in accordance with these specifications and shall conform to the dimensions shown on the plans.

The porous friction course shall be constructed in one layer, having a compacted nominal thickness as shown on the plans.

No porous friction course shall be constructed until the underlying surface has been cleaned, prepared and accepted by the Resident Engineer.

The Contractor shall be responsible for the quality control in the production and construction of the porous friction course.

MATERIALS

402-2.1 AGGREGATE. Aggregate shall consist of crushed stone blended with natural or manufactured sand and/or mineral filler.

The portion of the materials retained on the No. 8 sieve shall be known as course aggregate the portion passing the No. 8 sieve and retained on the No. 200 sieve as fine aggregate and the portion passing the No. 200 sieve as mineral filler.

A. Coarse aggregate shall consist of sound, tough, durable particles conforming to the following quality requirements:

QUALITY TEST (IDOT B Quality)	PERCENT
Na ₂ SO ₄ Soundness, 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104) Max. % Loss	15
Los Angeles Abrasion, ASTM C 131 Max. % Loss	40

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	2.0
Clay Lumps %	0.5
Soft & Unsound Frag. %	6.0
Other Deleterious %	2.0
<i>Total Deleterious Allowed %</i>	<i>6.0</i>

B. Fine Aggregate shall be defined as follows:

1. Sand: Sand shall be the fine granular material resulting from the natural disintegration of rock. Sand produced from deposits simultaneously with and by the same operations as gravel coarse aggregate may contain crushed particles in the quantity resulting normally from the crushing and screening of oversize particles.
2. Stone Sand: Stone sand shall be produced by washing or processing by air separation the fine material resulting from crushing rock quarried from undisturbed consolidated deposits.
3. Slag Sand: Slag sand shall be the graded product resulting from the screening of air cooled blast furnace slag. Air cooled blast furnace slag shall be the nonmetallic product consisting essentially of silicates and alumino-silicates of lime and other bases, which is developed in a molten condition simultaneously with iron in a blast furnace.
4. Steel Slag Sand: Steel slag sand shall be the graded product resulting from the screening of crushed steel slag. Crushed steel slag shall be the nonmetallic product that is developed in a molten condition simultaneously with steel in an open hearth, basic oxygen, or electric furnace.

The fine aggregate shall also conform to the following quality requirements:

QUALITY TEST (IDOT B Quality)	PERCENT
Na ₂ SO ₄ Soundness 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104), Max. % Loss	15
Minus No. 200 Sieve Material, ASTM C 136, Max. % Loss ^{1/}	6.0 ^{2/}

1/ Fine aggregate shall not contain more than 3 percent clay (2 micron or smaller) particles.

2/ Does not apply to stone sand.

DELETERIOUS TEST (IDOT B Quality)	PERCENT
Materials (Max. % allowed)	
Shale %	3.0
Clay Lumps %	3.0
Coal, Lignite & Shells %	3.0
Conglomerate %	3.0
Other Deleterious %	3.0
Total Deleterious Allowed %	5.0

402-2.2 MINERAL FILLER. Mineral filler shall consist of finely divided mineral matter conforming to the requirements of ASTM D-242. If the crushed stone does not contain sufficient finely divided mineral matter to conform to the grading requirements of TABLE 1, mineral filler shall be batched separately in amounts necessary to make up the deficiency in the amount of material passing the No. 200 sieve.

402-2.3 BITUMINOUS MATERIAL. For airports located North of U.S. Route 36, the bituminous material for the porous friction course shall be polymer modified and shall be SBS PG 70-28. For airports located south of U.S. Route 36, the bituminous material for the porous friction course shall be polymer modified and shall be either SBS PG 70-28 or SBS PG 70-22, at the Contractor's option.

COMPOSITION

402-3.1 COMPOSITION OF MIXTURES. The porous friction course shall be composed of a mixture of aggregate, filler, bituminous material, and antistripping agent (if required). The several aggregate fractions shall be sized, graded, and combined in the proportions that meet the requirements of the job mix formula.

An anti-stripping agent is required for this project. A heat-stable anti-strip additive shall be required in the manufacture of mix used in the construction of the porous friction course. The anti-strip additive shall come from a producer on the Department's latest list of approved bituminous anti-strip additives. The dosage rate shall be 1.0 percent by weight of asphalt cement. The Engineer shall approve the method of adding the anti-strip additive to the mix. No additional compensation shall be allowed to the Contractor as payment for furnishing and using an anti-strip agent.

402-3.2 JOB MIX FORMULA. Work shall not begin nor shall any mixture be accepted until the Contractor has submitted samples of the materials intended for use and the Engineer has established a satisfactory job mix formula for each PFC gradation to be used. The job mix formula for each PFC mixture shall be in effect until modified in writing by the Engineer. No mix shall be placed until the Illinois Division of Aeronautics Engineer of Construction & Materials issues a letter with the approved Job Mix Formula (JMF), based upon data submitted by the Contractor. The JMF for each mixture shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous material to be added to the aggregate and a single temperature for the mixture as it is discharged into the hauling units.

The combined aggregate shall be of such size, that the percentage composition by weight as determined by laboratory sieves, will conform to the gradation shown in TABLE 1, ½ inch maximum, when tested in accordance with ASTM C-136. The maximum mixing temperature shall not exceed 310° F at the time of mixing.

The best asphalt content may fall outside this range depending on the absorptive aggregate at specific gravities. The proper asphalt content shall be determined by trial batches.

The gradation shown in TABLE 1 is based on aggregate showing the same (uniform) specific gravity such that the percent passing each sieve size by weight is equal to the percent passing each sieve size by volume. Should the aggregates proposed for use, when tested by ASTM C-127 or C-128, show nonuniform apparent specific gravities (more than 0.20) between any two or more of the sieve sizes shown in TABLE 1, the Engineer will make appropriate adjustments to the job mix formula to retain the intended particle size distribution of the aggregate (percent passing by volume). Such adjustments to the job mix gradation should result in an aggregate gradation curve (sieve size vs. percent passing by volume) that will, when plotted on semi-logarithmic paper, show a curve of the same general shape as the median curve of the gradation band in TABLE 1. In addition, the "adjusted" gradation curve of the JMF (sieve size vs. percent passing by volume) shall fall within the gradation band of TABLE 1.

TABLE 1. AGGREGATE-POROUS FRICTION COURSE
Percentage by Weight Passing Sieves

Sieve Size	3/4" Maximum Aggregate Size	1/2" Maximum Aggregate Size
3/4 in.	100	---
1/2 in.	70-100	100
3/8 in.	45-75	80-100
No. 4	20-40	20-40
No. 8	12-20	12-20
No. 30	8-14	8-14
No. 200	3-5	3-5
Compacted Thickness	1 in.	3/4 in.
Bitumen %:	5-7 percent by weight of total mix	

The minimum thickness of the layer of the course being constructed shall be 1" when the 3/4" maximum size aggregate is to be used and 5/8" when the 1/2" maximum size aggregate is to be used. During construction the Resident Engineer shall check the minimum thickness on a daily basis.

The job mix tolerances shown in TABLE 2 shall be applied to the JMF to establish a job control grading band. The full tolerances will only apply if application of the job mix tolerances results in a job control grading band inside the master grading band.

TABLE 2. JOB MIX FORMULA TOLERANCES
(Based on a Single Test)

Material	Tolerances Plus or Minus
Aggregate passing No. 4 sieve or larger	7.0 percent
Aggregate passing Nos. 8 and 30 sieves	4.0 percent
Aggregate passing No. 200 sieve	1.0 percent
Bitumen	0.40 percent
Temperature of mix	20 degrees F.

If a change is made in any component of the HMA, a new JMF shall be established and approved by the Engineer before any additional material on the project is produced and placed. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

402-3.3 TEST SECTIONS. The Contractor shall schedule plant production on the first day of paving in order that a test section can be constructed. The test section shall be approximately 1000 feet in length and at least 12.5 feet in width. If mix production or mix laydown problems occur, the Contractor shall make corrective adjustments and may not continue paving past the limits of the strip until such corrective adjustments are made. Upon approval of the Engineer, the Contractor may continue paving past the limits of the test section. All preparation materials and construction methods shall be identical to those to be used on the remainder of the runway surface, and as specified in these Special Provisions and the construction plans. No separate payment will be made for construction of the test section, but will be paid for in accordance with section 402-6.1.

CONSTRUCTION METHODS

402-4.1 WEATHER AND SEASONAL LIMITATIONS. The porous friction course shall be constructed on a dry surface when the atmospheric temperature has been 60° F and rising two days before and is 60° F and rising on the day of placement. In addition, the weather cannot be foggy or rainy and the wind conditions must be less than or equal to 15 mph on the day of paving.

402-4.2 HMA PLANT. The Hot-Mix Asphalt (HMA) plant(s) shall conform to the following requirements, or the Engineer may accept the use of a hot-mix plant approved by the IDOT Division of Highways for the manufacture of Class I HMA, in accordance with the current IDOT Standard Specifications for Road and Bridge Construction. Recycled asphalt pavement will not be allowed in the production of Porous Friction Course.

The HMA plant shall include all facilities or equipment necessary to produce the HMA. The mix shall be delivered, in place, within 60 minutes after final mixing. Storage in surge bins or silos will not be allowed.

If the supplier is equipped with an automated plant the automation feature shall be used in the production of bituminous material for the project. If the supplier is equipped with a recordation feature, it also shall be used. Sufficient storage space shall be provided for each size of aggregate. The different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the drier. The storage yard shall be neat and orderly, and the separate stockpiles shall be readily accessible for sampling.

Plants used for the preparation of HMA shall conform to all requirements under A., except that scale requirements shall apply only where weight proportioning is used. In addition, batch mixing plants shall conform to the requirements under B., continuous mixing plants shall conform to the requirements under C., and drum mixers shall conform to the requirements under D.

- A. Requirements for All Plants. Mixing plants shall be of sufficient capacity to adequately produce the quantity of HMA for the proposed construction.
1. Plant scales. Scales shall be accurate to 0.5 percent of the required load. Poises shall be designed to be locked in any position to prevent unauthorized change of position. In lieu of plant scales, the Contractor may provide an approved automatic printer system to print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by a weigh ticket for each load. Scales shall be inspected for accuracy and sealed as often as the Engineer may deem necessary. The Contractor shall have on hand no less than ten 50-pound weights for testing the scales.
 2. Equipment for preparation of bituminous material. Tanks for storage of bituminous material shall be capable of heating the material under effective and positive control, at all times, to the temperature requirements specified herein. Heating shall be accomplished by steam coils, electricity, or other means that will allow no direct flames to come in contact with the bituminous material or its fumes. The circulating system for the bituminous material shall be of adequate size to insure proper and continuous circulation between storage tank and mixer during the entire operating period. Pipelines and fittings shall be steam-jacketed or otherwise properly heated, if required, or insulated to prevent heat loss. The storage tank capacity shall be sufficient for at least a one-day run. Provision shall be made for measuring quantities and for sampling the material in the storage tanks.
 3. Feeder for drier. The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier to obtain uniform production and temperature. When added mineral filler is specified, a separate bin and feeder shall be furnished with its drive interlocked with the aggregate feeders.
 4. Drier. The plant shall include a drier(s) which continuously agitates the aggregate during the heating and drying process.

5. Screens. Plant screens, capable of screening all aggregates to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer, shall be provided.
6. Bins. The plant shall include storage bins of sufficient capacity to supply a mixer operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates. When used, separate dry storage shall be provided for filler of hydrated lime, and the plant shall be equipped to feed such material into the mixer. Each bin shall be provided with overflow pipes of such size and at such location to prevent backup of material into the compartments or bins. Each compartment shall be provided with its individual outlet gate to prevent leakage. The gates shall cut off quickly and completely. Bins shall be constructed so that samples may be obtained readily. Bins shall be equipped with adequate tell-tale devices which indicate the position of the aggregates in the bins at the lower quarter points.

Prior to start of production of any mixture, the Contractor shall furnish the Resident Engineer with calibrations showing the rate of feet of each aggregate for the cold bin or silo in which it is to be used. Change of material or change of cold bin or silo will require new calibrations. The calibrations shall show the rate of feed per minute per unit of opening or setting of feed.

7. Bituminous control unit. Satisfactory means shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified by the job mix formula, either by weighing, metering, or volumetric measurements. Suitable means shall be provided, either by steam-jacketing or other methods of insulation, for maintaining the specified temperature of the bituminous material in the pipelines, meters, weigh buckets, spray bars, and other containers or flow lines. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer.
8. Thermometric equipment. An armored thermometer of adequate range shall be fixed in the bituminous feed line at a suitable location near the discharge valve at the mixer unit. The plant shall be further equipped with either an approved recording dial scale, a mercury-actuated thermometer, an electric recording pyrometer, or other thermometric instruments, so placed at the discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregate. When required by the Engineer, additional thermometric equipment shall be placed at the pug mill to control the temperature of the mixture.
9. Dust collector. The plant shall be equipped with a dust collector to waste or return uniformly to the hot elevator all or any part of the material collected as directed. The plant shall have a mixed cover and such additional housing necessary to the control of dust.
10. Truck scales. Unless an automatic batching plant with automatic printers is used, the HMA mixture shall be weighed on approved scales furnished by the Contractor or on public scales at the Contractor's expense. Scales shall be inspected for accuracy and sealed as often as the Resident Engineer deems necessary.
11. Safety requirements. Adequate and safe stairways to the mixer platform and sampling points shall be provided. Guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required. Accessibility to the top of truck bodies shall be provided by a suitable device to enable the Engineer to obtain mixture samples and temperature data. Means shall be provided to raise and lower calibration equipment, sampling equipment, and other similar equipment between the ground and the mixer platform. All belts, gears, pulleys, chains, sprockets, projecting setscrews, keys and other dangerous moving parts shall be guarded to prevent inadvertent contact by workmen or other moving equipment. Ample and unobstructed passage shall be maintained at all times in and around the truck-loading area.

This area shall be kept free of drippings from the mixing platform. Equipment exposed to steam or other lines carrying high temperatures, so located as to endanger workmen or create a fire hazard, shall be properly guarded or insulated as to prevent inadvertent injurious contact by workmen. Surge bins will not be allowed.

12. Testing laboratory. The Contractor or producer shall provide a testing laboratory, meeting the requirements of Illinois Division of Aeronautics' latest Policy Memorandum 96-2/2003-1, located at the IDOT internet site, for Quality Control and acceptance testing during periods of mix production, sampling, and testing, and whenever materials subject to the provision of these specifications are being supplied or tested. The laboratory shall provide adequate equipment, space, and utilities as required for the performance of the specified tests. All labs must be AMRL and AASHTO certified for all equipment.
13. Aggregate stockpiles. In preparation of the mineral aggregates, sufficient storage space shall be provided so that such aggregate size can be kept in separate stockpiles. The stockpile will be constructed in uniform layers by use of a clamshell or other approved methods in such manner as to prevent segregation. The use of bulldozers in stockpiling of aggregates will not be permitted. The storage yard shall be neat and orderly and the separate stockpiles readily accessible for sampling.

B. Requirements for Batching Plants.

1. Weigh box or hopper. The equipment shall include means for weighing each bin size of aggregate in a weigh box or hopper suspended on scales, ample size to hold a full batch without hand raking or running over. The assembly, consisting of the weigh box or hopper and the supporting fulcrums and knife edges, shall be so constructed that no part of the assembly will be easily thrown out of alignment or adjustment. The gates on both the bins and hoppers shall be so constructed as to prevent leakage of aggregate when closed. On manually operated plants, an interlocking device shall be provided that will prevent the opening of more than one gate at a time. On automatic plants, designed for simultaneous weighing of all sizes of aggregate, this provision shall not apply while the plant is operating under automatic control.
2. Bituminous control. The equipment used to measure the bituminous material shall be accurate to within plus or minus 0.5 percent. The bituminous material bucket shall be of a non-tilting type with a loose sheet metal cover. The length of the discharge opening of the spray-bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer. The bituminous material bucket, its discharge valve(s), and the spray-bar shall be adequately heated. Steam jackets, if used, shall be efficiently drained, and all connections shall be constructed so that they will not interfere with the efficient operation of the bituminous scales. The capacity of the bituminous material bucket shall be at least 15 percent of the weight of bituminous material required in any batch. The plant shall have an adequately heated, quick-acting, non-drip charging valve located directly over the bituminous material bucket.

The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used per batch. The controls shall be constructed to lock at any dial setting and automatically reset to that reading after each additional batch of bituminous material. The dial shall be in full view of the mixer operator. The flow of bituminous material shall be automatically controlled to begin when the dry mixing period is over. All of the bituminous material required for one batch shall be discharged in not more than 15 seconds after the flow has begun. The size and spacing of the spray-bar openings shall provide a uniform application of bituminous material the full length of the mixer. The section of the bituminous line between the charging valve and the spray-bar shall have a valve and an outlet for checking the meter when a metering device is substituted for a bituminous material bucket.

3. Mixer. The batch mixer shall be an approved type capable of producing a uniform mixture with well-coated aggregate in the prescribed mixing time within the job mix tolerance specified. If not enclosed, the mixer box shall be equipped with a hood to prevent loss of dust. The clearance of blades from all fixed and moving parts shall not exceed 1 inch.
4. Control of mixing time. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. It shall lock the weigh-box gate after the charging of the mixer and keep it locked until the closing of the mixer gate at the completion of the cycle. It shall lock the bucket throughout the dry mixing period and shall lock the mixer gate throughout the dry and wet mixing periods. The dry mixing period is the time interval between the opening of the weigh-box gate and the introduction of bituminous material. The wet mixing period is the

time interval between the introduction of the bituminous material and the opening of the mixer gate.

The timing control shall be flexible and shall be capable of settings at 5-second intervals or less throughout a 3-minute cycle. A mechanical batch counter shall be installed as a part of the timing device and shall be designed to register only completely mixed batches.

The setting of time intervals shall be at the direction of the Engineer who shall then lock the case covering the timing device until a change is made in the timing periods.

C. Requirements for Continuous Mix Plants.

1. Aggregate proportioning. The plant shall include means for accurately proportioning each size of aggregate.

The plant shall have a feeder mounted under each compartment bin. Each compartment bin shall have an accurately controlled individual gate to form an orifice for the volumetric measuring of material drawn from each compartment. The feeding orifice shall be rectangular with one dimension adjustable by positive mechanical means and provided with a lock.

Indicators shall be provided for each gate to show the respective gate opening in inches.

2. Weight calibration of aggregate feed. The plant shall include a means for calibration of gate openings by weighing test samples. Provision shall be made so that materials fed out of individual orifices may be bypassed to individual test boxes. The plant shall be equipped to conveniently handle individual test samples of not less than 200 pounds. Accurate scales shall be provided by the Contractor to weigh such test samples.
3. Synchronization of aggregate feed and bituminous material feed. A satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of bituminous material from the meter or other proportioning device. This control shall be by interlocking mechanical means or by any other positive method satisfactory to the Engineer.
4. Mixer. The plant shall include an approved continuous mixer adequately heated and capable of producing a uniform mixture within the job mix tolerances. It shall be equipped with a discharge hopper with dump gates to permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and shall be reversible to retard the flow of the mix. The mixer shall have a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge. Charts shall be provided showing the rate of feed per minute for each aggregate used.

D. Requirements for Drum Mixers.

1. Exclusions. Replace the appropriate sections of 402-4.2.A with the following sections that apply only for drum mixers.
2. Aggregate delivery system. An automatic plant shutoff shall be provided to operate when any aggregate bin becomes empty. Provisions shall be provided for conveniently sampling the full flow of materials from each cold feed and the total cold feed. Total cold feed shall be weighed continuously. The weighing system shall have an accuracy of 0.5 percent when tested for accuracy. The plant shall provide positive weight control of the cold aggregate feed by use of a belt scale, or other appropriate device, which will automatically regulate the feed gate and permit instant correction of variations in load. The cold feed flow shall be automatically coupled with the asphalt flow to maintain the required proportions of each material. Provisions shall be made for introducing the moisture content of the cold feed aggregates into the belt weighing signal and correcting wet aggregate weight to dry aggregate weight. Screens or other suitable devices which will reject oversize particles or lumps of aggregate that have been cemented together shall be installed in the feeder mechanism between the bins and the dryer drum.

Dry weight of the aggregate flow shall be displayed digitally in appropriate units of weight and time and totalized.

3. Bituminous material and additive delivery systems. Satisfactory means of metering shall be provided to introduce the proper amount of bituminous material and additives into the mix. Delivery systems shall prove accurate to plus or minus 1 percent when tested for accuracy. The bituminous material and additive delivery shall be interlocked with the aggregate weight. The bituminous material and additive flow shall be displayed digitally in appropriate units of volume (or weight) and time shall be totalized.
 4. Thermometric equipment. A recording thermometer of adequate range shall be located to indicate the temperature of the bituminous material in storage. The plant shall also be equipped with approved recording thermometers, pyrometers, or other approved recording thermometric instruments at the discharge chute of the drum mixer.
 5. Drum mixer. A drum mixer of satisfactory design shall be provided. It shall be capable of drying and heating the aggregate to the moisture and temperature requirements set forth in the paving mixture requirements and capable of producing a uniform mixture. If the quality requirements of Section 402-3.2 cannot be met, the Contractor will be required to utilize either batch or continuous mix plants.
 6. Temporary storage of HMA mixture. Use of surge bins or storage bins for temporary storage of Porous Friction Course will not be allowed.
- E. Inspection of Plant. The Engineer or his/her authorized representative shall have access, at all times, to all parts of the paving plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking the temperatures maintained in the preparation of the mixtures.

402-4.3 HAULING EQUIPMENT. Trucks used for hauling HMA shall have tight, clean, smooth beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of concentrated hydrated lime and water solution. The truck beds shall be raised to drain any excess solution before loading the mixture in the trucks. Each truck shall have a suitable cover to protect the mixture from adverse weather or long hauls. All trucks shall be insulated sufficiently to maintain the mixture at the specified temperature during hauling. The tarps shall be used at all times when transporting the PFC.

402-4.4 HMA PAVERS. HMA pavers shall be self-contained, power-propelled units with an activated screed or strike-off assembly, heated if necessary, and shall be capable of spreading and finishing courses of HMA which will meet the specified thickness, smoothness, and grade.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. The screed or strike-off assembly shall produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be capable of operating at forward speeds consistent with satisfactory laying of the mixture.

If an automatic grade control device is used, the paver shall be equipped with a control system capable of automatically maintaining the screed elevation as specified herein. The control system shall be automatically actuated from either a reference line or a surface through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The paver speed shall not exceed 35 feet per minute. Only electronic grade control for both the horizontal and transverse control of grade shall be used on this project. The use of 30 foot long (minimum) paving skis and matching shoes are required.

402-4.5 ROLLERS. A minimum of two (2) self propelled steel-wheel rollers shall be furnished. They shall be in good condition, capable of reversing without backlash, and of operating at slow speeds to avoid displacement of the HMA. The wheels shall be equipped with adjustable scrapers, water tanks

and a sprinkling apparatus to prevent the HMA from sticking to the wheels. If approved by the Engineer, the Contractor may add a small amount of detergent to the roller's water tanks to alleviate roller pick up. The weight of each roller shall be between 6 and 10 tons. When approved by the Engineer, vibratory rollers may be used in the static mode. The use of equipment, which results in crushing of the aggregate, will not be permitted. The Resident Engineer in compliance with these Special Provisions must approve all rollers at least one (1) day prior to paving.

402-4.6 PREPARATION OF MINERAL AGGREGATE. The aggregate for the mixture shall be dried and heated at the central mixing plant before entering the mixer. When introduced into the mixer, the combined aggregate moisture content (weighted according to the composition of the blend) shall be less than 0.25 percent for aggregate blends with water absorption of 2.5 percent or less and less than 0.50 percent for aggregate blends with water absorption greater than 2.5 percent. Water absorption of aggregates shall be determined by ASTM C 127 and ASTM C 128. The water absorption for the aggregate blend shall be the weighted average of the absorption values for the coarse aggregate retained on the No. 4 sieve and the fine aggregate passing the No. 4 sieve. The water content test will be conducted in accordance with ASTM C 566. In no case shall the moisture content be such that foaming of the mixture occurs prior to placement. At the time of mixing, the temperature of the aggregate shall be within the range specified in the job mix formula. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. Particular care shall be taken so that aggregates high in calcium or magnesium content are not damaged by overheating. The aggregate shall be screened to specified sizes and conveyed in separate bins ready for mixing with bituminous material.

The use of frozen aggregates or frozen aggregate stockpiles is prohibited. Frozen aggregates or frozen stockpiles must be thawed and/or double dried to reduce the combined aggregate moisture content to at or below 0.5 percent.

402-4.7 PREPARATION OF HMA. The HMA shall be prepared in a central mixing plant. The porous friction course shall be prepared at the temperature designated by the Engineer; the mixture shall not exceed 310° F at the time of mixing.

The dry aggregate shall be combined in the plant in the proportionate amounts of each aggregate size required to meet the specified gradation. The quantity of aggregate for each batch shall be determined, measured, and conveyed into the mixer. In case of volumetric proportioning, the size of the openings shall be determined, and the gates shall be locked in position.

The quantity of bituminous material for each batch shall be determined by the Engineer. It shall be measured by weight and introduced into the mixer within the temperature range specified in the job mix formula. For batch mixers, all aggregates shall be in the mixer before the bituminous material is added. In no case shall the temperature of the aggregate be more than 25° F above the temperature of the bituminous material when adding the bituminous material. As determined by the Engineer, the mixing shall continue until all particles are coated uniformly. In no case shall the HMA be stored in storage silos or surge bins.

402-4.8 TRANSPORTATION AND DELIVERY OF THE MIXTURE. The mixture shall be transported from the central mixing plant to the paving site in trucks described in 402-4.3. The time interval between mixing and laydown shall not be more than ninety (90) minutes. The PFC mixture shall be placed at a temperature range of 275-300° F. This is only a recommended range. The Contractor is responsible for the final outcome of the mix; therefore, the temperature may need to be changed in order to yield an acceptable mat. Delivery of mixture to the spreader shall be scheduled so that spreading and rolling occur in a continuous manner. Intermittent production or stopping and starting of the pavers will be cause for suspension of work.

402-4.9 SPREADING AND LAYING.

A. Preparation of Existing Surfaces. The existing pavement surface will be tacked in accordance with Item 603. The Engineer will set the exact rate. The pavement shall be cleared of all loose or deleterious material with brooms or blowers before the tack coat is placed. No PFC shall be placed until the bituminous tack coat has cured for the cure time listed in Table 1 under Item 603.

- B. Placing. Hauling over material already placed shall not be permitted until the material has been thoroughly compacted as specified and allowed to cool overnight and develop its stability for a period of at least 24 hours. No traffic or hauling will be allowed on the newly laid PFC during extremely hot temperatures or when marking or displacement of the porous friction course is observed. The maximum paver speed is 35 ft/min

402-4.10 COMPACTION OF MIXTURE. After spreading, the mixture shall be thoroughly and uniformly compacted with power rollers. Rolling of the mixture shall begin as soon after spreading as it will bear the roller without undue displacement or hair-checking. Rolling shall be initiated with the drive wheel toward the paving machine. The sequence of rolling the first paving lane should be to first roll the lower edge (with reference to the transverse slope) of the lane and then to roll the upper edge. The interior of the lane should then be rolled from the lower side toward the upper edge with overlapping roller paths. On adjoining paving lanes, rolling shall begin by overlapping the joint (with the previous lane) by 6 to 9 inches and then rolling the outside edge of the new lane. The interior should be rolled from the outside edge toward the compacted joint with overlapping wheel paths. Alternate trips of the roller shall be of slightly different lengths. No more than a total of three passes by the rollers will be required. The optimum weight of the rollers and the rolling pattern shall be determined during the test section construction. The number and type of rollers will be as specified in section 402-4.5.

The speed of the roller shall be slow enough to avoid displacement of the HMA. The maximum roller speed is 264 ft/min. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once by raking and applying fresh mixture.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until all roller marks are eliminated and the surface is of uniform texture and conforms to the required cross section.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers.

Any mixture which becomes loose and broken, mixed with dirt or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work will be done at the Contractor's expense. Skin patching and hand working of the PFC mixture will not be allowed.

402-4.11 JOINTS. The formation of all joints shall be made in such a manner as to ensure a continuous bond between old and new sections of the course. All joints shall present the same texture, density, and smoothness as other sections of the course.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose vertical face. In both methods all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint. The longitudinal joint shall offset that in the existing course by at least 1 foot.

Longitudinal joints will be butt joints and no lapping of pavements will be allowed.

402-4.12 SHAPING EDGES. While the surface is being compacted and finished, the Contractor shall carefully shape the longitudinal outside edges of the PFC to a vertical face at the established edge. When transitioning from PFC to existing pavement, transverse edges shall be constructed with a finer graded HMA.

402-4.13 SURFACE TESTS. After completion of the final rolling, the finished surface shall be tested with a 16-foot straightedge and shall not vary more than 1/4 inch. The 16-foot straightedge shall be applied parallel with and at right angles to the runway centerline in a pattern that includes longitudinal

and transverse joints. The 16-foot straightedge shall be advanced approximately half its length in the line of measurement.

Areas of the porous friction course exceeding the specified tolerances shall be corrected at the Contractor's expense by removing the defective work and replacing it with new material. Skin patching or hand working will not be permitted.

402-4.14 SAMPLING PFC MIXTURE AND HOT BINS. Samples of the PFC mixture shall be taken at the point of discharge in hauling units and tested to control uniformity in the bituminous content and gradation. Sampling procedures, sample sizes, and sampling frequency shall be done in accordance with the tables listed in Appendix B of the Illinois Division Aeronautics latest edition of Policy Memorandum 96-2, "Requirements for Laboratory, Testing, Quality Control, and Paving of Bituminous Concrete Mixtures," located at the IDOT internet site

Should the bituminous content of the duplicate tests agree within 0.50 percent, the average results shall be recorded. Variations greater than 0.50 percent between duplicate tests of the same sample shall also be recorded and duplicate tests on an additional sample shall be run. The average value of the bituminous content should fall within the tolerance of the job mix formula as specified in paragraph 402-3.2. Should the average bituminous content for four samples not fall within the job mix tolerances, the Resident Engineer may order the Contractor to cease production until such out-of-tolerance conditions have been remedied by the Contractor. The gradation of the residual aggregate should be determined by using ASTM D 2172 and compared to the approved job mix formula.

The samples of PFC mixture will be used to control the uniformity of the Contractor's plant production. In addition, the Contractor shall clearly mark each hauling unit from which the representative samples have been taken so that the same mixture sample may be located in the completed pavement.

Completed PFC shall be determined "acceptable" or "unacceptable" on the basis of visual inspection by the Engineer. The Resident Engineer shall immediately notify the Contractor of visual defects such as nonuniform texture, roller marks, bleeding of bituminous material, cracking and shoving of the mixture, and evidence of aggregate crushing during the roller operations, or nonconformance to the surface smoothness criteria as specified in paragraph 402-4.13.

"Unacceptable" PFC shall be removed, leaving a vertical face at the remaining PFC. The underlying surface shall be cleaned and a tack coat applied prior to replacing the PFC. All work shall be at the Contractor's expense. Unacceptable PFC shall not be measured for payment.

In addition to sampling and testing the PFC mixture, the Contractor shall sample each hot bin twice daily and furnish a gradation analysis of each hot bin according to ASTM C 136. The combined gradation analysis of the hot bins shall fall within the job mix formula tolerances. Should the hot bin gradation analysis fail to meet the tolerances of the job mix formula (on the same sieve size), the Resident Engineer may order another analysis in addition to the two analyses required each day to confirm the results of the previous tests or tell the Contractor to cease plant production until such out-of-tolerance conditions have been corrected.

402-4.15 BITUMINOUS AND AGGREGATE MATERIAL (CONTRACTOR'S RESPONSIBILITY).

Samples of the bituminous and aggregate materials that the Contractor proposes to use, together with a statement of their source and character, shall be submitted for approval prior to use. The Contractor shall require the manufacturer or producer of the bituminous and aggregate materials to furnish material subject to this and all other pertinent requirements of the contract. Only those materials which have been tested and approved for the intended use shall be acceptable.

The Engineer or the Engineer's authorized representative shall have access, at all times, to all parts of the paving plant to inspect the equipment, the conditions, and the operation of the plant; to verify the weights or proportions and character of materials; and to determine the temperatures maintained in the storage of the bituminous material and preparation of the mixtures.

The Contractor shall furnish the vendor's certified test reports for each carload or equivalent of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted to use the material. The vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All test reports shall be subject to verification by testing sample materials received for use on the project.

402-4.16 PROTECTION OF PAVEMENT. After final rolling, no vehicle traffic of any kind shall be permitted on the pavement until it has cooled and cured at least 24 hours. The Contractor may, with the approval of the Resident Engineer, water the pavement in order to cool it.

METHOD OF MEASUREMENT

402-5.1 MEASUREMENT OF POROUS FRICTION COURSE. Porous friction course shall be measured as the number of square yards of pavement in place. Only the areas of porous friction course meeting the following thickness requirements shall be measured for payment:

The compacted thickness of the porous friction course will be measured in place at random locations for each 3,000 square yards of pavement. Minimum acceptable thickness of porous friction course is as shown in the table below. When a random in place measurement is less than the minimum acceptable thickness, additional thickness measurements will be taken at necessary intervals until the porous friction course is within the limits. All areas that are determined to be less than the thickness shown in the table below shall be removed and replaced at the Contractor's expense.

PAY ITEM	MINIMUM THICKNESS
Item AR402620 -- Porous Friction Course 5/8"	½ inches
Item AR402621 -- Porous Friction Course, 1"	¾ inches
Item AR402622 -- Porous Friction Course, 0.10'	1 inch

BASIS OF PAYMENT

402-6.1 Payment shall be made at the contract price per square yard of Porous Friction Course. The price shall be full compensation for furnishing all materials, for all preparation and storage of materials, for cleaning the underlying surface, for mixing, hauling, placing and compaction of the mixtures, and for all tools, equipment and incidentals necessary to complete the item. No separate payment will be made for furnishing and batching mineral filler, antistripping agents, or additional bituminous material, should such items be required.

ITEM 403 BITUMINOUS BASE COURSE

(Central Plant Hot Mix)

DESCRIPTION

403-1.1. This work shall consist of a Hot-Mix Asphalt (HMA) base course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. The term "Hot Mix Asphalt" or "HMA" shall refer to this mixture in various combinations and uses.

Each course shall be constructed to the depth, typical section, or elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course. The Contractor shall be responsible for the Quality Control in the production and construction of the HMA (Hot Mix Asphalt) base course. The HMA base course shall be laid in a maximum of two (2) inch lifts. Thicker lifts not to exceed three (3) inches may be authorized by the Resident Engineer provided a continuous paving operation is maintained.

For all IDOT Division of Aeronautics projects, the production, placement, and acceptance of flexible (HMA) pavements is performed by either Method I or Method II, when indicated. The two Methods are differentiated by the quantity of material placed. Refer to the plans and project Special Provisions for which method is used for each pay item. In all cases, Method I refers to quantities less than 2,500 tons, while Method II refers to quantities greater than or equal to 2,500 tons.

MATERIALS

403-2.1 AGGREGATE. Aggregates shall consist of crushed stone or crushed gravel, or recyclable asphalt pavement (RAP), blended with crushed or natural sand(s) and/or mineral filler.

Crushed Stone: Crushed stone shall be the angular fragments resulting from crushing by, mechanical means the following types of rocks quarried from undisturbed consolidated deposits: granite and similar phanerocrystalline igneous rocks, limestone, dolomite, massive metamorphic quartzite, or similar rocks. Dolomite shall be a carbonate rock containing 11.0 percent or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0 percent magnesium oxide (MgO).

Crushed Gravel: Crushed gravel shall be the product resulting from crushing, by mechanical means, and shall consist entirely of particles obtained by crushing gravel, all of which before crushing will be retained on a screen with openings equal to or larger than the maximum nominal size of the resulting crushed material. If approved by the Engineer, final product gradations may be obtained by screening or blending various sizes of crushed gravel material.

Recyclable Asphalt Pavement (RAP): Recyclable asphalt pavement shall be defined as the product resulting from milling and/or crushing of bituminous pavement composed of aggregates and asphalt that originally met the quality requirements as stated herein. The Contractor shall furnish evidence satisfactory to the Division and the FAA that the material met the specified quality requirements.

Mineral Filler: Mineral filler shall consist of dry limestone dust, or other material approved by the Engineer and shall meet the requirements of ASTM D 242.

The portion of the materials retained on the No. 8 sieve shall be known as coarse aggregate, the portion passing the No. 8 sieve and retained on the No. 200 sieve as fine aggregate, and the portion passing the No. 200 sieve as mineral filler.

A. Coarse Aggregate. Coarse aggregate shall consist of sound, tough, durable particles conforming to the following quality requirements:

QUALITY TEST (IDOT C Quality)	PERCENT
Na ₂ SO ₄ Soundness 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104), Max. % Loss	20
Los Angeles Abrasion, ASTM C 131, Max. % Loss	45

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	4.0
Clay Lumps %	0.5
Soft & Unsound Frag. %	8.0
Other Deleterious %	2.0
<i>Total Deleterious Allowed %</i>	<i>10.0</i>

B. Fine Aggregate. Fine aggregate shall be defined as follows:

1. Sand: Sand shall be the fine granular material resulting from the natural disintegration of rock. Sand produced from deposits simultaneously with and by the same operations as gravel coarse aggregate may contain crushed particles in the quantity resulting normally from the crushing and screening of oversize particles.
2. Stone Sand: Stone sand shall be produced by washing or processing by air separation the fine material resulting from crushing rock quarried from undisturbed consolidated deposits.
3. Slag Sand: Slag sand shall be the graded product resulting from the screening of air cooled blast furnace slag. Air cooled blast furnace slag shall be the nonmetallic product, consisting essentially of silicates and alumino-silicates of lime and other bases, which is developed in a molten condition simultaneously with iron in a blast furnace.
4. Steel Slag Sand: Steel slag sand shall be the graded product resulting from the screening of crushed steel slag. Crushed steel slag shall be the nonmetallic product which is developed in a molten condition simultaneously with steel in an open hearth, basic oxygen or electric furnace.

The fine aggregate shall also conform to the following quality requirements:

QUALITY TEST (IDOT B Quality)	PERCENT
Na ₂ SO ₄ Soundness 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104), Max. % Loss	15
Minus No. 200 Sieve Mat'l., ASTM C 136, Max. % Loss ^{1/}	6.0 ^{2/}

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	3.0
Clay Lumps %	3.0
Coal, Lignite & Shells %	3.0
Conglomerate %	3.0
Other Deleterious %	3.0
<i>Total Deleterious Allowed %</i>	<i>5.0</i>

1/ Fine aggregate shall not contain more than three percent clay (2 micron or smaller) particles as determined by Illinois Modified AASHTO T 88.

2/ Does not apply to Stone Sand.

If necessary to obtain the gradation of aggregate blend or workability, natural sand may be used. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification.

C. Sampling and Testing. All aggregates proposed in the manufacture of the mix will be sampled and tested by the Contractor. ASTM D 75 shall be used in sampling coarse aggregate and fine

aggregate, and ASTM C 183 shall be used in sampling mineral filler. The Contractor shall provide the Engineer with aggregate producer (quarry) and Contractor (plant) quality control gradations. No aggregate shall be used in the production of mixture without prior approval.

- D. Sources of Aggregates. All aggregate sources that are approved by the Illinois Department of Transportation, Division of Highways, conforming to the description, gradation and quality specified herein, shall be permitted for use in the manufacture of the HMA base course. The supplier of aggregates must participate and meet the requirements of the Illinois Department of Transportation Division of Highways Source Certification Program (AGCS). The Engineer reserves the right to inspect the source(s) and manufacturing of all aggregates. If satisfactory quality control and production procedures are not being implemented, the Engineer may remove approval of the source(s). Approval of the source(s) of aggregate(s) does not relieve the Contractor in any way of the responsibility for delivery to the job site aggregates that meet the requirements specified herein.
- E. Samples of Aggregates. All the source(s) of the proposed aggregates for use by the Contractor in the Contractor's proposed HMA design must be approved in writing by the I.D.A. Engineer of Construction & Materials prior to use in any design or production of bituminous material.

403-2.2 FILLER. If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242.

403-2.3 BITUMINOUS MATERIAL. Performance Graded asphalt PG 64-22 shall be used for all HMA produced unless otherwise specified. When requested, producers shall provide the Engineer with viscosity/temperature relationships for the performance graded asphalt binders delivered and incorporated in the work.

The asphalt binder shall meet the requirements of AASHTO M 320, Table 1 "Standard Specification for Performance Graded Asphalt Binder" for the grade shown on the plans. Elastomers shall be added to the base asphalt binder to achieve the specified performance grade and shall be either a styrene-butadiene diblock or triblock copolymer without oil extension, or a styrene-butadiene rubber. Air blown asphalts, acid modification, and other modifiers will not be allowed. Asphalt modification at hot-mix asphalt plants will not be allowed.

The Contractor shall furnish vendor's certified test reports for each carload or equivalent of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall be the basis for final acceptance.

COMPOSITION

403-3.1 COMPOSITION OF MIXTURE. The HMA shall be composed of a mixture of aggregate, filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula.

403-3.2 JOB MIX FORMULA. The Contractor is responsible for the job mix formula (JMF) and no HMA mixture for payment shall be produced until a letter from the Illinois Division of Aeronautics' Engineer of Construction & Materials approving the Contractor's proposed JMF has been issued to the Contractor. The approved JMF shall indicate the definite percentage on each sieve for each aggregate, the percent of bitumen, and the number of Marshall blows specified for the individual project. The Contractor shall provide all laboratory sampling and testing to the Engineer upon the completion of the proposed JMF. The exact tests and procedures are outlined in the Illinois Division of Aeronautics (IDOA) latest *Policy Memorandum 96-2: "Requirements for Laboratory, Testing, Quality Control and Paving of Bituminous Concrete Mixtures,"* located on the IDOT website.

The job mix formula for each mixture shall be in effect until modified in writing by the Project Engineer. Should a change in sources of materials be made, a new job mix formula shall be established before the new material is used.

The HMA shall be tested according to the Asphalt Institute, 'Marshall Method of Mix Design', in the current Manual MS-2, *Mix Design Method for Asphalt Concrete*, and shall meet the criteria set forth in TABLES 1 and 2 herein.

TABLE 1. MARSHALL DESIGN CRITERIA

Properties	Over 60,000 lb ^{1/}	Under 60,000 lb
Number of Blows	75	50
Stability (Min.)	1800	1500
Flow	8-16	8-18
Percent Air Voids ^{2/}	1.5 – 4.0	1.5 – 3.5
Voids filled with asphalt (%)	75-90	75-90

- 1/ Stone sand (IDOT Gradation FA20 or FA21) shall be required as part of the fine aggregate portion of the JMF. The exact amount of stone sand will be determined by the Contractor based on preparation of the Mix Design. The percentage of stone sand will be verified as acceptable by the Division of Aeronautics based upon the Contractor's final proposed JMF. The Division reserves the right to request a change in the amount of stone sand at any point in the mix design process, as well as during production, based upon performance of the mix during placement.
- 2/ Contact the Division for optimum target voids required.

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory screens, will conform to the gradation or gradations specified in TABLE 2, when tested in accordance with ASTM Standard C 136 (dry sieve only). The percentage by weight for the bituminous material shall be within the limits specified.

TABLE 2. AGGREGATE HMA BASE COURSE
 Percentage by Weight Passing Sieves
 Job Mix Formula (JMF)

Sieve Size	Gradation B Range ¹ Maximum	Ideal Target
1-1/4 in		
1 in	100	100
3/4 in	93 – 97	95
1/2 in.	75 – 79	77
3/8 in.	64 – 68	66
No. 4	45 – 51	48
No. 8	34 – 40	37
No. 16	27 – 33	30
No. 30	19 – 23	21
No. 100	6 – 10	8
No. 200	4 – 6	5
Bitumen %	4.5 – 7.0	5.5

The gradation in TABLE 2 represents the limits which shall determine the suitability of aggregate for use from the sources of supply. The aggregate, as finally selected, shall have a gradation within the limits designated in TABLE 2 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be uniformly graded from coarse to fine. When approved by the Engineer, the Contractor may add up to 25 percent of recyclable asphalt pavement to meet the required gradations, provided he can produce a consistent mixture meeting the mix design, temperature, and density requirements specified herein.

The course and fine aggregate gradations specified in the Illinois Division of Highways Specifications for Road and Bridge Construction, current edition, may be blended to meet the job mix formula.

The job mix tolerances shown in TABLE 3 shall be applied to the job mix formula to establish a job control grading band. The tolerances listed in TABLE 3 will only apply when they cause a grading band within the band listed in TABLE 2. Otherwise, the grading bands listed in TABLE 2 shall apply.

TABLE 3 JOB MIX FORMULA TOLERANCES
(Based on a Single Test)

<u>Material</u>	<u>Tolerances (+/-)</u>
Aggregate passing No. 4 sieve or larger	7 percent
Aggregate passing No. 8 and No. 16 sieves	5 percent
Aggregate passing No. 30 sieve	4 percent
Aggregate passing No. 100 and No. 200 sieves	2 percent
Bitumen	0.45 percent
Temperature of mixing and placing	20 degrees F

The aggregate gradation may be adjusted within the limits of TABLE 2, as directed, without adjustments in the contract unit prices.

Should a change in sources of materials be made, a new job mix formula shall be established before the new material is used. Deviation from the approved JMF for bitumen content and gradation of aggregates shall not be greater than the tolerances permitted and shall be based on extraction, or calibrated ignition oven test for aggregate gradations and asphalt content. Results falling outside the set tolerances shall be cause for rejection of all the material placed from the time of testing until a passing test is obtained. The applicable ASTM and IDOT tests are outlined in the current IDOA *Policy Memorandum 96-2: "Requirements for Laboratory, Testing, Quality Control and Paving of Bituminous Concrete Mixtures,"* located on the IDOT website. These tests shall be performed by Contractor quality control personnel. Split mix samples shall be maintained by the Contractor for random testing by the Engineer.

403-3.3 BITUMINOUS AND AGGREGATE MATERIAL CONTRACTOR'S RESPONSIBILITY.

Samples of the bituminous and aggregate materials that the Contractor proposes to use, together with a statement of their source and character, shall be submitted to the Engineer; approval must be obtained before the use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous and aggregate materials to furnish material subject to this and all other pertinent requirements of the contract. Only those materials that have demonstrated performance under the proposed design requirements will be accepted.

The Engineer or his/her authorized representative shall have access, at all times, to all parts of the paving plant for the purpose of inspecting equipment, conditions and operation of the plant, for verification of weights or proportions and character of materials, and to determine temperatures maintained in the preparation of the mixtures.

The Contractor shall furnish vendor's certified test reports for each carload or equivalent of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of materials received for use on the project.

403-3.4 TEST SECTION. (For Method II only: Over 2,500 tons/pay item) Prior to the manufacture of mix for the test section, Contractor quality control personnel shall have completed all proportioning and testing in accordance with Policy Memorandum 96-2, to assure that the mix produced will meet the JMF. The Contractor shall then prepare a quantity of HMA base course in order to construct the test section.

The test section shall have a length of approximately 200 to 300 lineal feet and shall be of the same depth specified for the construction of the course which it represents. The Contractor may place up to 50 tons of mix prior to construction of the test section in order to line-out the plant, the mix, and the paving operation. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented.

- A. Construction of the Test Section. The test section shall consist of two parts: Development of a Growth Curve and establishing a Rolling Pattern.

1. Growth Curve

To construct the Growth Curve a self-propelled vibratory roller meeting the following minimum requirements shall be required:

Drum diameter 48 inches, length of drum 66 inches, vibrators 1600 vibrations per minute (VPM) minimum, unit static force on vibrating drum(s) 125 pounds per lineal inch (PLI), total applied force 325 pounds per lineal inch (PLI), adjustable eccentrics, reversible eccentrics on non-driven drum(s). The total applied force for various combinations of VPM and eccentric positions shall be shown on decals on the vibrating roller or on a chart maintained with the roller. The vibratory roller shall be equipped with water tanks and sprinkling devices, or other approved methods, which shall be used when necessary to wet the drum to prevent the HMA from sticking.

The Contractor shall have a vibrating reed tachometer (hand type) at the job site for checking roller vibrations. The reed tachometer shall have a range of 1000 to 4000 vibrations per minute (VPM). The vibrating reed tachometer shall have two (2) rows of reeds. One row shall range from 1000 to 2000 VPM and the other row shall range from 2000 to 4000 VPM.

The Growth Curve shall be constructed by successive passes of the vibratory roller, in a given area, in order to determine the maximum compactibility of the mix. The Growth Curve shall be done under the supervision of the Engineer, or his/her designated representative, who must validate the Growth Curve results before continuing with the remainder of the Test Section. More than one Growth Curve may be required as part of the test section if adjustments to the mix, plant operation, laydown, etc., are necessary to reach optimum compactibility.

2. Rolling Pattern

The Contractor shall then proceed to establish the Rolling Pattern using the equipment that he intends to use for the compaction of the rest of the HMA course.

B. Test Section Acceptance. The Test Section shall be evaluated and approved based on the following.

1. The completed Test Section (Rolling Pattern area) shall be divided into four (4) subsections with one (1) sample consisting of two (2) cores obtained from each subsection for determination of density. One additional core sample shall be obtained from the Growth Curve.
2. The Contractor shall correlate a nuclear density gauge to the Test Section for Quality Control testing. The nuclear density gauge shall not be used for acceptance testing.
3. The completed Test Section (rolling pattern area) shall have a minimum density of 94.0 percent (6.0 percent air voids) of the maximum theoretical specific gravity of the mix (ASTM D 2041). Individual test results (average of two cores) below 94.0% shall constitute a failing test section.
4. If the test section fails to meet these requirements, the Contractor shall construct a new Test Section meeting these requirements at his/her own expense.
5. Full production shall not be allowed until all tests, Reflux extraction or Ignition Oven, Gradation, Marshall Stability and Flow, Gravities of mix, and Core Densities are completed in order to determine compliance with these specifications.
6. The completed Test Section(s) shall be part of the proposed work. When recommended by the Resident Engineer and approved by the Engineer, test sections that do not conform to the specifications shall be removed and replaced at the Contractor's expense.
7. When a Test Section passes, the Test Section tonnage shall be paid 100%.

The mix used in construction of the Test Section shall be paid for under Section 403-6.1. Construction of the Test Section shall be paid for separately from the mix, but also in accordance with Section 403-6.1. Payment will be made for only one (1) Test Section.

CONSTRUCTION METHODS

403-4.1 WEATHER LIMITATIONS. The HMA shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in TABLE 4. The temperature requirements may be waived, but only when so directed by the Engineer.

TABLE 4. BASE TEMPERATURE LIMITATIONS

Mat Thickness	Base Temperature (Minimum)	
3 in. or greater	40 degrees F	4 degrees C
Greater than 1 in. but less than 3 in.	45 degrees F	7 degrees C
1 in. or less	50 degrees F	10 degrees C

No paving shall commence unless the ambient air temperature is 40° F. and rising. Paving shall halt when the ambient air temperature is 45° F. and falling.

403-4.2 HMA PLANT. The Hot-Mix Asphalt (HMA) plant(s) shall conform to the following requirements, or the Engineer may accept the use of a hot-mix plant approved by the IDOT Division of Highways for the manufacture of Class I HMA mixtures in accordance with the current IDOT Standard Specifications for Road and Bridge Construction. When recyclable asphalt pavement is used, the hot-mix plant shall also conform to the additional IDOT plant requirements for hot-mix recycling.

If the supplier is equipped with an automated plant the automation feature shall be used in the production of bituminous material for the project. If the supplier is equipped with a recordation feature, it also shall be used. Sufficient storage space shall be provided for each size of aggregate. The different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the drier. The storage yard shall be neat and orderly, and the separate stockpiles shall be readily accessible for sampling.

Plants used for the preparation of HMA shall conform to all requirements under A., except that scale requirements shall apply only where weight proportioning is used. In addition, batch mixing plants shall conform to the requirements under B., continuous mixing plants shall conform to the requirements under C., and drum mixers shall conform to the requirements under D.

- A. Requirements for All Plants. Mixing plants shall be of sufficient capacity to adequately produce the quantity of HMA for the proposed construction.
1. Plant scales. Scales shall be accurate to 0.5 percent of the required load. Poises shall be designed to be locked in any position to prevent unauthorized change of position. In lieu of plant and truck scales, the Contractor may provide an approved automatic printer system to print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by a weigh ticket for each load. Scales shall be inspected for accuracy and sealed as often as the Resident Engineer may deem necessary. The Contractor shall have on hand not less than ten 50-pound weights for testing the scales.
 2. Equipment for preparation of bituminous material. Tanks for storage of bituminous material shall be capable of heating the material under effective and positive control, at all times, to the temperature requirements specified herein. Heating shall be accomplished by steam coils, electricity, or other means that will allow no direct flames to come in contact with the bituminous material or its fumes. The circulating system for the bituminous material shall be of adequate size to insure proper and continuous circulation between storage tank and mixer during the entire operating period. Pipelines and fittings shall be steam-jacketed or otherwise properly heated, if required, or insulated to prevent heat loss. The storage tank capacity shall be sufficient for at least a one-day run. Provision shall be made for measuring quantities and for sampling the material in the storage tanks.

3. Feeder for drier. The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier to obtain uniform production and temperature. When added mineral filler is specified, a separate bin and feeder shall be furnished with its drive interlocked with the aggregate feeders.
4. Drier. The plant shall include a drier(s) which continuously agitates the aggregate during the heating and drying process.
5. Screens. Plant screens, capable of screening all aggregates to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer, shall be provided.
6. Bins. The plant shall include storage bins of sufficient capacity to supply a mixer operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates. When used, separate dry storage shall be provided for filler of hydrated lime, and the plant shall be equipped to feed such material into the mixer. Each bin shall be provided with overflow pipes of such size and at such location to prevent backup of material into the compartments or bins. Each compartment shall be provided with its individual outlet gate to prevent leakage. The gates shall cut off quickly and completely. Bins shall be constructed so that samples may be obtained readily. Bins shall be equipped with adequate tell-tale devices which indicate the position of the aggregates in the bins at the lower quarter points.

Prior to start of production of any mixture, the Contractor shall furnish the Resident Engineer with calibrations showing the rate of feet of each aggregate for the cold bin or silo in which it is to be used. Change of material or change of cold bin or silo will require new calibrations. The calibrations shall show the rate of feed per minute per unit of opening or setting of feed.

7. Bituminous control unit. Satisfactory means shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified by the job mix formula, either by weighing, metering, or volumetric measurements. Suitable means shall be provided, either by steam-jacketing or other methods of insulation, for maintaining the specified temperature of the bituminous material in the pipelines, meters, weigh buckets, spray bars, and other containers or flow lines. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer.
8. Thermometric equipment. An armored thermometer of adequate range shall be fixed in the bituminous feed line at a suitable location near the discharge valve at the mixer unit. The plant shall be further equipped with either an approved recording dial scale, a mercury-actuated thermometer, an electric recording pyrometer, or other thermometric instruments, so placed at the discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregate. When required by the Engineer, additional thermometric equipment shall be placed at the pug mill to control the temperature of the mixture.
9. Dust collector. The plant shall be equipped with a dust collector to waste or return uniformly to the hot elevator all or any part of the material collected as directed. The plant shall have a mixed cover and such additional housing necessary to the control of dust.
10. Truck scales. Unless an automatic batching plant with automatic printers is used, the HMA mixture shall be weighed on approved scales furnished by the Contractor or on public scales at the Contractor's expense. Scales shall be inspected for accuracy and sealed as often as the Resident Engineer deems necessary.
11. Safety requirements. Adequate and safe stairways to the mixer platform and sampling points shall be provided, and guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required. Accessibility to the top of truck bodies shall be provided by suitable device to enable the Resident Engineer to obtain sampling and mixture temperature data. Means shall be provided to raise and lower scale calibration equipment, sampling equipment, and other similar equipment between the ground and the mixer platform. All gears, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded. Ample and unobstructed passage shall be maintained at all times in and around the truck loading area.

This area shall be kept free of drippings from the mixing platform. Equipment exposed to steam or other lines carrying high temperatures, so located as to endanger workmen or create a fire hazard, shall be properly guarded or insulated as to prevent inadvertent injurious contact by workmen. Surge bins will not be allowed.

12. Testing laboratory. The Contractor or producer shall provide a testing laboratory, meeting the requirements of Illinois Division of Aeronautics' latest Policy Memorandum 96-2/2003-1, located at the IDOT internet site, for Quality Control and acceptance testing during periods of mix production, sampling, and testing, and whenever materials subject to the provision of these specifications are being supplied or tested. The laboratory shall provide adequate equipment, space, and utilities as required for the performance of the specified tests. All labs must be certified to do Marshall or Superpave mix design and testing, as required by design, having AMRL and AASHTO certification for all equipment.
13. Aggregate stockpiles. In preparation of the mineral aggregates, sufficient storage space shall be provided so that such aggregate size can be kept in separate stockpiles. The stockpile will be constructed in uniform layers by use of a clamshell or other approved methods in such manner as to prevent segregation. The use of bulldozers in stockpiling of aggregates will not be permitted. The storage yard shall be neat and orderly and the separate stockpiles readily accessible for sampling.

B. Requirements for Batching Plants.

1. Weigh box or hopper. The equipment shall include means for weighing each bin size of aggregate in a weigh box or hopper suspended on scales, ample size to hold a full batch without hand raking or running over. The assembly, consisting of the weigh box or hopper and the supporting fulcrums and knife edges, shall be so constructed that no part of the assembly will be easily thrown out of alignment or adjustment. The gates on both the bins and hoppers shall be so constructed as to prevent leakage of aggregate when closed. On manually operated plants, an interlocking device shall be provided that will prevent the opening of more than one gate at a time. On automatic plants, designed for simultaneous weighing of all sizes of aggregate, this provision shall not apply while the plant is operating under automatic control.
2. Bituminous control. The equipment used to measure the bituminous material shall be accurate to within +0.5 percent. The bituminous material bucket shall be of a non-tilting type with a loose sheet metal cover. The length of the discharge opening or spray bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer. The bituminous material bucket, its discharge valve(s), and spray bar shall be adequately heated. Steam jackets, if used, shall be efficiently drained, and all connections shall be so constructed that they will not interfere with the efficient operation of the bituminous scales. The capacity of the bituminous material bucket shall be at least 15 percent in excess of the weight of bituminous material required in any batch. The plant shall have an adequately heated, quick-acting non-drip charging valve located directly over the bituminous material bucket.

The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used per batch. The controls shall be constructed to lock at any dial setting and automatically reset to that reading after each additional batch of bituminous material. The dial shall be in full view of the mixer operator. The flow of bituminous material shall be automatically controlled to begin when the dry mixing period is over. All of the bituminous material required for one batch shall be discharged in not more than 15 seconds after the flow has begun. The size and spacing of the spray-bar openings shall provide a uniform application of bituminous material the full length of the mixer. The section of the bituminous line between the charging valve and the spray bar shall have a valve and outlet for checking the meter when a metering device is substituted for a bituminous material bucket.

3. Mixer. The batch mixer shall be an approved type capable of producing a uniform mixture with well-coated aggregate in the prescribed mixing time within the job mix tolerance specified. If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust. The clearance of blades from all fixed and moving parts shall not exceed 1 inch.

4. Control of mixing time. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. It shall lock the weigh-box gate after the charging of the mixer and keep it locked until the closing of the mixer gate at the completion of the cycle. It shall lock the bituminous material bucket throughout the dry mixing period and shall lock the mixer gate throughout the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh-box gate and the introduction of bituminous material. The wet mixing period is the interval of time between the introduction of bituminous material and the opening of the mixer gate.

The timing control shall be flexible and shall be capable of settings of 5-second intervals or less throughout a 3-minute cycle. A mechanical batch counter shall be installed as a part of the timing device and shall be designed to register only completely mixed batches.

The setting of time intervals shall be at the direction of the Engineer who shall then lock the case covering the timing device until a change is made in the timing periods.

C. Requirements for Continuous Mix Plants.

1. Aggregate proportioning. The plant shall include means for accurately proportioning each size of aggregate.

The plant shall have a feeder mounted under each compartment bin. Each compartment bin shall have an accurately controlled individual gate to form an orifice for the volumetric measuring of material drawn from each compartment. The feeding orifice shall be rectangular with one dimension adjustable by positive mechanical means and provided with a lock.

Indicators shall be provided for each gate to show the respective gate opening in inches.

2. Weight calibration of aggregate feed. The plant shall include a means for calibration of gate openings by weighing test samples. Provision shall be made so that materials fed out of individual orifices may be bypassed to individual test boxes. The plant shall be equipped to conveniently handle individual test samples of not less than 200 pounds. Accurate scales shall be provided by the Contractor to weigh such test samples.
3. Synchronization of aggregate feed and bituminous material feed. A satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of bituminous material from the meter or other proportioning device. This control shall be by interlocking mechanical means or by any other positive method satisfactory to the Engineer.
4. Mixer. The plant shall include an approved continuous mixer adequately heated and capable of producing a uniform mixture within the job mix tolerances. It shall be equipped with a discharge hopper with dump gates to permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and shall be reversible to retard the flow of the mix. The mixer shall have a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge. Charts shall be provided showing the rate of feed per minute for each aggregate used.

D. Requirements for Drum Mixers.

1. Exclusions. Replace the appropriate sections of 403-4.2.A with the following sections that apply only for drum mixers.
2. Aggregate delivery system. An automatic plant shutoff shall be provided to operate when any aggregate bin becomes empty. Provisions shall be provided for conveniently sampling the full flow of materials from each cold feed and the total cold feed. Total cold feed shall be weighed continuously. The weighing system shall have an accuracy of 0.5 percent when tested for accuracy. The plant shall provide positive weight control of the cold aggregate feed by use of a belt scale, or other appropriate device, which will automatically regulate the feed gate and permit instant correction of variations in load. The cold feed flow shall be automatically coupled with the asphalt flow to maintain the required proportions of each material. Provisions shall be made for introducing the moisture content of the cold feed aggregates into the belt

weighing signal and correcting wet aggregate weight to dry aggregate weight. Screens or other suitable devices which will reject oversize particles or lumps of aggregate that have been cemented together shall be installed in the feeder mechanism between the bins and the dryer drum.

Dry weight of the aggregate flow shall be displayed digitally in appropriate units of weight and time and totalized.

3. Bituminous material and additive delivery systems. Satisfactory means of metering shall be provided to introduce the proper amount of bituminous material and additives into the mix. Delivery systems shall prove accurate to plus or minus 1 percent when tested for accuracy. The bituminous material and additive delivery shall be interlocked with the aggregate weight. The bituminous material and additive flow shall be displayed digitally in appropriate units of volume (or weight) and time shall be totalized.
4. Thermometric equipment. A recording thermometer of adequate range shall be located to indicate the temperature of the bituminous material in storage. The plant shall also be equipped with approved recording thermometers, pyrometers, or other approved recording thermometric instruments at the discharge chute of the drum mixer.
5. Drum mixer. A drum mixer of satisfactory design shall be provided. It shall be capable of drying and heating the aggregate to the moisture and temperature requirements set forth in the paving mixture requirements and capable of producing a uniform mixture. If the quality requirements of Section 403-3.2 cannot be met, the Contractor will be required to utilize either batch or continuous mix plants.
6. Temporary storage of HMA mixture. Use of surge bins or storage bins for temporary storage of HMA mixtures will be permitted as follows:
 - a. The HMA mixture may be stored in surge bins for a period of time not to exceed 3 hours.
 - b. The HMA mixture may be stored in insulated and heated storage bins for a period of time not to exceed 12 hours, provided an inert gas atmosphere is maintained in the bin during the storage period.

If the Engineer determines that there is an excessive amount of heat loss, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

- E. Inspection of Plant. The Engineer or his/her authorized representative shall have access, at all times, to all parts of the paving plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking the temperatures maintained in the preparation of the mixtures.

403-4.3 HAULING EQUIPMENT. Trucks used for hauling HMA shall have tight, clean, smooth metal beds. To prevent the mixture from adhering to them, the beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, so that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

All trucks used for hauling HMA shall have a tightly closing tailgate to prevent spilling of material on airfield pavements or entrance roads used for haul roads. Prior to leaving the placing site, the end of the truck beds shall be cleaned of all loose material which may spill onto the pavements and the tail gate shall be secured.

403-4.4 HMA PAVERS. HMA pavers shall be self-contained, power-propelled units with an activated screed capable of vibrating at approximately 3000 VPM or strike-off assembly, heated if necessary, and shall be capable of spreading and finishing courses of HMA which will meet the specified thickness, smoothness, and grade. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of HMA in widths shown on the plans. All width extensions required to place material shall have the same placement features and equipment functions as

provided on the main body of the paver. Augers shall be extended as additional sections of screed are bolted on or automatically adjustable screeds are extended. The augers need not be extended when the screed extensions on either side of the machine are one foot or less and the finished surface of the mat is uniform. The use of any machine obsolete in design or in poor mechanical condition will not be permitted.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be capable of operating at forward speeds consistent with satisfactory laying of the mixture. An automatic grade control system shall be used to automatically maintain the screed elevation as specified herein. The control system shall be automatically actuated from either a reference line or surface through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface.

The controls shall be capable of working in conjunction with any of the following attachments, as specified by the Project Engineer:

- A. Ski-type device of not less than 30 feet in length or as directed by the Engineer.
- B. Taut stringline (wire) set to grade.
- C. Short ski or shoe.

403-4.5 ROLLERS. Rollers may be of the vibratory, steel wheel, or pneumatic-tired type. They shall be in good condition, capable of reversing without backlash, and operating at slow speeds to avoid displacement of the HMA. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density without detrimentally affecting the compacted material.

403-4.6 PREPARATION OF BITUMINOUS MATERIAL. The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. The temperature of the bituminous material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed the applicable maximum temperature set forth in AASHTO M 320 and not be more than 25° F above the temperature of the aggregate as specified in Section 403-4.7.

403-4.7 PREPARATION OF MINERAL AGGREGATE. The aggregate for the mixture shall be dried and heated to the temperature designated by the job formula within the job tolerance specified. Immediately after heating, the base course aggregate(s) shall be screened into at least four sizes. This requirement does not apply to drum mixer plants. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregates. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

403-4.8 PREPARATION OF HMA. The aggregates and the bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job mix formula.

The combined materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate are secured. Wet mixing time shall be approved by the Engineer for each plant and for each type aggregate used. Normally, the mixing time after introduction of bituminous material should not be less than 30 seconds. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer.

$$\text{Mixing time (seconds)} = \frac{\text{Pugmill dead capacity in pounds}}{\text{Pugmill output in pounds per second}}$$

403-4.9 TRANSPORTING, SPREADING, AND FINISHING. The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Section 403-4.3. Deliveries shall be scheduled so that spreading and rolling of all mixture prepared for one day's run can be completed during daylight, unless adequate artificial lighting is provided. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

Immediately before placing the HMA, the underlying course shall be cleared of all loose or deleterious material with power blowers, power brooms, or hand brooms and a bituminous tack coat shall be applied in accordance to Item 603.

The mix shall be placed at a temperature of not less than 275° F. Moisture content of the mix shall not exceed 0.5 percent. The Engineer may increase the asphalt content of the first lift by up to 0.3 percent when the HMA is placed directly on a prepared subgrade.

Upon arrival, the mixture shall be spread to the full width by an approved HMA paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and shall conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the HMA mat. The maximum allowed paver speed is 50 ft/min. Unless otherwise directed, placing shall begin along the centerline of areas to be paved on a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet, except where edge lanes require strips less than 10 feet to complete the area. The longitudinal joint in one layer shall offset that in the layer immediately below by at least 1 foot; however, the joint in the top layer shall be at the centerline of the pavement. Transverse joints in one layer shall be offset by at least 2 feet from transverse joints in the previous layer. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

The first lane of the first lift of the HMA base course shall be started at the center of the pavement with a taut stringline (guide wire) set to grade at both sides of the paver. The automatic grade control system of the paver shall be used to control grade of both sides of the paver from these reference stringlines. The grade control for the adjacent lanes of pavement shall be maintained by using a matching shoe with the previous laid pavement and a stringline on the outer edge of the next lane. A stringline and matching shoe shall be used to pave all remaining lanes of the first lift of base course. If grade is established on the first lift, succeeding lifts shall be laid with a traveling ski on both sides of the paver for the center lane with matching shoe and traveling ski on adjacent lanes. If grade is not established on the first lift, the Resident Engineer shall require taut stringline references until satisfactory grade is established.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted by hand tools.

403-4.10 COMPACTION OF MIXTURE. After spreading, the mixture shall be thoroughly and uniformly compacted with power rollers as directed by the Resident Engineer. Rolling of the mixture shall begin as soon after spreading as it will bear the roller without undue displacement or hair checking. On the first strip spread, rolling shall start at the low edge and progress toward the high edge. When adjoining lanes are placed, the same rolling procedure should be followed, but only after compaction of fresh mix at the longitudinal joint with 6 to 8 inches of the vibrating roller width overlapping on the previously compacted lane. Vibratory rollers will be operated so as to obtain a minimum of 10 impacts per foot. If a static roller is being used, 6 to 8 inches should be on the fresh mix at the longitudinal joint with the remainder of the roller width on the previously compacted lane. Rollers operated in static mode shall not exceed 3 mph (264 ft/min).

Initial rolling shall be done longitudinally. The rollers shall overlap on successive trips. Alternate trips of the roller shall be of slightly different lengths, and cross rolling shall not exceed more than one half the width of the pavement on crowned sections. The speed of the roller shall, at all times, be slow to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once by rakes and fresh mixture.

Sufficient rollers shall be used to handle the output of the plant. Rolling shall continue until all roller marks are eliminated producing a surface of uniform texture true to grade and cross section.

The Contractor shall provide, at all times, an approved Troxler (or equal) nuclear density gauge with a qualified operator to maintain quality control of the density as specified herein.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers.

Any mixture which becomes loose and broken, mixed with dirt, or in any way defective prior to the application of the finish coat shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This shall be done at the Contractor's expense.

403-4.11 JOINTS. The formation of all joints shall be made in such a manner as to ensure a continuous bond between old and new sections of the course. All joints shall present the same texture, density, and smoothness as other sections of the course.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. In both methods all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

All longitudinal joints constructed are to be compacted in such a manner that they are "pinched" to provide adequate density at the joint. When laying the HMA adjacent to a previously placed lane, the first pass of the roller shall be along the longitudinal joint on the fresh mixture with the compression wheel not more than 6 in. from the joint. The second pass of the roller shall overlap the longitudinal joint not more than 12 in. on the previously placed lane, after which the rolling shall proceed uniformly. Each stop shall be regulated to prevent trapping of water on the rolled surface. The steel wheeled rollers shall be operated with the compression wheels toward the direction of paving. The Contractor shall cut two cores per 2,500 tons at a random location over the longitudinal construction joint. The cores shall be delivered to the Resident Engineer for density testing and the two results will be used to obtain an average density. This average density at the joint shall be a minimum of 90%.

Density results below an average of 90% shall result in an immediate suspension of paving operations until a sufficient investigation and solution to the density problem is agreed to by the Engineer. The result of this deficiency will be a 5% penalty on all production done on the day the core was taken or represents.

403-4.12 SHAPING EDGES. While the surface is being compacted and finished, the Contractor shall carefully trim the outside edges of the pavement to the proper alignment. Edges so formed shall be beveled while still hot with the back of a rake or a smoothing iron and thoroughly compacted by tampers or by other satisfactory methods.

403-4.13 ACCEPTANCE TESTING OF HMA MIXES FOR DENSITY. (For Method I only: Under 2,500 tons/pay item) The HMA base course shall be compacted to a minimum density of 93 percent (7 percent air voids) and a maximum of 99 percent (1 percent air voids) of the Maximum Theoretical Specific Gravity (ASTM D 2041). If, during construction, the density test falls below 93 percent, additional approved rollers shall be required. Failure to achieve density within these limits shall be cause for rejection of the material, as determined by the Division.

Two random nuclear density tests shall be taken for each 500 tons of mix placed. Each nuclear density test shall be the average of five (5) nuclear tests taken as a cross-section of the pavement. The Resident Engineer shall have a nuclear gauge and qualified operator on the project when constructing this item. One random mix sample shall be taken from each 1,000 tons of mix laid, for Marshall, Extraction, Maximum Specific Gravity, and Air Void tests. The Resident Engineer shall have a nuclear gauge and qualified operator on the project when constructing this item.

(For Method II only: Over 2,500 tons/pay item) The HMA base course shall be compacted to a minimum density of 93 percent (7 percent air voids) and a maximum of 99 percent (1 percent air voids) of the maximum theoretical specific gravity (ASTM D 2041) and accepted by the following statistical procedure. When more than one base course mix design is used on the same project, each mix will be evaluated separately under the statistical acceptance procedure specified herein.

- A. Lot Size. The plant-produced mixture shall be tested on a lot basis. A lot shall consist of 4 sublots. End or final lots may contain between 3 and 6 sublots.

A subplot shall consist of 500 tons for each type of mix.

One density sample shall be taken randomly from each subplot. Each density sample shall be the average of two cores extracted from the sample location.

The Contractor shall take one random mix sample from each 1,000 tons of mix laid. This sample shall be split into two samples with one half tested by the Contractor for Marshall, Extraction or Ignition oven for Gradation and Nuclear Asphalt Gauge for asphalt content, Maximum Specific Gravity, Gradation, and Air Void tests. The other sample half shall be appropriately marked and retained by the Contractor until the Engineer requests the mix for testing or directs the Contractor in writing to dispose of the mix.

All tests shall be completed and reported to the Engineer no later than the morning of the day following production.

- B. Lot Early Termination. When less than 3 sublots are produced, such as at the end of construction of the base course or at the end of the construction season, the final subplot data shall be included with the previous lot for payment. The final lot may thus contain up to six (6) sublots.
- C. Acceptance Criteria. The acceptance of each lot of HMA base course shall be based on the **Percentage of material Within specification Limits (PWL)**. The PWL is determined using standard statistical techniques and involves the number of tests in each lot (n) and the quality indexes (Q_L is the Quality Index for the lower limit; Q_U is the Quality Index for the upper limit). The quality indexes are calculated using the following formulae:

$$Q_L = \frac{\bar{X} - 1}{S} \qquad Q_U = \frac{7 - \bar{X}}{S}$$

Where

- Q = Quality Index (lower or upper)
- \bar{X} = Mean (average) value of air voids in percent
- % Air Voids = (100 - % density)
- S = Standard Deviation of test results

For mat in-place air voids, estimate the **Percentage Within Tolerance (PWT)** for the lower and upper tolerance limits by entering TABLE 6 with Q_L and Q_U using the column appropriate to the total number (n) of core samples. The total percent of material between the lower and upper limits is defined as the **Percent Within Limits** and is calculated by the following formula:

$$PWL = [PWT(\text{lower}) + PWT(\text{upper})] - 100$$

Each lot of HMA material shall be accepted for 100 percent payment when the PWL equals or exceeds 90 percent. When the PWL is below 90 percent for a given lot, the lot tonnage shall be adjusted in accordance with TABLE 5.

TABLE 5 - PAY ADJUSTMENT SCHEDULE ^{1/}

PWL	% ADJUSTMENT IN LOT QUANTITY
90 - 100	100
80 - 89.9	0.5 PWL + 55.0
65 - 79.9	2.0 PWL - 65.0
Below 65	^{2/}

- 1/ All preliminary calculations used in determining the Percent Within Limits should be rounded to a minimum of four digits right of the decimal point. The PWL that is used for Table 5 purposes should then be rounded to one digit right of the decimal point to determine the percent of contract quantity to be paid. The final percent pay figure should be rounded to one digit right of the decimal point. The Resident Engineer shall notify the Contractor, in writing, of the final percent pay for each lot as soon as all lot tests are completed.
- 2/ The lot shall be removed and replaced. However, the Engineer may decide to accept the deficient lot. In that case, it will be paid for at 50% adjustment.

D. Mix sampling All mix sampling shall be done on a random basis as determined by the Resident Engineer. Samples that are obviously defective or become defective prior to testing shall be discarded and retaken. New samples shall be considered as if they were initial samples.

403-4.14 SURFACE TESTS. Tests for conformity with the specified crown and grade shall be made by the Contractor immediately after initial compression. Any variation shall be corrected by the removal or addition of materials and by continuous rolling.

After the completion of final rolling, the smoothness of the base course shall be tested with a 16-foot straightedge applied parallel with the centerline. Any humps or depressions exceeding ¼ inch shall be immediately corrected by removing the defective work and replacing with new material, as directed by the Resident Engineer. This shall be done at the Contractor's expense.

The finished surfaces of HMA courses shall not vary from the gradeline, elevations, and cross sections shown on the contract drawings by more than ½ inch. The Contractor shall correct pavement areas varying in excess of this amount by removing and replacing the defective work. Skin patching will not be permitted.

403-4.15 SAMPLING PAVEMENT. The completed pavement shall be cleaned so that no debris or dirt from coring operations is left on the surface of the pavement. Three (3) cores per lot shall be tested for thickness for any methods used.

(For Method II only: Over 2,500 tons/pay item) Cores from each subplot shall be taken at random locations as outlined by the Resident Engineer. No core samples shall be taken within two feet of the edge of pavement. Any core less than 1 ½ inch thickness shall not be used and a new location and sample shall be selected.

Core samples of approximately 4 inches in diameter, for determination of in-place air voids of the completed pavement, shall be obtained by the Contractor at no extra expense. The number and locations of the samples shall be as determined by the Resident Engineer. The Contractor shall furnish all tools, labor, and materials for sampling and replacing pavement.

All core tests necessary to determine initial conformance with specification requirements will be performed by the Resident Engineer at no cost to the Contractor.

Resampling and Retesting Resampling of a lot may be allowed only under the following conditions:

- A. The Contractor must request, in writing, the resampling and retesting of a complete lot within 48 hours after receiving the written test results of the lot from the Resident Engineer. Only one retest per lot will be permitted.
- B. If the retested lot should result in a higher "Percent Within Limits" figure than the original, based on all lot samples (original and new) the following will apply:
 - 1. The cost of resampling and retesting will be borne by the Engineer.

2. The new "Percent Within Limits" figure shall be calculated using all LOT samples, (original and new) for calculating the lot payment.
- C. If the retested lot should result in a "Percent Within Limits" figure equal to or less than the original, based on all the lot samples (original and new), the following will apply:
1. The cost of resampling and retesting will be borne by the Contractor.
 2. The new "Percent Within Limits" figure shall be calculated using all lot samples, (original and new) for calculating the lot payment.
- D. Procedures in ASTM E 178 shall be used to determine outliers based on all samples taken and a 5% significance level.
- E. Results of the retesting and resampling shall be final.

METHOD OF MEASUREMENT

403-5.1 HMA base course will be measured by the ton. The tonnage shall be the weight used in the accepted pavement. No deduction will be made for the weight of bituminous material in the mixture. Plant batch weights will be accepted. Loads shall be checked periodically by weighing full truckloads of the HMA on an approved platform scale at the plant or on a commercial scale.

The Contractor shall furnish approved duplicate load tickets upon which is recorded the net weight of the HMA in each truck. The load ticket shall have sufficient space for signatures, identification of the HMA, date of delivery, and any other data which the Project Engineer may require. The Contractor shall submit one load ticket to the Project Engineer, or his/her duly authorized representative, at the plant after the truck is loaded and another load ticket to the Project Engineer, or his/her duly authorized representative, at the construction site when the truck load is incorporated into the pavement.

Measurement for payment will not be made for any HMA base course in excess of 103 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.)

BASIS OF PAYMENT

403-6.1 The quantity of HMA base course measured as outlined in Section 403-5.1 shall be adjusted in accordance with Section 403-4.13 herein. Final payment shall be compensation for furnishing all materials, for all preparation, mixing, testing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

(For Method I only: Under 2,500 tons/pay item). Payment shall be based upon the acceptance test results for density. Acceptance test results not meeting the limits set forth in Section 403-4.13 shall be cause for a payment adjustment of the material placed in the failed subplot(s), as determined by the Division.

(For Method II only: Over 2,500 tons/pay item) Payment shall be calculated by multiplying the contract unit price per ton of HMA base course and the adjusted tons per lot.

The test section shall be paid for at the contract unit price per each, which price shall include the additional specified equipment, labor, Engineering, and testing time necessary to construct this item.

TABLE 6
TABLE FOR ESTIMATING PERCENTAGE OF LOT WITHIN LIMITS (PWL)
(STANDARD DEVIATION METHOD)
QUALITY INDEX (Q_L or Q_U)

PERCENT WITHIN TOLERANCE	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362	2.0656	2.0897
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630	1.8828	1.8989
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420	1.7566	1.7684
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454	1.6566	1.6655
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635	1.5721	1.5790
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4716	1.4829	1.4914	1.4981	1.5035
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265	1.4316	1.4358
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670	1.3709	1.3741
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118	1.3148	1.3172
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602	1.2623	1.2640
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115	1.2129	1.2141
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653	1.1661	1.1660
87	1.0597	1.1100	1.1173	1.1191	1.1199	1.1204	1.1208	1.1212	1.1215	1.1218
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789	1.0788	1.0787
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382	1.0377	1.0374
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990	0.9982	0.9976
83	0.9939	0.9900	0.9785	0.9715	0.9672	0.9643	0.9624	0.9610	0.9599	0.9591
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241	0.9228	0.9219
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882	0.8868	0.8857
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533	0.8517	0.8505

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192	0.8175	0.8161
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858	0.7840	0.7826
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531	0.7513	0.7498
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211	0.7192	0.7177
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896	0.6877	0.6861
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587	0.6567	0.6551
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282	0.6262	0.6247
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982	0.5962	0.5947
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686	0.5667	0.5651
70	0.6787	0.6000	0.5719	0.5583	0.5504	0.5454	0.5419	0.5394	0.5375	0.5360
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105	0.5086	0.5072
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820	0.4802	0.4787
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537	0.4520	0.4506
66	0.5563	0.4800	0.4545	0.4424	0.4354	0.4310	0.4280	0.4257	0.4241	0.4227
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4031	0.4001	0.3980	0.3964	0.3951
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705	0.3690	0.3678
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432	0.3418	0.3407
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161	0.3148	0.3137
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892	0.2880	0.2870
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624	0.2613	0.2604
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358	0.2348	0.2339
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2083	0.2084	0.2076
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829	0.1821	0.1814
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566	0.1559	0.1553
55	0.1806	0.1500	0.1406	0.1353	0.1338	0.1322	0.1312	0.1304	0.1298	0.1293
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1048	0.1042	0.1038	0.1034
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0792	0.0786	0.0781	0.0778	0.0775
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521	0.0518	0.0516
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260	0.0259	0.0258
50	0	0	0	0	0	0	0	0	0	0

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260	-0.0259	-0.0258
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521	-0.0518	-0.0516
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781	-0.0778	-0.0775
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042	-0.1037	-0.1034
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304	-0.1298	-0.1293
44	-0.2164	-0.1800	-0.1688	-0.1637	-0.1607	-0.1588	-0.1575	-0.1566	-0.1559	-0.1553
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829	-0.1821	-0.1814
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093	-0.2084	-0.2076
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358	-0.2348	-0.2339
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624	-0.2613	-0.2604
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892	-0.2880	-0.2870
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161	-0.3148	-0.3137
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432	-0.3418	-0.3407
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705	-0.3690	-0.3678
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980	-0.3964	-0.3951
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4354	-0.4310	-0.4280	-0.4257	-0.4241	-0.4227
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537	-0.4520	-0.4506
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820	-0.4802	-0.4787
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105	-0.5087	-0.5072
30	-0.6787	-0.6000	-0.5719	-0.5583	-0.5504	-0.5454	-0.5419	-0.5394	-0.5375	-0.5360
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686	-0.5667	-0.5651
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982	-0.5962	-0.5947
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282	-0.6262	-0.6217
26	-0.7904	-0.7200	-0.6920	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587	-0.6567	-0.6551
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896	-0.6876	-0.6861
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211	-0.7192	-0.7177
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531	-0.7513	-0.7498
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858	-0.7840	-0.7826
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8246	-0.8214	-0.8192	-0.8174	-0.8161
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533	-0.8517	-0.8565

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882	-0.8868	-0.8057
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241	-0.9228	-0.9219
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610	-0.9599	-0.9591
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990	-0.9982	-0.9976
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382	-1.0377	-1.0374
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789	-1.0788	-1.0787
13	-1.0597	-1.1100	-1.1173	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212	-1.1215	-1.1217
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653	-1.1661	-1.1668
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115	-1.2129	-1.2141
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602	-1.2623	-1.2640
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118	-1.3148	-1.3172
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670	-1.3709	-1.3741
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265	-1.4316	-1.4358
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4716	-1.4829	-1.4914	-1.4981	-1.5035
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635	-1.5721	-1.5790
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5872	-1.6127	-1.6313	-1.6454	-1.6566	-1.6655
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6992	-1.7235	-1.7420	-1.7566	-1.7684
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8054	-1.8379	-1.8630	-1.8828	-1.8989
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362	-2.0657	-2.0897

ITEM 403 BITUMINOUS BASE COURSE - SUPERPAVE

(Central Plant Hot Mix)

DESCRIPTION

403-1.1. This work shall consist of a Hot-Mix Asphalt (HMA) base course composed of mineral aggregate and bituminous material mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross sections shown on the plans. The term "Hot Mix Asphalt" or "HMA" shall refer to this mixture in various combinations and uses.

Each course shall be constructed to the depth, typical section, or elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course. The Contractor shall be responsible for the Quality Control in the production and construction of the HMA (Hot Mix Asphalt) base course. The HMA base course shall be laid in a maximum of two (2) inch lifts. Thicker lifts not to exceed three (3) inches may be authorized by the Resident Engineer provided a continuous paving operation is maintained.

For all IDOT Division of Aeronautics projects, the production, placement, and acceptance of flexible (HMA) pavements is performed by either Method I or Method II, when indicated. The two Methods are differentiated by the quantity of material placed. Refer to the plans and project Special Provisions for which method is used for each pay item. In all cases, Method I refers to quantities less than 2,500 tons, while Method II refers to quantities greater than or equal to 2,500 tons.

MATERIALS

403-2.1 AGGREGATE. Aggregates shall consist of crushed stone or crushed gravel, or recyclable asphalt pavement (RAP), blended with crushed or natural sand(s) and/or mineral filler.

Crushed Stone: Crushed stone shall be the angular fragments resulting from crushing by, mechanical means the following types of rocks quarried from undisturbed consolidated deposits: granite and similar phanerocrystalline igneous rocks, limestone, dolomite, massive metamorphic quartzite, or similar rocks. Dolomite shall be a carbonate rock containing 11.0 percent or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0 percent magnesium oxide (MgO).

Crushed Gravel: Crushed gravel shall be the product resulting from crushing by mechanical means, and shall consist entirely of particles obtained by crushing gravel, all of which before crushing will be retained on a screen with openings equal to or larger than the maximum nominal size of the resulting crushed material. If approved by the Engineer, final product gradations may be obtained by screening or blending various sizes of crushed gravel material.

Recyclable Asphalt Pavement (RAP): Recyclable asphalt pavement shall be defined as the product resulting from milling and/or crushing of HMA pavement composed of aggregates and asphalt that originally met the quality requirements as stated herein. The Contractor shall furnish evidence satisfactory to the Division and the FAA that the material met the specified quality requirements.

Mineral Filler: Mineral filler shall consist of dry limestone dust, or other material approved by the Engineer and shall meet the requirements of ASTM D 242.

The portion of the materials retained on the No. 8 sieve shall be known as coarse aggregate, the portion passing the No. 8 sieve and retained on the No. 200 sieve as fine aggregate, and the portion passing the No. 200 sieve as mineral filler.

A. Coarse Aggregate. Coarse aggregate shall consist of sound, tough, durable particles conforming to the following quality requirements:

QUALITY TEST (IDOT C Quality)	PERCENT
Na ₂ SO ₄ Soundness, 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104) Max. % Loss	20
Los Angeles Abrasion, ASTM C 131 Max. % Loss	45

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	4.0
Clay Lumps %	0.5
Soft & Unsound Frag. %	8.0
Other Deleterious %	2.0
<i>Total Deleterious Allowed %</i>	<i>10.0</i>

B. Fine Aggregate. Fine aggregate shall be defined as follows:

1. Sand: Sand shall be the fine granular material resulting from the natural disintegration of rock. Sand produced from deposits simultaneously with and by the same operations as gravel coarse aggregate may contain crushed particles in the quantity resulting normally from the crushing and screening of oversize particles.
2. Stone Sand: Stone sand shall be produced by washing or processing by air separation the fine material resulting from crushing rock quarried from undisturbed consolidated deposits.
3. Slag Sand: Slag sand shall be the graded product resulting from the screening of air cooled blast furnace slag. Air cooled blast furnace slag shall be the nonmetallic product, consisting essentially of silicates and alumino-silicates of lime and other bases, which is developed in a molten condition simultaneously with iron in a blast furnace.
4. Steel Slag Sand: Steel slag sand shall be the graded product resulting from the screening of crushed steel slag. Crushed steel slag shall be the nonmetallic product which is developed in a molten condition simultaneously with steel in an open hearth, basic oxygen or electric furnace.

The fine aggregate shall also conform to the following quality requirements:

QUALITY TEST (IDOT B Quality)	PERCENT
Na ₂ SO ₄ Soundness, 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104) Max. % Loss	15
Minus No. 200 Sieve Material, ASTM C 136 Max. % Loss ^{1/}	6.0 ^{2/}

1/ Fine aggregate shall not contain more than 3 percent clay (2 micron or smaller) particles.

2/ Does not apply to Stone Sand.

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	3.0
Clay Lumps %	3.0
Coal, Lignite & Shells %	3.0
Conglomerate %	3.0
Other Deleterious %	3.0
<i>Total Deleterious Allowed %</i>	<i>5.0</i>

If necessary to obtain the gradation of aggregate blend or workability, natural sand may be used. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification.

- C. Sampling and Testing. All aggregates proposed in the manufacture of the mix will be sampled and tested by the Contractor. ASTM D 75 shall be used in sampling coarse aggregate and fine aggregate, and ASTM C 183 shall be used in sampling mineral filler. The Contractor shall provide

the Engineer with aggregate producer (quarry) and Contractor (plant) quality control gradations. No aggregate shall be used in the production of mixture without prior approval.

- D. Sources of Aggregates. All aggregate sources that are approved by the Illinois Department of Transportation, Division of Highways, conforming to the description, gradation and quality specified herein, shall be permitted for use in the manufacture of the HMA base course. The supplier of aggregates must participate and meet the requirements of the Illinois Department of Transportation Division of Highways Source Certification Program (AGCS). The Engineer reserves the right to inspect the source(s) and manufacturing of all aggregates. If satisfactory quality control and production procedures are not being implemented, the Engineer may remove approval of the source(s). Approval of the source(s) of aggregate(s) does not relieve the Contractor in any way of the responsibility for delivery to the job site aggregates that meet the requirements specified herein.
- E. Samples of Aggregates. All the source(s) of the proposed aggregates for use by the Contractor in the Contractor's proposed HMA design must be approved in writing by the Division's Engineer of Construction & Materials prior to use in any design or production of bituminous material.

403-2.2 FILLER. If filler, in addition to that naturally present in the aggregate, is necessary, it shall meet the requirements of ASTM D 242.

403-2.3 BITUMINOUS MATERIAL. Performance Graded asphalt PG 64-22 shall be used for all HMA produced unless otherwise specified. When requested, producers shall provide the Engineer with viscosity/temperature relationships for the performance graded asphalt binders delivered and incorporated in the work.

The asphalt binder shall meet the requirements of AASHTO M 320, Table 1 "Standard Specification for Performance Graded Asphalt Binder" for the grade shown on the plans. Elastomers shall be added to the base asphalt binder to achieve the specified performance grade and shall be either a styrene-butadiene diblock or triblock copolymer without oil extension, or a styrene-butadiene rubber. Air blown asphalts, acid modification, and other modifiers will not be allowed. Asphalt modification at hot-mix asphalt plants will not be allowed.

The Contractor shall furnish vendor's certified test reports for each carload or equivalent of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall be the basis for final acceptance.

COMPOSITION

403-3.1 COMPOSITION OF MIXTURE. The HMA shall be composed of a mixture of aggregate, filler if required, and bituminous material. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula.

403-3.2 JOB MIX FORMULA. The Contractor is responsible for the job mix formula (JMF) and no HMA for payment shall be produced until a letter from the Illinois Division of Aeronautics' Engineer of Construction & Materials approving the Contractor's proposed JMF has been issued to the Contractor. The approved JMF shall indicate the definite percentage on each sieve for each aggregate, the percent of bitumen, and the number of gyrations specified for the individual project. The Contractor shall provide all laboratory sampling and testing to the Engineer upon the completion of the proposed JMF. The exact tests and procedures are outlined in the Illinois Division of Aeronautics (IDOA) latest *Policy Memorandum 2003-1: "Requirements for Laboratory, Testing, Quality Control and Paving of Superpave Bituminous Concrete Mixtures for Airports,"* located at the IDOT internet site.

The job mix formula for each mixture shall be in effect until modified in writing by the Project Engineer. Should a change in sources of materials be made, a new job mix formula shall be established before the new material is used.

The HMA shall be tested according to the Asphalt Institute's most current Superpave Series No. 2 (SP-2) manual entitled, "Superpave Mix Design" and shall meet the criteria set forth in TABLES 1 and 2 herein.

TABLE 1 SUPERPAVE DESIGN CRITERIA

TRAFFIC MIX					
Design Parameter	Aircraft over 60,000 lbs. ^{1/}		Aircraft under 60,000 lbs.		Automobile
	Runway or Taxiway	Parking Apron	Runway or Taxiway	Parking Apron	Entrance roads and Parking Lots
N_{ini} ^{2/}	5	7	5	5	5
N_{des} ^{3/}	40	50	30	30	30
N_{max}	58	74	42	42	42
% Air Voids V_a ^{4/}	2-4	2-4	2-4	2-4	2-4
VFA (min %)	75-90	75-90	75-90	75-90	75-90

- 1/ Stone sand (IDOT Gradation FA20 or FA21) shall be required as part of the fine aggregate portion of the JMF. The exact amount of stone sand will be determined by the Contractor based on preparation of the Mix Design. The percentage of stone sand will be verified as acceptable by the Division of Aeronautics based upon the Contractor's final proposed JMF. The Division reserves the right to request a change in the amount of stone sand at any point in the mix design process, as well as during production, based upon performance of the mix during placement.
- 2/ Where N= number of gyrations on an IDOT approved superpave gyratory compactor.
- 3/ The N_{des} value may be changed in order to obtain an acceptable mix design when approved by the Engineer.
- 4/ Contact the Division for optimum target voids required.

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory screens, will conform to the gradation or gradations specified in TABLE 2, when tested in accordance with ASTM Standard C 136 (dry sieve only). The percentage by weight for the bituminous material shall be within the limits specified.

TABLE 2. AGGREGATE HMA BASE COURSE
Percentage by Weight Passing Sieves
Job Mix Formula (JMF)

Sieve Size	Gradation B Range ¹ Maximum	Ideal Target
1-1/4 in.		
1 in.	100	100
3/4 in.	93 – 97	95
1/2 in.	75 – 79	77
3/8 in.	64 – 68	66
No. 4	45 – 51	48
No. 8	34 – 40	37
No. 16	27 – 33	30
No. 30	19 – 23	21
No. 100	6 – 10	8
No. 200	4 – 6	5
Bitumen %:	4.5 – 7.0	5.5

The gradation in TABLE 2 represents the limits which shall determine the suitability of aggregate for use from the sources of supply. The aggregate, as finally selected, shall have a gradation within the limits designated in TABLE 2 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be uniformly graded from coarse to fine. When approved by the Engineer, the Contractor may add up to 25 percent of recyclable asphalt pavement to meet the required gradations, provided he can produce a consistent mixture meeting the mix design, temperature, and density requirements specified herein.

The course and fine aggregate gradations specified in the Illinois Division of Highways Specifications for Road and Bridge Construction, current edition, may be blended to meet the job mix formula.

The job mix tolerances shown in TABLE 3 shall be applied to the job mix formula to establish a job control grading band. The tolerances listed in TABLE 3 will only apply when they cause a grading band within the band listed in TABLE 2. Otherwise, the grading bands listed in TABLE 2 shall apply.

TABLE 3. JOB MIX FORMULA TOLERANCES
(Based on a Single Test)

Material	Tolerances Plus or Minus
Aggregate passing No. 4 sieve or larger	7 percent
Aggregate passing Nos. 8 and 16 sieves	5 percent
Aggregate passing Nos. 30 sieve	4 percent
Aggregate passing Nos. 100 and 200 sieves	2 percent
Bitumen	0.45 percent
Temperature of mixing and placing	20 degrees F.

The aggregate gradation may be adjusted within the limits of TABLE 2, as directed, without adjustments in the contract unit prices.

Should a change in sources of materials be made, a new job mix formula shall be established before the new material is used. Deviation from the approved JMF for bitumen content and gradation of aggregates shall not be greater than the tolerances permitted and shall be based on extraction, or calibrated ignition oven test for aggregate gradations and asphalt content. Results falling outside the set tolerances shall be cause for rejection of all the material placed from the time of testing until a passing test is obtained. The applicable ASTM and IDOT tests are outlined in the current IDOA *Policy Memorandum 2003-1: "Requirements for Laboratory, Testing, Quality Control and Paving of Superpave Bituminous Concrete Mixtures for Airports,"* located at the IDOT internet site. These tests shall be performed by Contractor quality control personnel. Split mix samples shall be maintained by the Contractor for random testing by the Engineer.

403-3.3 BITUMINOUS AND AGGREGATE MATERIAL CONTRACTOR'S RESPONSIBILITY.

Samples of the bituminous and aggregate materials that the Contractor proposes to use, together with a statement of their source and character, shall be submitted to the Engineer; approval must be obtained before the use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous and aggregate materials to furnish material subject to this and all other pertinent requirements of the contract. Only those materials that have demonstrated performance under the proposed design requirements will be accepted.

The Engineer or his/her authorized representative shall have access, at all times, to all parts of the paving plant for the purpose of inspecting equipment, conditions and operation of the plant, for verification of weights or proportions and character of materials, and to determine temperatures maintained in the preparation of the mixtures.

The Contractor shall furnish vendor's certified test reports for each carload or equivalent of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of materials received for use on the project.

403-3.4 TEST SECTION. (For Method II only: Over 2,500 tons/pay item) Prior to the manufacture of mix for the test section, Contractor quality control personnel shall have completed all proportioning and testing in accordance with Policy Memorandum 2003-1, to assure that the mix produced will meet the JMF. The Contractor shall then manufacture a quantity of HMA base course mixture in order to construct the test section.

The test section shall have a length of approximately 200 to 300 lineal feet and shall be of the same depth specified for the construction of the course which it represents. The Contractor may place up to 50 tons of mix prior to construction of the test section in order to line-out the plant, the mix, and the paving operation. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented.

- A. Construction of the Test Section. The test section shall consist of two parts: Development of a Growth Curve and establishing a Rolling Pattern.

1. Growth Curve: To construct the Growth Curve a self-propelled vibratory roller meeting the following minimum requirements shall be required:

Drum diameter 48 inches, length of drum 66 inches, vibrators 1600 vibrations per minute (VPM) minimum, unit static force on vibrating drum(s) 125 pounds per lineal inch (PLI), total applied force 325 pounds per lineal inch (PLI), adjustable eccentrics, reversible eccentrics on nondriven drum(s). The total applied force for various combinations of VPM and eccentric positions shall be shown on decals on the vibrating roller or on a chart maintained with the roller. The vibratory roller shall be equipped with water tanks and sprinkling devices, or other approved methods, which shall be used when necessary to wet the drum to prevent the HMA from sticking.

The Contractor shall have a vibrating reed tachometer (hand type) at the job site for checking roller vibrations. The reed tachometer shall have a range of 1000 to 4000 vibrations per minute (VPM). The vibrating reed tachometer shall have two (2) rows of reeds. One row shall range from 1000 to 2000 VPM and the other row shall range from 2000 to 4000 VPM.

The Growth Curve shall be constructed by successive passes of the vibratory roller, in a given area, in order to determine the maximum compactibility of the mix. The Growth Curve shall be done under the supervision of the Engineer, or his/her designated representative, who must validate the Growth Curve results before continuing with the remainder of the Test Section. More than one Growth Curve may be required as part of the test section if adjustments to the mix, plant operation, laydown, etc., are necessary to reach optimum compactibility.

2. Rolling Pattern: The Contractor shall then proceed to establish the Rolling Pattern using the equipment that he intends to use for compaction of the rest of the HMA course.

B. Test Section Acceptance. The Test Section shall be evaluated and approved based on the following.

1. The completed Test Section (Rolling Pattern area) shall be divided into four (4) subsections with one (1) sample consisting of two (2) cores obtained from each subsection for determination of density. One additional core sample shall be obtained from the Growth Curve.
2. The Contractor shall correlate a nuclear density gauge to the Test Section for Quality Control testing. The nuclear density gauge shall not be used for acceptance testing.
3. The completed Test Section (rolling pattern area) shall have a minimum density of 94.0 percent (6.0 percent air voids) of the maximum theoretical specific gravity of the mix (ASTM D 2041). Individual test results (average of two cores) below 94.0% shall constitute a failing test section.
4. If the test section fails to meet these requirements, the Contractor shall construct a new Test Section meeting these requirements at his/her own expense.
5. Full production shall not be allowed until all tests, Reflux extraction or Ignition Oven, Gradation, Gravities of mix, and Core Densities are completed in order to determine compliance with these specifications.
6. The completed Test Section(s) shall be part of the proposed work. When recommended by the Resident Engineer and approved by the Engineer, test sections that do not conform to the specifications shall be removed and replaced at the Contractor's expense.
7. When a Test Section passes, the Test Section tonnage shall be paid 100%.

The mix used in construction of the Test Section shall be paid for under Section 403-6.1. Construction of the Test Section shall be paid for separately from the mix, but also in accordance with Section 403-6.1. Payment will be made for only one (1) Test Section.

CONSTRUCTION METHODS

403-4.1 WEATHER LIMITATIONS. The HMA shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in TABLE 4. The temperature requirements may be waived, but only when so directed by the Engineer.

TABLE 4. BASE TEMPERATURE LIMITATIONS

Mat Thickness	Base Temperature (Minimum)	
	°F	°C
3 in. or greater	40	4
Greater than 1 in. but less than 3 in.	45	7
1 in. or less	50	10

No paving shall commence unless the ambient air temperature is 40° F. and rising. Paving shall halt when the ambient air temperature is 45° F. and falling.

403-4.2 HMA PLANT. The Hot-Mix Asphalt (HMA) plant(s) shall conform to the following requirements, or the Engineer may accept the use of a hot-mix plant approved by the IDOT Division of Highways for the manufacture of Class I HMA mixtures in accordance with the current IDOT Standard Specifications for Road and Bridge Construction. When recyclable asphalt pavement is used, the hot-mix plant shall also conform to the additional IDOT plant requirements for hot-mix recycling.

If the supplier is equipped with an automated plant the automation feature shall be used in the production of bituminous material for the project. If the supplier is equipped with a recordation feature, it also shall be used. Sufficient storage space shall be provided for each size of aggregate. The different aggregate sizes shall be kept separated until they have been delivered to the cold elevator feeding the drier. The storage yard shall be neat and orderly, and the separate stockpiles shall be readily accessible for sampling.

Plants used for the preparation of HMA shall conform to all requirements under A., except that scale requirements shall apply only where weight proportioning is used. In addition, batch mixing plants shall conform to the requirements under B., continuous mixing plants shall conform to the requirements under C., and drum mixers shall conform to the requirements under D.

- A. **Requirements for All Plants.** Mixing plants shall be of sufficient capacity to adequately produce the quantity of HMA for the proposed construction.
1. **Plant scales.** Scales shall be accurate to 0.5 percent of the required load. Poises shall be designed to be locked in any position to prevent unauthorized change of position. In lieu of plant and truck scales, the Contractor may provide an approved automatic printer system to print the weights of the material delivered, provided the system is used in conjunction with an approved automatic batching and mixing control system. Such weights shall be evidenced by a weigh ticket for each load. Scales shall be inspected for accuracy and sealed as often as the Resident Engineer may deem necessary. The Contractor shall have on hand not less than ten 50-pound weights for testing the scales.
 2. **Equipment for preparation of bituminous material.** Tanks for storage of bituminous material shall be capable of heating the material under effective and positive control, at all times, to the temperature requirements specified herein. Heating shall be accomplished by steam coils, electricity, or other means that will allow no direct flames to come in contact with the bituminous material or its fumes. The circulating system for the bituminous material shall be of adequate size to insure proper and continuous circulation between storage tank and mixer during the entire operating period. Pipelines and fittings shall be steam-jacketed or otherwise properly heated, if required, or insulated to prevent heat loss. The storage tank capacity shall be sufficient for at least a one-day run. Provision shall be made for measuring quantities and for sampling the material in the storage tanks.
 3. **Feeder for drier.** The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier to obtain uniform production and temperature. When

added mineral filler is specified, a separate bin and feeder shall be furnished with its drive interlocked with the aggregate feeders.

4. Drier. The plant shall include a drier(s) which continuously agitates the aggregate during the heating and drying process.
5. Screens. Plant screens, capable of screening all aggregates to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer, shall be provided.
6. Bins. The plant shall include storage bins of sufficient capacity to supply a mixer operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates. When used, separate dry storage shall be provided for filler of hydrated lime, and the plant shall be equipped to feed such material into the mixer. Each bin shall be provided with overflow pipes of such size and at such location to prevent backup of material into the compartments or bins. Each compartment shall be provided with its individual outlet gate to prevent leakage. The gates shall cut off quickly and completely. Bins shall be constructed so that samples may be obtained readily. Bins shall be equipped with adequate tell-tale devices which indicate the position of the aggregates in the bins at the lower quarter points.

Prior to start of production of any mixture, the Contractor shall furnish the Resident Engineer with calibrations showing the rate of feet of each aggregate for the cold bin or silo in which it is to be used. Change of material or change of cold bin or silo will require new calibrations. The calibrations shall show the rate of feed per minute per unit of opening or setting of feed.

7. Bituminous control unit. Satisfactory means shall be provided to obtain the proper amount of bituminous material in the mix within the tolerance specified by the job mix formula, either by weighing, metering, or volumetric measurements. Suitable means shall be provided, either by steam-jacketing or other methods of insulation, for maintaining the specified temperature of the bituminous material in the pipelines, meters, weigh buckets, spray bars, and other containers or flow lines. Means shall be provided for checking the quantity or rate of flow of bituminous material into the mixer.
8. Thermometric equipment. An armored thermometer of adequate range shall be fixed in the bituminous feed line at a suitable location near the discharge valve at the mixer unit. The plant shall be further equipped with either an approved recording dial scale, a mercury-actuated thermometer, an electric recording pyrometer, or other thermometric instruments, so placed at the discharge chute of the dryer as to register automatically or indicate the temperature of the heated aggregate. When required by the Engineer, additional thermometric equipment shall be placed at the pug mill to control the temperature of the mixture.
9. Dust collector. The plant shall be equipped with a dust collector to waste or return uniformly to the hot elevator all or any part of the material collected as directed. The plant shall have a mixed cover and such additional housing necessary to the control of dust.
10. Truck scales. Unless an automatic batching plant with automatic printers is used, the HMA mixture shall be weighed on approved scales furnished by the Contractor or on public scales at the Contractor's expense. Scales shall be inspected for accuracy and sealed as often as the Resident Engineer deems necessary.
11. Safety requirements. Adequate and safe stairways to the mixer platform and sampling points shall be provided, and guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required. Accessibility to the top of truck bodies shall be provided by suitable device to enable the Resident Engineer to obtain sampling and mixture temperature data. Means shall be provided to raise and lower scale calibration equipment, sampling equipment, and other similar equipment between the ground and the mixer platform. All gears, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded. Ample and unobstructed passage shall be maintained at all times in and around the truck loading area.

This area shall be kept free of drippings from the mixing platform. Equipment exposed to steam or other lines carrying high temperatures, so located as to endanger workmen or create a fire hazard, shall be properly guarded or insulated as to prevent inadvertent injurious contact by workmen. Surge bins will not be allowed.

12. Testing laboratory. The Contractor or producer shall provide a testing laboratory, meeting the requirements of Illinois Division of Aeronautics' latest Policy Memorandum 96-2/2003-1, located at the IDOT internet site, for Quality Control and acceptance testing during periods of mix production, sampling, and testing, and whenever materials subject to the provision of these specifications are being supplied or tested. The laboratory shall provide adequate equipment, space, and utilities as required for the performance of the specified tests. All labs must be certified to do Marshall or Superpave mix design and testing, as required by design, having AMRL and AASHTO certification for all equipment.
13. Aggregate stockpiles. In preparation of the mineral aggregates, sufficient storage space shall be provided so that such aggregate size can be kept in separate stockpiles. The stockpile will be constructed in uniform layers by use of a clamshell or other approved methods in such manner as to prevent segregation. The use of bulldozers in stockpiling of aggregates will not be permitted. The storage yard shall be neat and orderly and the separate stockpiles readily accessible for sampling.

B. Requirements for Batching Plants.

1. Weigh box or hopper. The equipment shall include means for weighing each bin size of aggregate in a weigh box or hopper suspended on scales, ample size to hold a full batch without hand raking or running over. The assembly, consisting of the weigh box or hopper and the supporting fulcrums and knife edges, shall be so constructed that no part of the assembly will be easily thrown out of alignment or adjustment. The gates on both the bins and hoppers shall be so constructed as to prevent leakage of aggregate when closed. On manually operated plants, an interlocking device shall be provided that will prevent the opening of more than one gate at a time. On automatic plants, designed for simultaneous weighing of all sizes of aggregate, this provision shall not apply while the plant is operating under automatic control.
2. Bituminous control. The equipment used to measure the bituminous material shall be accurate to within +0.5 percent. The bituminous material bucket shall be of a non-tilting type with a loose sheet metal cover. The length of the discharge opening or spray bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer. The bituminous material bucket, its discharge valve(s), and spray bar shall be adequately heated. Steam jackets, if used, shall be efficiently drained, and all connections shall be so constructed that they will not interfere with the efficient operation of the bituminous scales. The capacity of the bituminous material bucket shall be at least 15 percent in excess of the weight of bituminous material required in any batch. The plant shall have an adequately heated, quick-acting non-drip charging valve located directly over the bituminous material bucket.

The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of bituminous material used per batch. The controls shall be constructed to lock at any dial setting and automatically reset to that reading after each additional batch of bituminous material. The dial shall be in full view of the mixer operator. The flow of bituminous material shall be automatically controlled to begin when the dry mixing period is over. All of the bituminous material required for one batch shall be discharged in not more than 15 seconds after the flow has begun. The size and spacing of the spray-bar openings shall provide a uniform application of bituminous material the full length of the mixer. The section of the bituminous line between the charging valve and the spray bar shall have a valve and outlet for checking the meter when a metering device is substituted for a bituminous material bucket.

3. Mixer. The batch mixer shall be an approved type capable of producing a uniform mixture with well-coated aggregate in the prescribed mixing time within the job mix tolerance specified. If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust. The clearance of blades from all fixed and moving parts shall not exceed 1 inch.
4. Control of mixing time. The mixer shall be equipped with an accurate time lock to control the operations of a complete mixing cycle. It shall lock the weigh-box gate after the charging of the

mixer and keep it locked until the closing of the mixer gate at the completion of the cycle. It shall lock the bituminous material bucket throughout the dry mixing period and shall lock the mixer gate throughout the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh-box gate and the introduction of bituminous material. The wet mixing period is the interval of time between the introduction of bituminous material and the opening of the mixer gate.

The timing control shall be flexible and shall be capable of settings of 5-second intervals or less throughout a 3-minute cycle. A mechanical batch counter shall be installed as a part of the timing device and shall be designed to register only completely mixed batches.

The setting of time intervals shall be at the direction of the Engineer who shall then lock the case covering the timing device until a change is made in the timing periods.

C. Requirements for Continuous Mix Plants.

1. Aggregate proportioning. The plant shall include means for accurately proportioning each size of aggregate.

The plant shall have a feeder mounted under each compartment bin. Each compartment bin shall have an accurately controlled individual gate to form an orifice for the volumetric measuring of material drawn from each compartment. The feeding orifice shall be rectangular with one dimension adjustable by positive mechanical means and provided with a lock.

Indicators shall be provided for each gate to show the respective gate opening in inches.

2. Weight calibration of aggregate feed. The plant shall include a means for calibration of gate openings by weighing test samples. Provision shall be made so that materials fed out of individual orifices may be bypassed to individual test boxes. The plant shall be equipped to conveniently handle individual test samples of not less than 200 pounds. Accurate scales shall be provided by the Contractor to weigh such test samples.
3. Synchronization of aggregate feed and bituminous material feed. A satisfactory means shall be provided to afford positive interlocking control between the flow of aggregate from the bins and the flow of bituminous material from the meter or other proportioning device. This control shall be by interlocking mechanical means or by any other positive method satisfactory to the Engineer.
4. Mixer. The plant shall include an approved continuous mixer adequately heated and capable of producing a uniform mixture within the job mix tolerances. It shall be equipped with a discharge hopper with dump gates to permit rapid and complete discharge of the mixture. The paddles shall be adjustable for angular position on the shafts and shall be reversible to retard the flow of the mix. The mixer shall have a manufacturer's plate giving the net volumetric contents of the mixer at the several heights inscribed on a permanent gauge. Charts shall be provided showing the rate of feed per minute for each aggregate used.

D. Requirements for Drum Mixers.

1. Exclusions. Replace the appropriate sections of 403-4.2.A with the following sections that apply only for drum mixers.
2. Aggregate delivery system. An automatic plant shutoff shall be provided to operate when any aggregate bin becomes empty. Provisions shall be provided for conveniently sampling the full flow of materials from each cold feed and the total cold feed. Total cold feed shall be weighed continuously. The weighing system shall have an accuracy of 0.5 percent when tested for accuracy. The plant shall provide positive weight control of the cold aggregate feed by use of a belt scale, or other appropriate device, which will automatically regulate the feed gate and permit instant correction of variations in load. The cold feed flow shall be automatically coupled with the asphalt flow to maintain the required proportions of each material. Provisions shall be made for introducing the moisture content of the cold feed aggregates into the belt weighing signal and correcting wet aggregate weight to dry aggregate weight. Screens or other suitable devices which will reject oversize particles or lumps of aggregate that have been

cemented together shall be installed in the feeder mechanism between the bins and the dryer drum.

Dry weight of the aggregate flow shall be displayed digitally in appropriate units of weight and time and totalized.

3. Bituminous material and additive delivery systems. Satisfactory means of metering shall be provided to introduce the proper amount of bituminous material and additives into the mix. Delivery systems shall prove accurate to plus or minus 1 percent when tested for accuracy. The bituminous material and additive delivery shall be interlocked with the aggregate weight. The bituminous material and additive flow shall be displayed digitally in appropriate units of volume (or weight) and time shall be totalized.
4. Thermometric equipment. A recording thermometer of adequate range shall be located to indicate the temperature of the bituminous material in storage. The plant shall also be equipped with approved recording thermometers, pyrometers, or other approved recording thermometric instruments at the discharge chute of the drum mixer.
5. Drum mixer. A drum mixer of satisfactory design shall be provided. It shall be capable of drying and heating the aggregate to the moisture and temperature requirements set forth in the paving mixture requirements and capable of producing a uniform mixture. If the quality requirements of Section 403-3.2 cannot be met, the Contractor will be required to utilize either batch or continuous mix plants.
6. Temporary storage of HMA mixture. Use of surge bins or storage bins for temporary storage of HMA mixtures will be permitted as follows:
 - a. The HMA mixture may be stored in surge bins for a period of time not to exceed 3 hours.
 - b. The HMA mixture may be stored in insulated and heated storage bins for a period of time not to exceed 12 hours, provided an inert gas atmosphere is maintained in the bin during the storage period.

If the Engineer determines that there is an excessive amount of heat loss, segregation and/or oxidation of the mixture due to temporary storage, use of surge bins or storage bins will be discontinued.

- E. Inspection of Plant. The Engineer or his/her authorized representative shall have access, at all times, to all parts of the paving plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and character of materials; and checking the temperatures maintained in the preparation of the mixtures.

403-4.3 HAULING EQUIPMENT. Trucks used for hauling HMA shall have tight, clean, smooth metal beds. To prevent the mixture from adhering to them, the beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, so that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated and covers shall be securely fastened.

All trucks used for hauling HMA shall have a tightly closing tailgate to prevent spilling of material on airfield pavements or entrance roads used for haul roads. Prior to leaving the placing site, the end of the truck beds shall be cleaned of all loose material which may spill onto the pavements and the tail gate shall be secured.

403-4.4 HMA PAVERS. HMA pavers shall be self-contained, power-propelled units with an activated screed capable of vibrating at approximately 3000 VPM or strike-off assembly, heated if necessary, and shall be capable of spreading and finishing courses of HMA which will meet the specified thickness, smoothness, and grade. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of HMA in widths shown on the plans. All width extensions required to place material shall have the same placement features and equipment functions as provided on the main body of the paver. Augers shall be extended as additional sections of screed are bolted on or automatically adjustable screeds are extended. The augers need not be extended when

the screed extensions on either side of the machine are one foot or less and the finished surface of the mat is uniform. The use of any machine obsolete in design or in poor mechanical condition will not be permitted.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed. The screed or strike-off assembly shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

The paver shall be capable of operating at forward speeds consistent with satisfactory laying of the mixture. An automatic grade control system shall be used to automatically maintain the screed elevation as specified herein. The control system shall be automatically actuated from either a reference line or surface through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface.

The controls shall be capable of working in conjunction with any of the following attachments, as specified by the Project Engineer:

- A. Ski-type device of not less than 30 feet in length or as directed by the Engineer.
- B. Taut stringline (wire) set to grade.
- C. Short ski or shoe.

403-4.5 ROLLERS. Rollers may be of the vibratory, steel wheel, or pneumatic-tired type. They shall be in good condition, capable of reversing without backlash, and operating at slow speeds to avoid displacement of the HMA. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density without detrimentally affecting the compacted material.

403-4.6 PREPARATION OF BITUMINOUS MATERIAL. The bituminous material shall be heated to the specified temperature in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. The temperature of the bituminous material delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed the applicable maximum temperature set forth in AASHTO M 320 and not be more than 25° F above the temperature of the aggregate as specified in Section 403-4.7.

403-4.7 PREPARATION OF MINERAL AGGREGATE. The aggregate for the mixture shall be dried and heated to the temperature designated by the job formula within the job tolerance specified. Immediately after heating, the base course aggregate(s) shall be screened into at least four sizes. This requirement does not apply to drum mixer plants. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregates. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

403-4.8 PREPARATION OF HMA. The aggregates and the bituminous material shall be measured or gauged and introduced into the mixer in the amount specified by the job mix formula.

The combined materials shall be mixed until a complete and uniform coating of the particles and a thorough distribution of the bituminous material throughout the aggregate are secured. Wet mixing time shall be approved by the Engineer for each plant and for each type aggregate used. Normally, the mixing time after introduction of bituminous material should not be less than 30 seconds. For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer.

$$\text{Mixing time (seconds)} = \frac{\text{Pugmill dead capacity in pounds}}{\text{Pugmill output in pounds per second}}$$

403-4.9 TRANSPORTING, SPREADING, AND FINISHING. The mixture shall be transported from the mixing plant to the point of use in vehicles conforming to the requirements of Section 403-4.3. Deliveries shall be scheduled so that spreading and rolling of all mixture prepared for one day's run can be completed during daylight, unless adequate artificial lighting is provided. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

Immediately before placing the HMA, the underlying course shall be cleared of all loose or deleterious material with power blowers, power brooms, or hand brooms as directed and a tack coat shall be applied according to Item 603.

The mix shall be placed at a temperature of not less than 275° F. Moisture content of the mix shall not exceed 0.5 percent. The Engineer may increase the asphalt content of the first lift by up to 0.3 percent when the HMA is placed directly on a prepared subgrade.

Upon arrival, the mixture shall be spread to the full width by an approved HMA paver. It shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and shall conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the HMA mat. The maximum allowed paver speed is 50 ft/min. Unless otherwise directed, placing shall begin along the centerline of areas to be paved on a crowned or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 10 feet, except where edge lanes require strips less than 10 feet to complete the area. The longitudinal joint in one layer shall offset that in the layer immediately below by at least 1 foot; however, the joint in the top layer shall be at the centerline of the pavement. Transverse joints in one layer shall be offset by at least 2 feet from transverse joints in the previous layer. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet.

The first lane of the first lift of the HMA base course shall be started at the center of the pavement with a taut stringline (guide wire) set to grade at both sides of the paver. The automatic grade control system of the paver shall be used to control grade of both sides of the paver from these reference stringlines. The grade control for the adjacent lanes of pavement shall be maintained by using a matching shoe with the previous laid pavement and a stringline on the outer edge of the next lane. A stringline and matching shoe shall be used to pave all remaining lanes of the first lift of base course. If grade is established on the first lift, succeeding lifts shall be laid with a traveling ski on both sides of the paver for the center lane with matching shoe and traveling ski on adjacent lanes. If grade is not established on the first lift, the Resident Engineer shall require taut stringline references until satisfactory grade is established.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted by hand tools.

403-4.10 COMPACTION OF MIXTURE. After spreading, the mixture shall be thoroughly and uniformly compacted with power rollers as directed by the Resident Engineer. Rolling of the mixture shall begin as soon after spreading as it will bear the roller without undue displacement or hair checking. On the first strip spread, rolling shall start at the low edge and progress toward the high edge. When adjoining lanes are placed, the same rolling procedure should be followed, but only after compaction of fresh mix at the longitudinal joint with 6 to 8 inches of the vibrating roller width overlapping on the previously compacted lane. Vibratory rollers will be operated so as to obtain a minimum of 10 impacts per foot. If a static roller is being used, 6 to 8 inches should be on the fresh mix at the longitudinal joint with the remainder of the roller width on the previously compacted lane. Rollers operated in static mode shall not exceed 3 mph(264 ft/min).

Initial rolling shall be done longitudinally. The rollers shall overlap on successive trips. Alternate trips of the roller shall be of slightly different lengths, and cross rolling shall not exceed more than one half the width of the pavement on crowned sections. The speed of the roller shall, at all times, be slow to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once by rakes and fresh mixture.

Sufficient rollers shall be used to handle the output of the plant. Rolling shall continue until all roller marks are eliminated producing a surface of uniform texture true to grade and cross section.

The Contractor shall provide, at all times, an approved Troxler (or equal) nuclear density gauge with a qualified operator to maintain quality control of the density as specified herein.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened, but excessive water will not be permitted.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with hot hand tampers.

Any mixture which becomes loose and broken, mixed with dirt, or in any way defective prior to the application of the finish coat shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This shall be done at the Contractor's expense.

403-4.11 JOINTS. The formation of all joints shall be made in such a manner as to ensure a continuous bond between old and new sections of the course. All joints shall present the same texture, density, and smoothness as other sections of the course.

The roller shall not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. In both methods all contact surfaces shall be given a tack coat of bituminous material before placing any fresh mixture against the joint.

Longitudinal joints which are irregular, damaged, or otherwise defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

All longitudinal joints constructed are to be compacted in such a manner that they are "pinched" to provide adequate density at the joint. When laying the HMA adjacent to a previously placed lane, the first pass of the roller shall be along the longitudinal joint on the fresh mixture with the compression wheel not more than 6 in. from the joint. The second pass of the roller shall overlap the longitudinal joint not more than 12 in. on the previously placed lane, after which the rolling shall proceed uniformly. Each stop shall be regulated to prevent trapping of water on the rolled surface. The steel wheeled rollers shall be operated with the compression wheels toward the direction of paving. The Contractor shall cut two cores per 2,500 tons at a random location over the longitudinal construction joint. The cores shall be delivered to the Resident Engineer for density testing and the two results will be used to obtain an average density. This average density at the joint shall be a minimum of 90%.

Density results below an average of 90% shall result in an immediate suspension of paving operations until a sufficient investigation and solution to the density problem is agreed to by the Engineer. The result of this deficiency will be a 5% penalty on all production done on the day the core was taken or represents.

403-4.12 SHAPING EDGES. While the surface is being compacted and finished, the Contractor shall carefully trim the outside edges of the pavement to the proper alignment. Edges so formed shall be beveled while still hot with the back of a rake or a smoothing iron and thoroughly compacted by tampers or by other satisfactory methods.

403-4.13 ACCEPTANCE TESTING OF HMA MIXES FOR DENSITY. (For Method I only; Under 2,500 tons/pay item) The HMA base course shall be compacted to a minimum density of 93 percent (7 percent air voids) and a maximum of 99 percent (1 percent air voids) of the Maximum Theoretical Specific Gravity (ASTM D 2041). If, during construction, the density test falls below 93 percent, additional approved rollers shall be required. Failure to achieve density within these limits shall be cause for rejection of the material, as determined by the Division.

Two random nuclear density tests shall be taken for each 500 tons of mix placed. Each nuclear density test shall be the average of five (5) nuclear tests taken as a cross-section of the pavement. The Resident Engineer shall have a nuclear gauge and qualified operator on the project when constructing this item. One random mix sample shall be taken from each 1,000 tons of mix laid, for Extraction or Ignition Oven, Maximum Specific Gravity and Air Void tests. The Resident Engineer shall have a nuclear gauge and qualified operator on the project when constructing this item.

(For Method II only; Over 2,500 tons/pay item) The HMA base course shall be compacted to a minimum density of 93 percent (7 percent air voids) and a maximum of 99 percent (1 percent air voids) of the maximum theoretical specific gravity (ASTM D 2041) and accepted by the following statistical procedure. When more than one base course mix design is used on the same project, each mix will be evaluated separately under the statistical acceptance procedure specified herein.

- A. Lot Size. The plant-produced mixture shall be tested on a lot basis. A lot shall consist of 4 sublots. End or final lots may contain between 3 and 6 sublots.

A subplot shall consist of 500 tons for each type of mix.

One density sample shall be taken randomly from each subplot. Each density sample shall be the average of two cores extracted from the sample location.

The Contractor shall take one random mix sample from each 1,000 tons of mix placed. This sample shall be split into two samples with one half tested by the Contractor for, Extraction or Ignition oven, Maximum Specific Gravity, Gradation, and Air Void tests. The other sample half shall be appropriately marked and retained by the Contractor until the Engineer requests the mix for testing or directs the Contractor in writing to dispose of the mix.

All tests shall be completed and reported to the Engineer no later than the morning of the day following production.

- B. Lot Early Termination. When less than 3 sublots are produced, such as at the end of construction of the base course or at the end of the construction season, the final subplot data shall be included with the previous lot for payment. The final lot may thus contain up to six (6) sublots.

- C. Acceptance Criteria. The acceptance of each lot of HMA base course shall be based on the **Percentage of material Within specification Limits (PWL)**. The PWL is determined using standard statistical techniques and involves the number of tests in each lot (n) and the quality indexes (Q_L is the Quality Index for the lower limit; Q_U is the Quality Index for the upper limit). The quality indexes are calculated using the following formulae:

$$Q_L = \frac{\bar{X} - 1}{S} \qquad Q_U = \frac{7 - \bar{X}}{S}$$

Where

- Q = Quality Index (lower or upper)
- \bar{X} = Mean (average) value of air voids in percent
- % Air Voids = (100 - % density)
- S = Standard Deviation of test results

For mat in-place air voids, estimate the **Percentage Within Tolerance (PWT)** for the lower and upper tolerance limits by entering TABLE 6 with Q_L and Q_U using the column appropriate to the total number (N) of core samples. The total percent of material between the lower and upper limits is defined as the **Percent Within Limits** and is calculated by the following formula:

$$PWL = [PWT(lower) + PWT(upper)] - 100$$

Each lot of bituminous material shall be accepted for 100 percent payment when the PWL equals or exceeds 90 percent. When the PWL is below 90 percent for a given lot, the lot tonnage shall be adjusted in accordance with TABLE 5.

TABLE 5 PAY ADJUSTMENT SCHEDULE ^{1/}

PWL	% ADJUSTMENT IN LOT QUANTITY
90 - 100	100
80 - 89.9	0.5 PWL + 55.0
65 - 79.9	2.0 PWL - 65.0
Below 65	^{2/}

- 1/ *All preliminary calculations used in determining the Percent Within Limits should be rounded to a minimum of four digits right of the decimal point. The PWL that is used for Table 5 purposes should then be rounded to one digit right of the decimal point to determine the percent of contract quantity to be paid. The final percent pay figure should be rounded to one digit right of the decimal point. The Resident Engineer shall notify the Contractor, in writing, of the final percent pay for each lot as soon as all lot tests are completed.*
- 2/ *The lot shall be removed and replaced. However, the Engineer may decide to accept the deficient lot. In that case, it will be paid for at 50% adjustment.*

D. Mix sampling All mix sampling shall be done on a random basis as determined by the Resident Engineer. Samples that are obviously defective or become defective prior to testing shall be discarded and retaken. New samples shall be considered as if they were initial samples.

403-4.14 SURFACE TESTS. Tests for conformity with the specified crown and grade shall be made by the Contractor immediately after initial compression. Any variation shall be corrected by the removal or addition of materials and by continuous rolling.

After the completion of final rolling, the smoothness of the base course shall be tested with a 16-foot straightedge applied parallel with the centerline. Any humps or depressions exceeding $\frac{1}{4}$ inch shall be immediately corrected by removing the defective work and replacing with new material, as directed by the Resident Engineer. This shall be done at the Contractor's expense.

The finished surfaces of HMA courses shall not vary from the gradeline, elevations, and cross sections shown on the contract drawings by more than $\frac{1}{2}$ inch. The Contractor shall correct pavement areas varying in excess of this amount by removing and replacing the defective work. Skin patching will not be permitted.

403-4.15 SAMPLING PAVEMENT. The completed pavement shall be cleaned so that no debris or dirt from coring operations is left on the surface of the pavement. Three (3) cores per lot shall be tested for thickness for any method used.

(For Method II only: Over 2,500 tons/pay item) Cores from each subplot shall be taken at random locations as outlined by the Resident Engineer. No core samples shall be taken within two feet of the edge of pavement. Any core less than 1 $\frac{1}{2}$ inch thickness shall not be used and a new location and sample shall be selected.

Core samples of approximately 4 inches in diameter, for determination of in-place air voids of the completed pavement, shall be obtained by the Contractor at no extra expense. The number and locations of the samples shall be as determined by the Resident Engineer. The Contractor shall furnish all tools, labor, and materials for sampling and replacing pavement.

All core tests necessary to determine initial conformance with specification requirements will be performed by the Resident Engineer at no cost to the Contractor.

Resampling and Retesting Resampling of a lot may be allowed only under the following conditions:

- A. The Contractor must request, in writing, the resampling and retesting of a complete lot within 48 hours after receiving the written test results of the lot from the Resident Engineer. Only one retest per lot will be permitted.
- B. If the retested lot should result in a higher "Percent Within Limits" figure than the original, based on all lot samples (original and new) the following will apply:
 1. The cost of resampling and retesting will be borne by the Engineer.
 2. The new "Percent Within Limits" figure shall be calculated using all LOT samples, (original and new) for calculating the lot payment.
- C. If the retested lot should result in a "Percent Within Limits" figure equal to or less than the original, based on all the lot samples (original and new), the following will apply:
 1. The cost of resampling and retesting will be borne by the Contractor.

2. The new "Percent Within Limits" figure shall be calculated using all lot samples, (original and new) for calculating the lot payment.
- D. Procedures in ASTM E 178 shall be used to determine outliers based on all samples taken and a 5% significance level.
- E. Results of the retesting and resampling shall be final.

METHOD OF MEASUREMENT

403-5.1 HMA base course will be measured by the ton. The tonnage shall be the weight used in the accepted pavement. No deduction will be made for the weight of bituminous material in the mixture. Plant batch weights will be accepted. Loads shall be checked periodically by weighing full truckloads of the HMA on an approved platform scale at the plant or on a commercial scale.

The Contractor shall furnish approved duplicate load tickets upon which is recorded the net weight of the HMA in each truck. The load ticket shall have sufficient space for signatures, identification of the HMA, date of delivery, and any other data which the Project Engineer may require. The Contractor shall submit one load ticket to the Project Engineer, or his/her duly authorized representative, at the plant after the truck is loaded and another load ticket to the Project Engineer, or his/her duly authorized representative, at the construction site when the truck load is incorporated into the pavement.

Measurement for payment will not be made for any HMA base course in excess of 103 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.)

BASIS OF PAYMENT

403-6.1 The quantity of HMA base course mixture measured as outlined in Section 403-5.1 shall be adjusted in accordance with Section 403-4.13 herein. Final payment shall be compensation for furnishing all materials, for all preparation, mixing, testing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

(For Method I only: Under 2,500 tons/pay item). Payment shall be based upon the acceptance test results for density. Acceptance test results not meeting the limits set forth in Section 403-4.13 shall be cause for a payment adjustment of the material placed in the failed subplot(s), as determined by the Division.

(For Method II only: Over 2,500 tons/pay item) Payment shall be calculated by multiplying the contract unit price per ton of HMA base course and the adjusted tons per lot.

The test section shall be paid for at the contract unit price per each, which price shall include the additional specified equipment, labor, Engineering, and testing time necessary to construct this item.

TABLE 6
TABLE FOR ESTIMATING PERCENTAGE OF LOT WITHIN LIMITS (PWL)
(STANDARD DEVIATION METHOD)
QUALITY INDEX (Q_L or Q_U)

PERCENT WITHIN TOLERANCE	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362	2.0656	2.0897
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630	1.8828	1.8989
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420	1.7566	1.7684
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454	1.6566	1.6655
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635	1.5721	1.5790
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4716	1.4829	1.4914	1.4981	1.5035
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265	1.4316	1.4358
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670	1.3709	1.3741
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118	1.3148	1.3172
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602	1.2623	1.2640
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115	1.2129	1.2141
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653	1.1661	1.1660
87	1.0597	1.1100	1.1173	1.1191	1.1199	1.1204	1.1208	1.1212	1.1215	1.1218
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789	1.0788	1.0787
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382	1.0377	1.0374
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990	0.9982	0.9976
83	0.9939	0.9900	0.9785	0.9715	0.9672	0.9643	0.9624	0.9610	0.9599	0.9591
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241	0.9228	0.9219
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882	0.8868	0.8857
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533	0.8517	0.8505

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192	0.8175	0.8161
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858	0.7840	0.7826
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531	0.7513	0.7498
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211	0.7192	0.7177
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896	0.6877	0.6861
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587	0.6567	0.6551
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282	0.6262	0.6247
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982	0.5962	0.5947
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686	0.5667	0.5651
70	0.6787	0.6000	0.5719	0.5583	0.5504	0.5454	0.5419	0.5394	0.5375	0.5360
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105	0.5086	0.5072
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820	0.4802	0.4787
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537	0.4520	0.4506
66	0.5563	0.4800	0.4545	0.4424	0.4354	0.4310	0.4280	0.4257	0.4241	0.4227
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4031	0.4001	0.3980	0.3964	0.3951
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705	0.3690	0.3678
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432	0.3418	0.3407
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161	0.3148	0.3137
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892	0.2880	0.2870
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624	0.2613	0.2604
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358	0.2348	0.2339
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2083	0.2084	0.2076
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829	0.1821	0.1814
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566	0.1559	0.1553
55	0.1806	0.1500	0.1406	0.1353	0.1338	0.1322	0.1312	0.1304	0.1298	0.1293
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1048	0.1042	0.1038	0.1034
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0792	0.0786	0.0781	0.0778	0.0775
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521	0.0518	0.0516
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260	0.0259	0.0258
50	0	0	0	0	0	0	0	0	0	0

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260	-0.0259	-0.0258
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521	-0.0518	-0.0516
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781	-0.0778	-0.0775
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042	-0.1037	-0.1034
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304	-0.1298	-0.1293
44	-0.2164	-0.1800	-0.1688	-0.1637	-0.1607	-0.1588	-0.1575	-0.1566	-0.1559	-0.1553
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829	-0.1821	-0.1814
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093	-0.2084	-0.2076
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358	-0.2348	-0.2339
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624	-0.2613	-0.2604
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892	-0.2880	-0.2870
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161	-0.3148	-0.3137
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432	-0.3418	-0.3407
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705	-0.3690	-0.3678
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980	-0.3964	-0.3951
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4354	-0.4310	-0.4280	-0.4257	-0.4241	-0.4227
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537	-0.4520	-0.4506
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820	-0.4802	-0.4787
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105	-0.5087	-0.5072
30	-0.6787	-0.6000	-0.5719	-0.5583	-0.5504	-0.5454	-0.5419	-0.5394	-0.5375	-0.5360
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686	-0.5667	-0.5651
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982	-0.5962	-0.5947
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282	-0.6262	-0.6217
26	-0.7904	-0.7200	-0.6920	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587	-0.6567	-0.6551
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896	-0.6876	-0.6861
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211	-0.7192	-0.7177
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531	-0.7513	-0.7498
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858	-0.7840	-0.7826
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8246	-0.8214	-0.8192	-0.8174	-0.8161
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533	-0.8517	-0.8565

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882	-0.8868	-0.8057
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241	-0.9228	-0.9219
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610	-0.9599	-0.9591
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990	-0.9982	-0.9976
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382	-1.0377	-1.0374
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789	-1.0788	-1.0787
13	-1.0597	-1.1100	-1.1173	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212	-1.1215	-1.1217
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653	-1.1661	-1.1668
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115	-1.2129	-1.2141
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602	-1.2623	-1.2640
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118	-1.3148	-1.3172
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670	-1.3709	-1.3741
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265	-1.4316	-1.4358
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4716	-1.4829	-1.4914	-1.4981	-1.5035
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635	-1.5721	-1.5790
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5872	-1.6127	-1.6313	-1.6454	-1.6566	-1.6655
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6992	-1.7235	-1.7420	-1.7566	-1.7684
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8054	-1.8379	-1.8630	-1.8828	-1.8989
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362	-2.0657	-2.0897

RIGID PAVEMENT

ITEM 501 PORTLAND CEMENT CONCRETE PAVEMENT (PLAIN AND REINFORCED)

DESCRIPTION

501-1.1. This work shall consist of pavement composed of Portland Cement concrete (PCC), or pavement composed of Portland Cement concrete with partial replacement of cement with fly ash only, or with partial replacement of cement with Ground Granulated Blast-furnace (GGBF) slag only, with or without reinforcement, constructed on a prepared subgrade, subbase, or base course in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross sections on the plans.

All references to Method I paving shall be for projects having a plan quantity less than or equal to 1,500 cubic yards of PCC material. References to Method II paving shall be for projects having a plan quantity over 1,500 cubic yards and up to 15,000 cubic yards of PCC material. References to Method III paving shall be for projects having a plan quantity over 15,000 cubic yards of PCC material.

MATERIALS

501-2.1 FINE AGGREGATE. Fine aggregate, or sand, shall be:

- A. Sand: Sand shall be the fine granular material resulting from the natural disintegration of rock. Sand produced from deposits simultaneously with and by the same operations as gravel coarse aggregate may contain crushed particles in the quantity resulting normally from the crushing and screening of oversize particles.
- B. Stone Sand: Stone sand shall be produced by washing or processing by air separation the fine material resulting from crushing rock quarried from undisturbed consolidated deposits.

The fine aggregate shall also meet the following quality requirements:

QUALITY TEST (IDOT A Quality)	PERCENT
Na ₂ SO ₄ Soundness, 5 Cycle, ASTM C 88 (Illinois Modified AASHTO T 104) Max. % Loss	10
Minus No. 200 Sieve Mat'l., ASTM C 136 (IL Mod. AASHTO T11) Max. %	3

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	3.0
Clay Lumps %	1.0
Coal, Lignite & Shells %	1.0
Conglomerate %	3.0
Other Deleterious %	3.0
<i>Total Deleterious Allowed %</i>	<i>3.0</i>

TABLE 1. GRADATION FOR FINE AGGREGATE

Sieve Designation (Square Openings)	Percentage by Weight Passing Sieves
3/8 in	100
No. 4	94-100
No. 16	45-85
No. 50	3-30
No. 100	0-10
(IDOT Gradation)	(FA-1 or FA-2)

501-2.2 COARSE AGGREGATE. Coarse aggregate shall be a non "D" cracking crushed stone as determined by the Illinois Department of Transportation.

Crushed stone. Crushed stone shall be the angular fragments resulting from crushing by, mechanical means the following types of rocks quarried from undisturbed consolidated deposits: granite and similar phanerocrystalline igneous rocks, limestone, dolomite, massive metamorphic quartzite, or similar rocks. Dolomite shall be a carbonate rock containing 11.0 percent or more magnesium oxide (MgO). Limestone shall be a carbonate rock containing less than 11.0 percent magnesium oxide (MgO).

The coarse aggregate shall also conform to the following quality requirements:

QUALITY TEST (A Quality)	PERCENT
Na ₂ SO ₄ Soundness, 5 Cycle ASTM C 88 (IL Mod. AASHTO T104) Max. % Loss	15
Los Angeles Abrasion ASTM C 131 (IL Mod. AASHTO T96) Max. % Loss	45
Minus No. 200 Sieve Mat'l., ASTM C 136 (IL Mod. AASHTO T11) Max. %	1.0 ^{1/}

DELETERIOUS TEST	PERCENT
Materials (Max. % allowed)	
Shale %	1.0
Clay Lumps %	0.25
Coal, Lignite & Shells %	0.25
Soft & Unsound %	4.0
Other Deleterious %	4.0 ^{2/}
Total Deleterious Allowed %	5.0

1/ If the material finer than the No. 200 sieve consists of dust from the fracture, essentially free from clay or silt, this percentage may be increased to 2.5%.

2/ Includes deleterious chert. Deleterious chert shall be the lightweight fraction separated in a 2.55 heavy media separation.

TABLE 2. GRADATION FOR COARSE AGGREGATE

Sieve	¾" – No. 4	1" – No. 4
2	--	--
1 ½	--	100
1	100	90-100
¾	84-100	--
½	30-60	30-60
No. 4	0-12	0-10
No. 16	--	--
IDOT Gradation	(CA-11)	(CA-07)

501-2.3 CEMENTITIOUS MATERIAL

A. **Cement.** Type I cement conforming to the requirements of ASTM C 150 shall be required. No other types of cement shall be allowed unless specified by Special Provision.

B. **Fly Ash.** The fly ash shall meet the requirements of ASTM C 618, for Class C or Class F fly ash. The fly ash source shall be approved by the Department of Transportation, and the conditions outlined by the latest edition of the policy memorandum on "Acceptance Procedure For Finely Divided Minerals Used In Portland Cement Concrete And Other Applications", as issued by IDOT Bureau of Materials and Physical Research. Fly ash shall not be used in concrete mixtures after October 15 nor before April 1 unless the Contractor demonstrates, by preparing a Test Batch, a 14-day strength no less than that obtained from the equivalent cement-only mix. The test batch for both the fly ash and cement-only mix shall be prepared in accordance with 501-3.6(A) or 501-3.6(B) and shall be constructed at no additional expense to the contract.

C. Ground Granulated Blast-furnace Slag (GGBF). The GGBF slag shall consist of the glassy granular material formed when molten blast-furnace slag is rapidly chilled, and then finely ground. Type 1S Portland blast-furnace slag cement or Type 1 (SM) slag-modified Portland cement may be used at the option of the Contractor provided the slag constituent does not exceed 25% of the mass (weight) of the Portland blast-furnace slag cement. Portland blast-furnace slag cements shall not be used after October 15th or before April 1st. The GGBF slag shall meet the standard physical and chemical requirements of AASHTO M-302, for grade 100 or grade 120 material. The GGBF slag shall meet the requirements of the Department's latest Policy Memorandum, Acceptance Procedure of Finely Divided Minerals Used in Portland Cement Concrete and Other Applications. The GGBF slag must come from one of the approved suppliers on the Department's latest Annual List of Approved Suppliers of GGBF slag for P.C. Concrete. A Job Mix Formula (JMF) with Portland cement, fly ash, and GGBF slag will not be allowed for use on the project unless approved by the Engineer. GGBF slag shall not be used in concrete mixtures when the air temperature is below 40° F. Different sources or grades of GGBF slag shall not be mixed or used alternately in the same item of construction.

501-2.4 PREMOLDED JOINT FILLER. Premolded joint filler for expansion joints shall conform to the requirements of ASTM D 1751 and shall be punched to admit the dowels where called for on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the Project Engineer. When the use of more than one piece is authorized for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the Resident Engineer.

501-2.5 JOINT SEALER. The joint sealer for the joints in the concrete pavement shall meet the requirements of Item 605.

501-2.6 STEEL REINFORCEMENT. Reinforcing shall consist of **_____ conforming to the requirements of _____.

** The Engineer shall designate one of the following:

Welded steel wire fabric	ASTM A 185
Welded deformed steel fabric	ASTM A 497
Bar mats	ASTM A 184 or A 704

Reinforcement Bars will be accepted according to the current Illinois Department of Transportation Bureau of Materials and Physical Research Policy Memorandum, "Reinforcement Bar and Dowel Bar Plant Certification Procedure".

- A. Reinforcement Bars (Non-Coated). Reinforcement bars shall be according to ASTM A 706M (A 706), Grade 420 (60) for deformed bars.
- B. Epoxy Coated Reinforcement Bars. Epoxy coated reinforcement bars shall be coated according to ASTM A 775 and the epoxy coating shall be certified under the Concrete Reinforcing Steel Institute's (CRSI) Epoxy Plant Certification Program.

501-2.7 DOWEL AND TIE BARS. Tie bars shall be deformed steel bars and conform to the requirements of ASTM A 706, except that rail steel bars, Grade 50 or 60, shall not be used for tie bars that are to be bent or re-straightened during construction. Tie bars designated as Grade 40 in ASTM A 706 can be used for construction requiring bent bars.

Dowel bars shall be plain, round steel bars conforming to the requirements of AASHTO M 227, minimum Grade 70. The finished bars shall be saw cut and free from burrs or out-of-round ends which will prevent their slipping easily in the concrete. The bars shall be epoxy coated according to the requirements of ASTM A 775.

The sleeves for dowel bars used in expansion joints shall be metal, of an approved design to cover 2 to 3 inches of the dowel, with a closed end and with a suitable stop to hold the end of the bar at least 1 inch from the closed end of the sleeve. Sleeves shall be of such design that they will not collapse during construction.

501-2.8 WATER. Water used in mixing or curing shall be as clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product as possible. If the water is of questionable quality, it shall be tested in accordance with the requirements of the applicable ASTM Part 31 tests as deemed necessary by the Engineer. Water known to be of potable quality may be used without testing.

501-2.9 COVER MATERIAL FOR CURING. Curing materials shall conform to one of the following specifications:

- A. Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C 309, Type 2.
- B. White polyethylene film for curing concrete shall conform to the requirements of ASTM C 171.
- C. White burlap-polyethylene sheeting for curing concrete shall conform to the requirements of ASTM C 171.
- D. Waterproof paper for curing concrete shall conform to the requirements of ASTM C 171.

501-2.10 ADMIXTURES. The use of any material added to the concrete mix shall be approved by the Engineer. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the Engineer may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests will be made of samples taken by the Engineer from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved. Air-Entraining Admixture and Water-Reducing Admixtures shall be required. Retarding admixtures may be used when approved by the Engineer. High Range Water Reducer may be required to achieve the workability needed by the Contractor. The use of High Range Water Reducer shall be at no extra expense to the contract. All admixtures shall be approved by the Engineer.

- A. Air Entraining Admixtures: Air-entraining admixtures approved by IDOT shall be used.
- B. Water-reducing Admixtures: Water-reducing admixtures approved by IDOT shall be used.
- C. Retarding Admixtures: Retarding admixtures approved by IDOT shall be used.
- D. High Range Water-Reducing Admixtures: High range Water-reducing admixtures approved by IDOT shall be used.

501-2.11 CHEMICAL ADHESIVES. When it is necessary to anchor dowel bars to hardened concrete, a chemical adhesive shall be used. When it is necessary to anchor tie bars to hardened concrete, a chemical adhesive or non-shrink grout shall be used. The chemical adhesive resin system shall consist of a 2-part, fast setting resin and filler/hardener, and must be on the Illinois Department of Transportation's most recent Approved Chemical Adhesives List. The non-shrink grout used must be on the Illinois Department of Transportation's most recent Approved Non-Shrink Grout List. The latest list is available through the internet at the IDOT website. The adhesive shall be mixed in accordance with the manufacturer's instructions. After drilling, the hole shall be blown out with compressed air to remove any dust. The hole shall also be dry before installing dowel or tie bars. The adhesive shall be injected into the hole in a manner that fills from the back of the hole to approximately one third of its depth. When the bar is inserted, the quantity of adhesive shall be such that a small amount leaks out of the front of the hole. The Division of Aeronautics retains the right to test the chemical adhesive or non-shrink grout used and the method of installation as a condition of approval. See Section 501-3.12 C. 1. for installation method when using non-shrink grout.

CONSTRUCTION METHODS

501-3.1 EQUIPMENT. Equipment and tools necessary for handling materials and performing all parts of the work shall be approved by the Engineer as to design, capacity, and mechanical condition. The equipment shall be at the job site before the start of construction operations for examination and approval. For Method II projects (5,000 cubic yards to 15,000 cubic yards), a central mix concrete plant

shall be required for manufacturing the concrete. For Method III projects (more than 15,000 cubic yards), an onsite central mix plant shall be required for manufacturing the concrete and shall be used exclusively for this project during any and all paving operations.

The concrete plant(s) shall conform to the following requirements or the Engineer may accept the use of a concrete plant approved by IDOT Division of Highways, in accordance with the latest IDOT Standard Specifications for Road and Bridge Construction.

A. Batching Plant and Equipment.

1. General. The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and coarse aggregate. If bulk cement is used, a bin, hopper, and separate scale for cement shall be included. The weighing hoppers shall be properly sealed and vented to preclude dusting during operation.

The batching plant shall be a computerized plant interfaced with a printer and shall print theoretical batch weights, actual batch weights, added water, tempering water, mixing time, and amount of each additive per batch. The delivery tickets must indicate the approved Aeronautics' mix design number for the project or the material shall be rejected.

2. Bins and hopper. Bins with adequate separate compartments for fine aggregate and coarse aggregate shall be provided in the batching plant. Each compartment shall discharge efficiently and freely into the weighing hopper. Means of control shall be provided so that, as the quantity desired in the weighing hopper is approached, the material may be added slowly and shut off with precision. A port or other opening for removing an overload of any one of the several materials from the hopper shall be provided. Weighing hoppers shall be constructed to eliminate accumulations of materials and to discharge fully.

Cement and fly ash or GGBF slag shall be stored in separate bins. When a manual plant is utilized, cement and fly ash or GGBF slag shall be weighed in a separate weigh hopper. When an automatic batching plant is utilized, the fly ash or GGBF slag may be weighed into the cement weigh hopper.

3. Scales. The scales for weighing aggregates and cement shall be of either the beam or the springless dial type. They shall be accurate within 0.5 percent throughout their range of use. When beam-type scales are used, provisions such as a "telltale" dial shall be made for indicating to the operator that the required load in the weighing hopper is being approached. A device on the weighing beams shall clearly indicate critical position. Poises shall be designed to be locked in any position and to prevent unauthorized change. The weight beam and "telltale" device shall be in full view of the operator while charging the hopper, and the operator shall have convenient access to all controls.

Scales shall be inspected and sealed as often as the Resident Engineer may deem necessary to assure their continued accuracy. The Contractor shall have on hand not less than ten 50-pound weights for testing of all scales when directed by the Resident Engineer.

B. Mixers.

1. General. Concrete may be mixed at a central plant, or wholly or in part in truck mixers, for Method I only. Each mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

A device accurate within 3 percent and satisfactory to the Engineer shall be provided at the mixer for determining the amount of air-entraining agent or other admixture to be added to each batch requiring such admixtures.

Mixers shall be examined daily for the accumulation of hard concrete or mortar and the wear of blades.

2. Central plant mixer. Mixing shall be in an approved mixer capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specified mixing period, and of discharging the mixture without segregation. Central plant mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed.

The water system for a central mixer shall be either a calibrated measuring tank or a meter and shall not necessarily be an integral part of the mixer. The mixers shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down $\frac{3}{4}$ inch or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

3. Truck mixers and truck agitators. Truck mixers used for mixing and hauling concrete and truck agitators used for hauling central-mixed concrete shall conform to the requirements of ASTM C 94.
4. Nonagitator trucks. Nonagitating hauling equipment shall conform to the requirements of ASTM C 94.

C. Finishing Equipment.

1. Finishing machine. The finishing machine shall be equipped with one or more oscillating-type transverse screeds.
2. Vibrators. For side-form construction, vibrators may be either the surface pan type for pavements less than 8 inches thick or the internal type with either immersed tube or multiple spuds, for the full width of the concrete slab. Pavements greater than or equal to 8 inches thick must use internal type vibrators with either immersed tubes or multiple spuds. They may be attached to the spreader or the finishing machine, or they may be mounted on a separate carriage. They shall not come in contact with the joint, load-transfer devices, subgrade, or side forms. The frequency of the surface vibrators shall not be less than 3,500 vibrations per minute, and the frequency of the internal type shall not be less than 7,000 vibrations per minute for spud vibrators. When spud-type internal vibrators are used adjacent to the side forms, they shall have a frequency of not less than 3,500 vibrations per minute. Hand vibrators should be used to consolidate the concrete along forms and other isolated areas.

For slip-form construction, the paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed. Vibration shall be accomplished by internal vibrators with a frequency range variable between 7,000 and 12,000 vibrations per minute. The amplitude of vibration shall be between 0.025 and 0.06 inches.

The number, spacing, frequency, and eccentric weights shall be provided as necessary to achieve an acceptable concrete density and finishing quality. Adequate power to operate all vibrators at the weight and frequency required for a satisfactory finish shall be available on the paver. The internal vibrators may be supplemented by vibrating screeds operating on the surface of the concrete. The frequency of surface vibrators shall not be less than 3,500 vibrations per minute. The Contractor shall furnish a tachometer or other suitable device for measuring the frequency of the vibrators. The vibrators and tamping elements shall be automatically controlled so that they shall be stopped as forward motion ceases. Any override switch shall be of the spring-loaded, momentary contact type.

3. Finishing Equipment. When the project has a concrete quantity greater than or equal to 5000 cubic yards, fogging equipment shall be available for use during the paving operations. Use of the fogging equipment shall be required when the rate of evaporation from the surface of the concrete exceeds 0.2 lb./sq. ft./hr. or as directed by the Engineer. The evaporation rate shall be determined according to the figure in the Portland Cement Association's publication titled "Design and Control of Concrete Mixtures". Refer to the section on plastic shrinkage cracking. The publication is provided in the Portland Cement Concrete Level I technician course, or it can be obtained from the Portland Cement Association. Fogging equipment shall consist of a mechanically operated pressurized system using a triple headed nozzle or an equivalent nozzle. The fogging nozzle shall

be capable of producing a fine fog mist that will increase the relative humidity of the air just above the fresh concrete surface without accumulating any water on the concrete. The fogging equipment shall be mounted on either the finishing equipment or a separate work bridge behind the finishing equipment. Controls shall be designed to vary the water flow, shall be easily accessible, and shall immediately shut off the water when in the off position. Hand held fogging equipment will not be allowed.

- D. Concrete Saw. Only self-propelled, water cooled and lubricated saws with diamond blades shall be used on this project. When sawing of joints is specified, the Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions and at the required rate. The Contractor shall provide at least one standby saw in good working order. An ample supply of saw blades shall be maintained at the site of the work at all times during sawing operations. The Contractor shall provide adequate artificial lighting facilities for night sawing. All of this equipment shall be on the job both before and at all times during concrete placement.
- E. Forms. Straight side forms shall be made of steel having a thickness of not less than 7/32 inch and shall be furnished in sections not less than 10 feet in length. Forms shall have a depth equal to the prescribed edge thickness of the concrete without horizontal joint, and a base width equal to the depth of the forms. Flexible or curved forms of proper radius shall be used for curves of 100-foot radius or less. Flexible or curved forms shall be of a design acceptable to the Engineer. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Flange braces shall extend outward on the base not less than two-thirds the height of the form. Forms with battered top surfaces and bent, twisted, or broken forms shall be removed from the work. Repaired forms shall not be used until inspected and approved. Built-up forms shall not be used, except as approved by the Engineer. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the upstanding leg shall not vary more than 1/4 inch. The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting.
- F. Slip-form Pavers. The paver shall be fully energized, self-propelled, and designed for the specific purpose of placing, consolidating, and finishing the concrete pavement, true to grade, tolerances, and cross section. It shall be of sufficient weight and power to construct the maximum specified concrete paving lane width as shown in the plans, at adequate forward speed, without transverse, longitudinal or vertical instability or without displacement. The paver should be equipped with electronic or hydraulic horizontal and vertical control devices.

The guide wires for pavers shall be set with steel standards (pins) set with weighted bases. An alternate method will be standards driven in drilled holes in the existing pavement or other methods recommended by the Contractor and approved by the Resident Engineer.

- G. Drilling Machine. The machine used for drilling the holes for dowel bars in the face of the pavement shall be capable of drilling the size and depth of holes as shown on the plans. A drill support system using the pavement surface as a reference shall be required to assure hole alignment at the specified depth of the PCC pavement. Hand-held tools will not be allowed.

501-3.2 FORM SETTING. Forms shall be set sufficiently in advance of the concrete placement to insure continuous paving operation. After the forms have been set to correct grade, the grade shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place with not less than 3 pins for each 10-foot section. A pin shall be placed at each side of every joint.

Form sections shall be tightly locked and shall be free from play or movement in any direction. The forms shall not deviate from true line by more than 1/4 inch at any joint. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the placing of concrete.

The alignment and grade elevations of the forms shall be checked and accepted by the Resident Engineer and corrections made by the Contractor before placing the concrete. When any form has been disturbed or any grade has become unstable, the form shall be reset and rechecked.

501-3.3 CONDITIONING OF UNDERLYING COURSE, SLIP-FORM CONSTRUCTION. The compacted subgrade, subbase, or base on which the pavement will be placed shall be widened approximately 3 feet to extend beyond the paving machine track to support the paver without any noticeable displacement. Any grading, compacting, or furnishing and installing stabilizing materials shall be considered incidental to the project and no separate payment will be made. After the subgrade, subbase, or base has been placed and compacted to the required density, the areas which will support the paving machine and the area to be paved shall be trimmed to the proper elevation and profile by means of a properly designed machine. The grade of the subgrade, subbase, or base on which the concrete pavement is to be placed shall be controlled automatically by steel guide wires erected and maintained by the Contractor. If the density of the base is disturbed by the trimming operations, it shall be corrected by additional compaction before the concrete is placed except when stabilized subbases are being constructed. If damage occurs on a stabilized subbase, it shall be corrected full depth by the Contractor or the damaged areas filled with concrete integral with the pavement. The grading operations should be delayed as long as possible and immediately precede paving insofar as practical, particularly if the base course is subjected to haul traffic. If traffic is allowed to use the prepared grade, the grade shall be checked and corrected immediately before the placement of concrete. The prepared grade shall be well moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from concrete. In cold weather the underlying subbase shall be protected so that it will be entirely free of frost when concrete is placed. All areas shall be constructed true to grade and acceptable to the Resident Engineer prior to paving.

501-3.4 CONDITIONING OF UNDERLYING COURSE, SIDE-FORM CONSTRUCTION. The prepared grade shall be well moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from the concrete. Ruts or depressions in the subgrade or subbase caused by hauling or usage of other equipment shall be filled as they develop with suitable material (not with concrete or concrete aggregates) and thoroughly compacted by rolling. If damage occurs to a stabilized subbase, it shall be corrected full depth by the Contractor, or the damaged areas filled with concrete integral with the pavement. A multiple-pin templet weighing not less than 1,000 pounds per 20 feet or other approved templet shall be provided and operation on the forms immediately in advance of the placing of the concrete. The templet shall be propelled only by and not attached to a tractor or other power unit. Templets shall be adjustable so that they may be set and maintained at the correct contour of the underlying course. The adjustment and operation of the templet shall be such as will provide an accurate retest of the grade before placing the concrete thereon. All excess material shall be removed. Low areas may be filled and compacted to a condition similar to that of the surrounding grade, or filled with concrete integral with the pavement. In cold weather, the underlying subbase shall be protected so that it will be entirely free from frost when the concrete is placed. The use of chemicals to eliminate frost in the underlying material will not be permitted. The templet shall be maintained in accurate adjustment, at all times by the Contractor, and should be checked daily. The work described under the foregoing paragraphs does not constitute a regular subgrading operation, but rather a final accurate check of the underlying course.

501-3.5 HANDLING, MEASURING, AND BATCHING MATERIAL. The batch plant site, layout, equipment, and provisions for transporting material shall assure a continuous supply of material to the work. Stockpiles shall be built up in layers of not more than 3 feet in thickness. Each layer shall be completely in place before beginning the next layer and shall not be allowed to "cone" down over the next lower layer. Aggregates from different sources and of different grading shall not be stockpiled together. Improperly placed stockpiles will not be accepted by the Resident Engineer. Loading out from stockpiles for purposes of batching, shall be accomplished in a systematic manner to minimize highly variable moisture contents. After concrete production begins, the Contractor shall load out of an established stockpile while the others are constructed.

Aggregates shall be handled from stockpiles or other sources to the batching plant in such manner to secure the specified grading of the material. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Rail shipments requiring more than 12 hours will be accepted as adequate binning only if the car bodies permit free drainage. The fine aggregate and coarse aggregate shall be separately weighed into hoppers in the respective amounts set by the Engineer in the job mix. Cement shall be measured by weight. Separate scales and hopper, with a device to positively indicate the complete discharge of the batch of cement into the batch box or container, shall be used for weighing the cement.

When required by the contract or when permitted, batching plants shall be equipped to proportion aggregates and bulk cement, by weight, automatically using interlocked proportioning devices of an approved type. When bulk cement is used, the Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, such as a chute, boot, or other approved device, to prevent loss of cement. The device shall be arranged to provide positive assurance of the actual presence in each batch of the entire cement content specified.

When cement is placed in contact with the aggregates, batches may be rejected unless mixed within 1 ½ hours of such contact. Batching shall be conducted so that the results in the weights of each material required will be within a tolerance of 1 percent for cement and 2 percent for aggregates.

Water may be measured either by volume or by weight. The accuracy of measuring the water shall be within plus or minus 1 percent of required amounts. Unless the water is to be weighed, the water-measuring equipment shall include an auxiliary tank from which the measuring tank shall be filled. The measuring tank shall be equipped with an outside tap and valve to provide for checking the setting, unless other means are provided for readily and accurately determining the amount of water in the tank. The volume of the auxiliary tank shall be at least equal to that of the measuring tank.

Methods and equipment for adding air-entraining agent or other admixtures to the batch, when required, shall be approved by the Engineer. All admixtures shall be measured into the mixer with an accuracy of plus or minus 3 percent. The air entrainment and water reducing admixtures shall be incorporated into the batch water stream during the batching process. Each additive must be added separately to the mixing water, with no intermixing of additives.

501-3.6 (A) PROPORTIONS. Proportioning requirements for the concrete shall be designed for a field compressive strength of 4000 psi at 28 days for pavements designed for aircraft weighing less than 60,000 pounds. The Contractor shall note that, in order to ensure that no more than 10 percent of the concrete actually produced will fall below the specified strength, the mix design average strength must be considerably higher than the specified strength. The concrete strength necessary to meet specification requirements depends on the producer's standard deviation of compressive test results and the accuracy which that value can be estimated from historic data for the same or similar materials.

Prior to the start of paving operations and after approval of all materials to be used in the manufacture of the concrete, the Contractor shall provide a preliminary mix design(s) for evaluation at the Test Batch. The mix design shall indicate saturated surface dry batch weights per cubic yard for each material component. In addition, each material component, including chemical admixtures, shall be identified by the IDOT material code number, the IDOT producer code number, and the producer name and location. Saturated surface dry and oven dry specific gravities for each proposed aggregate to be used in the mix shall be indicated on the mix design. Absorption for each proposed aggregate to be used in the mix shall be indicated on the mix design. When requested in writing by the Contractor, the Engineer will recommend a preliminary mix design for evaluation at the Test Batch. Upon completion of a successful test batch as specified herein, the Division of Aeronautics will issue a mix design approval letter with the Contractor's selected mix design(s) attached. Whether the Contractor selects his/her own mix design or chooses to use the mix design recommended by the Division, the Contractor is responsible for the mix design, as well as the manufacture and placement of the mix. The mix design shall produce a compressive strength of at least 800 psi over the specified field strength. Test specimens shall be required to verify mix design parameters. Compressive strength shall be as specified at 28 days using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

The Contractor shall be required to provide all Quality Control personnel for the manufacture of the concrete. Quality Control shall be performed in accordance with the Division of Aeronautics' Policy Memorandum No. 87-3, Mix Design, Test Batch, Quality Control, and Acceptance Testing of PCC Pavement Mixture. The use of a microwave moisture probe or equal for purposes of determining the percent moisture in the fine aggregate may be allowed for Method I and II paving, when approved by the Engineer, and shall be required for all Method III paving. The microwave moisture probe must be interfaced with the plant batching computer. The percent of free moisture (Above Saturated Surface Dry Moisture) and the adjusted fine aggregate batch weight must be determined by the microwave moisture probe and indicated on the computer screen for each batch. As part of the approval process, the Contractor shall obtain a minimum of 10 samples of fine aggregate within the proximity at which the probe is fixed below the fine aggregate bin. The Contractor shall determine the percent moisture (Above Saturated Surface Dry Moisture) by the Adjusted Oven Dry Method, the Chapman Flask, the Pycnometer

Jar Method or the Dunagan Method for each sample. A correlation shall then be established between the Contractor's results and the corresponding percent moisture indicated by the microwave moisture probe for each sample taken. If necessary, adjustments to the microwave probe should be made so that the correct percent moisture is utilized during the batching process. The calibration procedure described herein shall be completed in the presence of and witnessed by the Resident Engineer.

For each day of mix production, the Proportioning Technician shall perform a minimum of two (2) gradation analyses and two (2) moisture tests on each aggregate used. The free moisture for each aggregate shall be determined daily and completed on form AER-6. From this data, the JMF shall be adjusted for moisture and verified on form AER-12. The Proportioning Technician and Resident Engineer shall complete form AER-4 a minimum of two (2) times each day of production, to be done on random loads and independent of each other. The Proportioning Technician shall complete form AER-7 for each paving day. All forms are to be submitted to the Resident Engineer before payment can be made.

The minimum cement content shall be maintained to produce concrete of suitable durability and workability. The maximum water-cement ratio specified for concrete shall not be exceeded. Entrained air shall be required to increase durability and provide workability.

For slip-form construction, a high degree of uniformity in the plastic concrete is required. Caution should be exercised in establishing the air-entrainment percentage, as excessive air entrainment will aggravate edge slumping and insufficient air entrainment will result in poor concrete durability. Batches with slump in excess of 1 ½ inches shall be wasted. Some edge slump of the wet concrete behind the slip form on the paving machine will occur, even with low slump concrete. This may continue, though very slowly, until initial set has taken place. Provision for adequate compensating adjustment in the slip form and in the final screed must be incorporated in the paver.

The cement content specified in this paragraph is a minimum. If the results of the Test Batch strength testing fail to meet the requirements of the contract, the Contractor may have to increase the cement content, select different material sources, or some combination of these or other mix design adjustments. Additional costs for increased cement or other adjustments necessary to produce an acceptable mix shall be borne by the Contractor. The cement content shall not be less than 6.5 sacks (611 lbs.) per cubic yard. However, if the Contractor can demonstrate that the selected course aggregate gradation has a minimum of 50 percent passing the ½ inch sieve, the minimum cement content may be reduced to 6.25 sacks (588 lbs.) per cubic yard. As a minimum for approval, the Contractor shall provide 10 recent gradation tests on aggregate taken from the proposed course aggregate stockpile intended for use in the project. All ten gradation test results must meet the 50% passing the ½ inch sieve requirement in addition to meeting the rest of the CA-7 or CA-11 specification. In order to achieve 50% passing the ½ inch sieve, combining aggregate sizes will be permitted. Two or more aggregate sizes consisting of IDOT gradations CA-7, CA-11, CA-13, CA-14, and CA-16 of the same coarse aggregate quality requirements specified under section 501-2.2 may be combined. However a CA-7 or CA-11 shall be included in the blend. The mathematically combined coarse aggregate gradation shall be determined in the same manner as for a coarse and fine aggregate blend, which is discussed in the most current edition of the "Portland Cement Concrete Level II Technician Course" manual. Each size shall be stored separately and care shall be taken to prevent them from being mixed until they are ready to be proportioned. The Contractor will be permitted to mix more than two sizes of coarse aggregate, provided the separate sizes selected and the proportions used in combining them are approved by the Engineer and that separate compartments are provided to proportion each size.

When Class C fly ash is used, the amount of cement replaced shall not exceed 20% by mass (weight) or 122 pounds, at a replacement ratio of 1.25 : 1 (fly ash: cement replaced). For Class C fly ash, and at the request of the Contractor, the minimum replacement ratio may be reduced to 1:1, if the fly ash calcium oxide is 18 percent or greater, the fly ash loss on ignition is less than 2.0 percent, and a water-reducing or high range water-reducing admixture is used. If class F fly ash is used, the amount of cement replaced shall not exceed 15 percent by mass (weight), and the replacement ratio (fly ash: cement replaced) shall be a minimum of 1.5 : 1. Fly ash and cement weights will be rounded up to the nearest 5 lbs. in the mix design. For cement-fly ash mixes, the water/cement ratio will be based on the total cementitious material contained in the mix. The amount of cement replaced by GGBF slag shall not exceed 25 percent by mass (weight). The replacement ratio (GGBF slag: cement replaced) shall be a 1:1 replacement for Grade 100 or Grade 120. For cement-GGBF slag mixes, the water/cement ratio will be based on the total cementitious material contained in the mix. Measurements of GGBF slag and cement shall be rounded up to the nearest 5 lbs. in the mix design.

Air-entraining admixture shall be added in such a manner that will insure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The percentage of air entrainment in the mix shall be 6 percent plus or minus 1 ½ percentage points. Air content shall be determined by testing in accordance with ASTM C 231.

Test Batch. At least 28 days prior to the start of production the Contractor and/or producer shall prepare a Test Batch under the direction of the Engineer. The Test Batch shall be prepared at the concrete plant proposed for use in the production of the concrete mix for the project and shall be in accordance with the approved Job Mix Formula (JMF). When approved by the Engineer, the Test Batch may be prepared at a different plant provided that the same materials specified in the JMF are used. In addition, the proposed Test Batch plant must meet the plant requirements specified herein. If more than one JMF is required as a result of different sources of materials, additional test batches shall be conducted for each JMF as outlined herein. The cost for each additional test batch shall be borne by the Contractor. The plant shall have been surveyed and approved by the Engineer prior to preparation of the Test Batch. The Contractor shall provide all Quality Control for production of the concrete. For Method III paving, the Contractor shall have his/her Quality Control Officer and a representative of the Contractor familiar with the paving operation present at the test batch preparation. The Test Batch shall be prepared as follows:

A. Proportioning. Prior to preparation of the mix, the Proportioning Technician shall perform a minimum of two (2) gradation analyses and two (2) moisture tests on each aggregate used. In order to obtain representative aggregate moisture, the Contractor shall construct a small stockpile for both the coarse and fine aggregates. The small stockpiles shall contain enough material to manufacture as many test batches as the Contractor decides to make. An aggregate sample shall be obtained from each small stockpile using proper aggregate sampling techniques for obtaining a representative sample. The free moisture for each aggregate shall be determined. From this data, the JMF shall be adjusted for moisture, as outlined in IDOT's Manual of Instructions for Concrete Proportioning and Testing.

B. Preparation of the Mix:

1. Prepare a Test Batch that is at least one-half (1/2) the manufacturer's rated capacity of the mixing drum (in cubic yards). The Test Batch shall be prepared in accordance with the approved JMF, adjusted for moisture.

2. Mixing requirements shall be:

a. Central Mix Plant: Minimum of 90 seconds. If transit mixer trucks are used to transport the mix, the mix shall be agitated, after mixing, at 2-5 RPM for the approximate travel time anticipated between batching at the plant and deposit of the concrete in the forms.

If non-mixing trucks are used to transport the mix, the mix shall remain in the central mixer with no mixing or agitation for the approximate time anticipated from when mixing is complete to deposit of the concrete in the forms.

b. Transit Mix Plant: 70-100 Revs. @ 5-16 RPM. After initial mixing, agitate mix at 2-5 RPM for the approximate time anticipated from when mixing is complete to deposit of the concrete in the forms. This plant option is not allowed for Method III paving and only allowed for Method II paving if the plan quantity is less than 5,000 cubic yards of concrete.

3. Air, Slump, and Water/Cement Ratio (w/c): After aging, the air content of the concrete shall be 6.0% plus or minus 1.5%. The slump and water/cement ratio shall not exceed the following criteria as outlined by TABLE 1 below:

TABLE 1: 4000 PSI CONCRETE

<u>CONCRETE TEMPERATURE</u>	<u>CEMENT MIX</u>		<u>CEMENT FLY ASH MIX</u>		<u>IDOT RECOMMENDED DOSAGE OF WATER REDUCER</u>
	<u>MAX W/C</u>	<u>MAX SLUMP</u>	<u>MAX W/C</u>	<u>MAX SLUMP</u>	
50-60°F	0.44	4 IN.	0.40	4 IN.	1 TIMES
61-70°F	0.44	4 IN.	0.40	4 IN.	1 TIMES
71-80°F	0.44	3 IN.	0.41	3 IN.	1 TIMES
81-90°F	0.44	2 IN.	0.42	2 IN.	*1 TIMES
91-95°F	0.44	1.5 IN.	0.42	1.5 IN.	1.5 TIMES

** At 85°F and above, the dosage of water reducer shall be 1.5 times the recommended dosage. Concrete produced at these temperatures may require the use of Mid Range Water Reducers and/or Retarding admixtures. If shrinkage cracks should develop at any time, the paving operation shall cease until the condition is corrected by the Contractor. This may require the use of additional admixtures and/or the use of a fog sprayer system on the finishing equipment. Paving operations shall not resume until the Contractor's proposed solution(s) are accepted by the Division.*

NOTE: The actual water/cement ratio established at the time of the Test Batch shall be the maximum permitted for production concrete. The maximum slump shall be established from TABLE 1 using the actual temperature of the concrete at the time of production. This slump may be exceeded to a maximum limit of 4 inches when approved by the Engineer and by the use of superplasticizer only.

Once the concrete conforms to TABLE 1, cylinders shall be made for testing at 3,7,14, and 28 days. With permission from the Engineer at the time of the Test Batch, the maximum slump may be exceeded provided the maximum allowable water-cementitious ratio is not exceeded. In addition, the Contractor should be aware that if the Test Batch concrete does not obtain 4,800 psi at 28 days, a new Test Batch shall be required at the Contractor's expense.

4. The Proportioning Technician shall complete Form AER M-7, Plastic, Concrete Air, Slump and Quantity and Form AER M-6, Concrete Moisture Determination (Adjusted Oven Dry Method), to be given to the Resident Engineer after completion of the Test Batch.
5. The Resident Engineer shall complete Form AER M-4, Concrete Plant Production, Mix Verification.
6. The concrete test cylinders shall be tested at 3, 7, 14 and 28 days to establish a growth curve of concrete strength vs. age. The compressive strength shall be at least 800 psi, over the specified strength, at 28 days.

The Test Batch shall be paid for as noted under Section 501-5.1. Only one Test Batch will be paid for per project. Any additional Test Batches shall be paid for by the Contractor.

The Contractor shall provide complete facilities for the curing of the cylinders on the job site. Curing facilities for test cylinders shall include, but not be limited to, furnishing and operating water tanks equipped with temperature control devices that will automatically maintain the temperature of the water as specified in ASTM C 31. Submersible heaters are acceptable provided the above mentioned criteria are achieved.

501-3.6 (B) PROPORTIONS. Proportioning requirements for concrete shall be designed for a field flexural strength of 650 psi at 28 days for pavements designed for aircraft weighing 60,000 pounds or more. The Contractor shall note that, in order to ensure that not more than 10 percent of the concrete actually produced will fall below the specified strength, the mix design average strength must be higher than the specified strength. The concrete strength necessary to meet specification requirements depends on the producer's standard deviation of flexural test results and the accuracy which that value can be estimated from historic data for the same or similar materials.

Prior to the start of paving operations and after approval of all materials to be used in the manufacture of the concrete, the Contractor shall provide a preliminary mix design(s) for evaluation at the Test Batch. The mix design shall indicate saturated surface dry batch weights per cubic yard for each material component. In addition, each material component, including chemical admixtures, shall be identified by the IDOT material code number, the IDOT producer code number, and the producer name and location. Saturated surface dry and oven dry specific gravities for each proposed aggregate to be used in the mix shall be indicated on the mix design. Absorption for each proposed aggregate to be used in the mix shall be indicated on the mix design. When requested in writing by the Contractor, the Engineer will recommend a preliminary mix design for evaluation at the Test Batch. Upon completion of a successful test batch as specified herein, the Division of Aeronautics will issue a mix design approval letter with the Contractor's selected mix design(s) attached. Whether the Contractor selects his/her own mix design or chooses to use the mix design recommended by the Division, the Contractor is responsible for the mix design, as well as the manufacture and placement of the mix. The mix design shall produce a flexural strength of at least 100 psi over the specified field strength. Test specimens shall be required to verify mix design parameters. Flexural strength shall be as specified at 28 days using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 78. For side form concrete, superplasticizer shall be required.

The Contractor shall be required to provide all Quality Control personnel for the manufacture of the concrete. Quality Control shall be performed in accordance with the Division of Aeronautics' Policy Memorandum No. 87-3, Mix Design, Test Batch, Quality Control, and Acceptance Testing of PCC Pavement Mixture. The use of a microwave moisture probe for purposes of determining the percent moisture in the fine aggregate may be allowed when approved by the Engineer. The microwave moisture probe must be interfaced with the plant batching computer. The percent of free moisture (Above Saturated Surface Dry Moisture) and the adjusted fine aggregate batch weight must be determined by the microwave moisture probe and indicated on the computer screen for each batch. As part of the approval process, the Contractor shall obtain a minimum of 10 samples of fine aggregate within the proximity at which the probe is fixed below the fine aggregate bin. The Contractor shall determine the percent moisture (Above Saturated Surface Dry Moisture) by the Adjusted Oven Dry Method, the Chapman Flask, the Pycnometer Jar Method, or the Dunagan Method for each sample. A correlation shall then be established between the Contractor's results and the corresponding percent moisture indicated by the microwave moisture probe for each sample taken. If necessary, adjustments to the microwave probe should be made so that the correct percent moisture is utilized during the batching process. The calibration procedure described herein shall be completed in the presence of, and witnessed by the Resident Engineer.

For each day of mix production, the Proportioning Technician shall perform a minimum of two (2) gradation analyses and two (2) moisture tests on each aggregate used. The free moisture for each aggregate shall be determined daily and completed on form AER-6. From this data, the JMF shall be adjusted for moisture and verified on form AER-12. The Proportioning Technician and Resident Engineer shall complete form AER-4 a minimum of two (2) times each day of production, to be done on random loads and independent of each other. The Proportioning Technician shall complete form AER-7 for each paving day. All forms are to be submitted to the Resident Engineer before payment can be made.

The minimum cement content shall be maintained to produce concrete of suitable durability and workability. The maximum water-cement ratio specified for concrete shall not be exceeded. Entrained air shall be required to increase durability and provide workability.

For slip-form construction, a high degree of uniformity in the plastic concrete is required. Caution should be exercised in establishing the air-entrainment percentage, as excessive air entrainment will aggravate edge slumping and insufficient air entrainment will result in poor concrete durability. Batches with slump in excess of 1 ½ inches shall be wasted. Some edge slump of the wet concrete behind the slip form on the paving machine will occur, even with low slump concrete. This may continue, though very slowly, until initial set has taken place. Provision for adequate compensating adjustment in the slip form and in the final screed must be incorporated in the paver.

The cement content specified in this paragraph is a minimum. If the results of the Test Batch strength testing fail to meet the requirements of the contract, the Contractor may have to increase the cement content, select different material sources, or some combination of these or other mix design adjustments. Additional costs for increased cement or other adjustments necessary to produce an acceptable mix shall be borne by the Contractor. The cement content shall not be less than 6.5 sacks (611 lbs.) per cubic yard. However, if the Contractor can demonstrate that the selected course aggregate gradation has a minimum of 50 percent passing the ½ inch sieve, the minimum cement content may be reduced to 6.25 sacks (588

lbs.) per cubic yard. As a minimum for approval, the Contractor shall provide 10 recent gradation tests on aggregate taken from the proposed course aggregate stockpile intended for use in the project. All ten gradation test results must meet the 50% passing the ½ inch sieve requirement in addition to meeting the rest of the CA-7 or CA-11 specification. In order to achieve 50% passing the ½ inch sieve, combining aggregate sizes will be permitted. Two or more aggregate sizes consisting of IDOT gradations CA-7, CA-11, CA-13, CA14, and CA-16 of the same coarse aggregate quality requirements specified under section 501-2.2 may be combined. However a CA-7 or CA-11 shall be included in the blend. The mathematically combined coarse aggregate gradation shall be determined in the same manner as for a coarse and fine aggregate blend, which is discussed in the most current edition of the "Portland Cement Concrete Level II Technician Course" manual. Each size shall be stored separately and care shall be taken to prevent them from being mixed until they are ready to be proportioned. The Contractor will be permitted to mix more than two sizes of coarse aggregate, provided the separate sizes selected and the proportions used in combining them are approved by the Engineer and that separate compartments are provided to proportion each size.

When Class C fly ash is used, the amount of cement replaced shall not exceed 20% by mass (weight) or 122 pounds, at a replacement ratio of 1.25 : 1 (fly ash: cement replaced). For Class C fly ash, and at the request of the Contractor, the minimum replacement ratio may be reduced to 1:1, if the fly ash calcium oxide is 18 percent or greater, the fly ash loss on ignition is less than 2.0 percent, and a water-reducing or high range water-reducing admixture is used. If class F fly ash is used, the amount of cement replaced shall not exceed 15 percent by mass (weight), and the replacement ratio (fly ash: cement replaced) shall be a minimum of 1.5 : 1. Fly ash and cement weights will be rounded up to the nearest 5 lbs. in the mix design. For cement-fly ash mixes, the water/cement ratio will be based on the total cementitious material contained in the mix. The amount of cement replaced by GGBF slag shall not exceed 25 percent by mass (weight). The replacement ratio (GGBF slag: cement replaced) shall be a 1:1 replacement for Grade 100 or Grade 120. For cement-GGBF slag mixes, the water/cement ratio will be based on the total cementitious material contained in the mix. Measurements of GGBF slag and cement shall be rounded up to the nearest 5 lbs. in the mix design.

Air-entraining admixture shall be added in such a manner that will insure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The percentage of air entrainment in the mix shall be 6 percent plus or minus 1 ½ percentage points. Air content shall be determined by testing in accordance with ASTM C 231.

Test Batch. At least 28 days prior to the start of production the Contractor and/or producer shall prepare a Test Batch under the direction of the Resident Engineer. The Test Batch shall be prepared at the concrete plant proposed for use in the production of the concrete mix for the project and shall be in accordance with the approved Job Mix Formula (JMF). When approved by the Engineer, the Test Batch may be prepared at a different plant provided that the same materials specified in the JMF are used. In addition, the proposed Test Batch plant must meet the plant requirements specified herein. If more than one JMF is required as a result of different sources of materials, additional test batches shall be conducted for each JMF as outlined herein. The cost for each additional test batch shall be borne by the Contractor. The plant shall have been surveyed and approved by the Engineer prior to preparation of the Test Batch. As required by these Special Provisions the Contractor shall provide all Quality Control for production of the concrete. The Contractor shall have his/her Quality Control Officer and a representative of the Contractor familiar with the paving operation, present at the test batch preparation. The Test Batch shall be prepared as follows:

- A. Proportioning. Prior to preparation of the mix, the Proportioning Technician shall perform a minimum of two (2) gradation analyses and two (2) moisture tests on each aggregate used. In order to obtain representative aggregate moisture, the Contractor shall construct a small stockpile for both the coarse and fine aggregates. The small stockpiles shall contain enough material to manufacture as many test batches as the Contractor decides to make. An aggregate sample shall be obtained from each small stockpile using the proper aggregate sampling techniques for obtaining a representative sample. The free moisture for each aggregate shall be determined. From this data, the JMF shall be adjusted for moisture, as outlined in IDOT's Manual of Instructions for Concrete Proportioning and Testing.

B. Preparation of the Mix:

1. Prepare a minimum Test Batch that is at least one-half (1/2) the manufacturer's rated capacity of the mixing drum (in cubic yards). The Test Batch shall be prepared in accordance with the approved JMF, adjusted for moisture.
2. Mixing requirements shall be:
 - a. Central Mix Plant: Minimum of 90 seconds. If transit mixer trucks are used to transport the mix, the mix shall be agitated, after mixing, at 2-5 RPM for the approximate travel time anticipated between batching at the plant and deposit of the concrete in the forms.

If non-mixing trucks are used to transport the mix, the mix shall remain in the central mixer with no mixing or agitation for the approximate time anticipated from when mixing is complete to deposit of the concrete in the forms.
 - b. Transit Mix Plant: 70-100 Revs. @ 5-16 RPM. After initial mixing, agitate mix at 2-5 RPM for the approximate time anticipated from when the water contacts the cement and deposit of the concrete in the forms. This plant option is not allowed for Method III paving and only allowed for Method II paving if the plan quantity is less than 5,000 cubic yards of concrete.
3. Air, Slump, and Water/Cement Ratio (w/c): After aging, the air content of the concrete shall be 6.0% plus or minus 1.5%. The slump and water/cement ratio shall not exceed the following criteria as outlined by TABLE 2 below:

TABLE 2: 650 PSI CONCRETE

<u>CONCRETE TEMPERATURE</u>	<u>CEMENT MIX</u>		<u>CEMENT FLY ASH MIX</u>		<u>IDOT RECOMMENDED DOSAGE OF WATER REDUCER</u>
	<u>MAX W/C</u>	<u>MAX SLUMP</u>	<u>MAX W/C</u>	<u>MAX SLUMP</u>	
50-60°F	0.42	3 IN.	0.37	3 IN.	1 TIMES
61-70°F	0.42	2 IN.	0.37	2 IN.	1 TIMES
71-80°F	0.42	1.5 IN.	0.38	3 IN.	1 TIMES
81-90°F	0.42	1 IN.	0.39	2 IN.	*1 TIMES
91-95°F	0.42	7/8 IN.	0.39	1.5 IN.	1.5 TIMES

** At 85°F and above, the dosage of water reducer shall be 1.5 times the recommended dosage. Concrete produced at these temperatures may require the use of Mid Range Water Reducers and/or Retarding admixtures. If shrinkage cracks should develop at any time, the paving operation shall cease until the condition is corrected by the Contractor. This may require the use of additional admixtures and/or fog sprayer system on the finishing equipment. Paving operations shall not resume until the Contractor's proposed solution(s) are accepted by the Division.*

NOTE: The actual water/cement ratio established at the time of the Test Batch shall be the maximum permitted for production concrete. The maximum slump shall be established from TABLE 2 using the actual temperature of the concrete at the time of production. This slump may be exceeded to a maximum limit of 4 inches when approved by the Engineer and by the use of superplasticizer only.

Once the concrete conforms to TABLE 2, beams shall be made for testing at 3, 7, 14, and 28 days. With permission from the Engineer at the time of the Test Batch, the maximum slump may be exceeded, provided the maximum allowable water/cementitious ratio is not exceeded. In addition, the Contractor should be aware that if the Test Batch concrete does not obtain 750 psi at 28 days, a new Test Batch shall be required at the Contractor's expense.

4. The Proportioning Technician shall complete Form AER M-7, Plastic Concrete Air, Slump and Quantity and Form AER M-6, Concrete Moisture Determination (Adjusted Oven Dry Method), to be given to the Resident Engineer after completion of the Test Batch.

5. The Resident Engineer shall complete Form AER M-4, Concrete Plant Production, Mix Verification.
6. The concrete test beams shall be tested at 3, 7, 14 and 28 days to establish a growth curve of concrete strength vs. age. The flexural strength shall be at least 100 psi over the specified strength at 28 days. A set of cylinders shall be tested at 28 days.

The Test Batch shall be paid for as noted under Section 501-5.1. Only one Test Batch will be paid for per project. Any additional Test Batches shall be paid for by the Contractor.

The Contractor shall provide complete facilities for the curing of the beams on the job site. Curing facilities for test beams shall include, but not be limited to, furnishing and operating water tanks equipped with temperature control devices that will automatically maintain the temperature of the water as specified in ASTM C 31. Submersible heaters are acceptable provided the above criteria can be achieved.

501-3.7 FIELD TEST SPECIMENS. Concrete samples shall be taken in the field by the Contractor to determine consistency (slump), air content, and strength of the concrete. A minimum of one random flexural strength sample or one random compressive strength sample shall be taken for every 300 cubic yards for acceptance testing at 28 days. A sample shall consist of two (2) beam breaks for flexural strength testing or two (2) cylinders for compression strength testing. Additional beams or cylinders shall be taken for testing at 3, 7, and 14 days until such time as the Engineer is satisfied that the concrete production, sampling and testing is under control. (The 3, 7, and 14-day test results will be used to monitor strength growth and quality control.) All samples shall be prepared in accordance with ASTM C 31 and tested in accordance with either ASTM C 39 or ASTM C 78. For flexural strength testing under ASTM C 78, a Rainhart Series 416, Recording Beam Tester or equivalent, shall be required and supplied by the Contractor and maintained on site. For Method II paving, a backup Rainhart Beam Tester shall be required and supplied by the Contractor and maintained on site. For Method III paving, three (3) Rainhart Beam Testers shall be required and supplied by the Contractor and maintained on site. All acceptance testing shall be done in the presence of the Contractor or his/her representative.

501-3.8 MIXING CONCRETE. The concrete may be mixed at the work site in 1) a central mix plant or 2) in truck mixers, when a transit mix plant is approved for use. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are emptied into the drum. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements of ASTM C 94, and in accordance with Policy Memo 87-3. The mixing trucks shall all be IDOT-approved and the Contractor shall supply evidence of this acceptance to the Engineer upon request.

The mixing time shall be 90 seconds. However, the Contractor may at his/her own expense elect to perform a mixer performance test in accordance with Illinois Division of Aeronautics' Policy Memorandum 95-1, Field Test Procedures for Mixer Performance and Concrete Uniformity Tests. The test shall be conducted after issuance of the notice to proceed and in the presence of the Engineer. A maximum of two mixing times shall be considered by the Division. Mixing time ends when the discharge chute opens. Transfer time in multiple drum mixers is included in mixing time. The contents of an individual mixer drum shall be removed before a succeeding batch is emptied therein.

The mixer shall be operated at the drum speed as shown on the manufacturer's nameplate on the approved mixer. Any concrete mixed less than the specified time shall be discarded at the Contractor's expense. The volume of concrete mixed per batch shall not exceed the mixer's nominal capacity in cubic feet, as shown on the manufacturer's standard rating plate on the mixer. An overload up to 10 percent above the mixer's nominal capacity may be permitted provided concrete test data for segregation and uniform consistency are satisfactory, and provided no spillage of concrete takes place. The batch shall be charged into the drum so that a portion of the mixing water shall enter in advance of the cement and aggregates. The flow of water shall be uniform, and all water shall be in the drum by the end of the first 15 seconds of the mixing period. The throat of the drum shall be kept free of such accumulations as may restrict the free flow of materials into the drum.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or nonagitating trucks. The time elapsing from the time water is added to the mix until the concrete is deposited in place at the work site shall not exceed 30 minutes when the concrete is hauled in nonagitating trucks, nor 60 minutes when the concrete is hauled in truck mixers or truck agitators. When a retarding admixture is approved and being used as part of the approved Job Mix Formula, the time

elapsed from the time the water is added to the mix until the concrete is deposited in place at the work site shall not exceed 60 minutes when the concrete is hauled in nonagitating trucks, nor 90 minutes when the concrete is hauled in truck mixers or truck agitators. Retempering concrete by adding water or by other means will not be permitted.

501-3.9 LIMITATIONS OF MIXING. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

Unless authorized in writing by the Engineer, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40 degrees F and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35 degrees F.

When concreting is authorized during cold weather, the aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials. Unless otherwise authorized, the temperature of the mixed concrete shall not be less than 50 degrees F at the time of placement in the forms.

If the air temperature is 35 degrees F or less at the time of placing concrete, the Engineer may require the water and/or the aggregates to be heated to not less than 70 degrees F nor more than 150 degrees F. Concrete shall not be placed on frozen subgrade nor shall frozen aggregates be used in the concrete.

During periods of warm weather when the maximum daily air temperature exceeds 85 degrees F, the following precautions should be taken. The forms and/or the underlying material shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90 degrees F. The aggregates and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum. When the temperature of the plastic concrete reaches 85° F, the Contractor shall make adjustments to maintain the required slump. In no case shall the addition of water raise the water/cementitious ratio above the approved JMF water/cementitious ratio. The Contractor may have to utilize water reducing and/or retarding admixtures to control slump and initial set. The dosage rate of admixtures shall be determined by the Contractor and approved by the Engineer. No plastic concrete shall be placed at mix temperatures above 90° F, unless permitted by the Engineer. When the temperature of the plastic concrete reaches 85° F, an approved retarding admixture shall be used. Any concrete which in the opinion of the Engineer has a significant amount of surface distress shall be removed and replaced at no extra expense to the contract. Repair of any damaged concrete will be allowed only when approved by the Engineer.

501-3.10 PLACING CONCRETE. Hauling equipment or other mechanical equipment may be permitted on adjoining previously constructed pavement when the concrete strength reaches a compressive strength of 3,500 psi or a flexural strength of 550 psi based on field cured specimens. Subgrade and subbase planers, concrete pavers and concrete finishing equipment may be permitted to ride on the edges of previously constructed pavement when concrete has attained a minimum compressive strength of 3,000 psi or a flexural strength of 400 psi. The Contractor shall take additional concrete cylinders or beams as required to demonstrate the concrete strength at his/her own expense. If equipment causes any damage to previously constructed pavements, operations shall cease until the Contractor can satisfy the Resident Engineer that no damage shall occur. Any damage caused by these operations shall be repaired to the satisfaction of the Engineer.

A. Side-form Method. For the side-form method, the concrete shall be deposited on the moistened grade to require as little rehandling as possible. Unless truck mixers, truck agitators, or nonagitating hauling equipment are equipped with means for discharge of concrete without segregation of the materials, the concrete shall be unloaded into an approved spreading device and mechanically spread on the grade to prevent segregation of the materials. Placing shall be continuous between transverse joints without the use of intermediate bulkheads.

Necessary hand spreading shall be done with shovels, not rakes. Workmen shall not be allowed to walk in the freshly mixed concrete with boots or shoes coated with earth or foreign substances.

Concrete shall be thoroughly consolidated against and along the faces of all forms and along the full length and on both sides of all joint assemblies by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact with a joint assembly, the grade, or a side form. In no case shall the vibrator be operated longer than 15 seconds in any one location, nor shall the vibrators be used to move the concrete.

Concrete shall be deposited as near to expansion and contraction joints as possible without disturbing them but shall not be dumped from the discharge bucket or hopper onto a joint assembly unless the hopper is well centered on the joint assembly.

Should any concrete materials fall on or be worked into the surface of a completed slab, they shall be removed immediately by approved methods.

- B. Slip-form Method. For the slip-form method, the concrete shall be placed with an approved crawler-mounted, slip-form paver designed to spread, consolidate, and shape the freshly placed concrete in one complete pass of the machine so that a minimum of hand finishing will be necessary to provide a dense and homogeneous pavement in conformance with requirements of the plans and specifications. The concrete should be placed directly on top of the joint assemblies to prevent them from moving when the paver moves over them. Side forms and finishing screeds shall be adjustable to the extent required to produce the specified pavement edge and surface tolerance. The side forms shall be of dimensions, shape, and strength to support the concrete laterally for a sufficient length of time so that no appreciable edge slumping will occur. Final finishing shall be accomplished while the concrete is still in the plastic state.

It is the intent of the specification to produce a high quality, dense, long lasting, and smooth pavement suitable for the high speed operations of roughness-sensitive heavy jet aircraft. This requires that all joints, and particularly all longitudinal joints, meet the specified tolerance throughout their length. The Engineer will designate the paving lanes in an apron, taxiway, or the outer runway paving lanes to be used for the initial paving operations. No edge slump will be permitted. In the event that slumping or sloughing occurs behind the paver or if there are any other structural or surface defects which, in the opinion of the Engineer, cannot be corrected within permissible tolerances, the Engineer may halt paving operations until proper adjustment of the equipment or procedures have been made. In the event that satisfactory procedures and pavement are not achieved to the satisfaction of the Engineer, the Contractor shall complete the balance of the work with the use of standard metal forms and the formed method of placing and curing.

In addition to the requirements of this section, the concrete shall be placed as described in the applicable sections of Section 501-3.10 A.

Any equipment used for transporting concrete shall be capable of discharging the material at the minimum specified slump. Concrete, which is transported in vehicles not capable of discharging concrete at the minimum slump, is subject to rejection by the Resident Engineer.

New pavements or pavements which will not be overlaid shall be protected from track damage by rubber mats, plywood or other means acceptable to the Resident Engineer.

501-3.11 STRIKE-OFF OF CONCRETE AND PLACEMENT OF REINFORCEMENT. Following the placing of the concrete, it shall be struck off to conform to the cross section shown on the plans and to an elevation such that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of reinforcing steel fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off, and screeded. If any portion of the bottom layer of concrete has been placed more than 30 minutes without being covered with the top layer or if initial set has taken place, it shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale, or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements.

501-3.12 JOINTS.

A. General.

1. Longitudinal and transverse joints. Longitudinal and transverse joints shall be constructed as indicated on the plans and in accordance with these requirements. All joints shall be constructed true to line with their faces perpendicular to the surface of the pavement. Joints shall not vary more than $\frac{1}{2}$ inch from a true line or from their designated position. The vertical surface of the pavement adjacent to all expansion joints shall be finished to a true plane and edged to a radius of $\frac{1}{4}$ inch or as shown on the plans. The surface across the joints shall be tested with a 10-foot straightedge as the joints are finished and any irregularities in excess of $\frac{1}{4}$ inch shall be corrected before the concrete has hardened. When required, keyways shall be accurately formed with a template of metal or wood. The gauge or thickness of the material in the template shall be such that the full keyway, as specified, is formed and is in the correct location. Transverse joints shall be at right angles to the centerline of the pavement and shall extend the full width of the slab. The transverse joints in succeeding lanes shall be placed in line with similar joints in the first lane. All joints shall be so prepared, finished, or cut to provide a groove of the width and depth shown on the plans.

New pavement slabs that are broken or contain random cracks shall be removed and replaced at the Contractor's expense. Removal of partial slabs is not permitted. Panel removal and replacement shall be full depth, shall be full width of the slab and the limits of removal shall be perpendicular to the paving lane and to each original transverse joint. Removal and replacement methods shall be approved by the Engineer prior to initiation of the repairs.

2. Tie bars. Tie bars shall consist of deformed bars installed principally in longitudinal joints as shown on the plans. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals of 30 inches, unless otherwise specified. They shall be held in position parallel to the pavement surface and midway between the surfaces of the slab. When tie bars extend into an unpaved lane, they may be bent at right angles against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. These bars shall not be painted, greased, or enclosed in sleeves.

Epoxy-coated deformed steel tie bars of specified length, size, spacing, and material shall be placed across the longitudinal construction joint to tie lanes together when adjacent lanes of pavement are constructed separately.

3. Dowel bars. Dowel bars or other load transfer units of an approved type shall be placed across transverse or other joints in the manner as specified on the plans. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment by an approved assembly device to be left permanently in place. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. A metal, or other type, dowel expansion cap or sleeve shall be furnished for each dowel bar used with expansion joints. These caps shall be substantial enough to prevent collapse and shall be placed on the ends of the dowels as shown on the plans. The caps or sleeves shall fit the dowel bar tightly and the closed end shall be watertight. When epoxy-coated steel dowels are used, a lubrication bond breaker shall be used except when approved pullout tests indicate it is not necessary. Mechanical dowel bar placers shall not be used.
4. Slip-form construction. For slip-form construction, the following shall apply: When keyed construction joints are called for, a sheet metal keyway liner shall be required. The liner may remain in place permanently and become part of the keyed joint and shall be galvanized, copper clad, or of similar rust-resistant material, of sufficient stiffness to support the upper keyway flange. Two-piece hook bolts may be installed in either male or female side of the keyed joint providing the installation is made without distorting the keyed dimensions or

causing edge slump. If a bent tie bar installation is used, the tie bars shall be inserted through the sheet metal keyway liner only on the female side of the joint. The bent tie bar installation may cause breaking of some small amount of laitance where the bar goes through the liner when the exposed portion of the bar is bent for extension into the adjacent lane. In no case shall a bent tie bar installation for male keyways be permitted which will require chipping away of concrete to perform the straightening of the tie bar. Alternate methods of bar installation may be approved by the Engineer if the keyway can be formed to a tolerance of ¼ inch in any dimension and without distortion or slumping of the top of the male flange. Dowels shall be accurately placed and not disturbed during concrete placement. Transverse dowels will require use of an apparatus to firmly hold the dowels perpendicular to the joint and parallel to the slab surface. During the concrete placement operation, it is advisable to place plastic concrete directly on the dowel assembly immediately prior to passage of the paver to help maintain dowel alignment. Mechanical dowel bar placers shall not be used.

- B. Installation. The top of an assembled joint device shall be set at the proper distance below the pavement surface and the elevation shall be checked. Such devices shall be set to the required position and line and shall be securely held in place by stakes or other means during the pouring and finishing of the concrete. The premolded joint material shall be placed and held in a vertical position; if constructed in sections, there shall be no offsets between adjacent units. Dowel bars shall be checked for exact position and alignment as soon as the joint device is staked in place, and the device shall be tested to determine whether it is firmly supported. The maximum permissible tolerance on dowel bar alignment in each plane, horizontal and vertical, shall not exceed 2 percent or ¼ inch per foot of a dowel bar. The most effective way to obtain proper alignment is with well-fabricated dowel baskets and dowel assemblies. Mechanical dowel bar placers shall not be used. Tie wires shall remain uncut and intact at all times in dowel baskets.

All joints shall be sawcut. The joints shall be cut as shown on the plans in one continuous sawcut for the width of the slab. Only self-propelled diamond blade saws with water cooling shall be used. No dry sawing or inserts will be allowed. The circular cutter shall be capable of cutting a groove in a straight line and shall produce a slot at least 1/8 inch wide and to the depth shown on the plans. When shown on the plans or required by the specifications, the top portion of the slot or groove shall be widened by means of a second shallower cut or by suitable and approved beveling to provide adequate space for joint sealers. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing. Sawing shall be carried on both during the day and night as required. The joints shall be sawed at the required spacing consecutively in sequence of the concrete placement, unless otherwise approved by the Engineer.

After each joint is sawed, the sawcut and the adjacent concrete surface shall be thoroughly cleaned to remove all extraneous material including slurry.

C. Longitudinal Joints.

1. Construction. Longitudinal construction joints necessary for lane construction shall be formed against suitable side forms (usually made of steel) with or without keyways, as indicated in the plans. Wooden forms may be used under special conditions, when approved by the Engineer. When the concrete is placed using slip-form pavers, the keyway shall be formed in the plastic concrete by means of preformed metal keyway liners which are inserted during the slip-form operations to form the female side of the key and which may be left in place. The dimensions of the keyway forms shall not vary more than plus or minus ¼ inch from the dimensions indicated and shall not deviate more than plus or minus ¼ inch from the mid-depth of the pavement. Where butt-type joints with dowels are designated, the dowels for this type shall be painted and greased. The edges of the joint shall be finished with a grooving tool or edging tool, and a space or slot shall be formed along the joint of the dimensions, as indicated, to receive the joint sealing material. Longitudinal construction joints shall be sawed to provide a groove at the top conforming to the details and dimensions indicated on the plans. Provisions shall be made for the installation of tie bars as noted on the plans.

The epoxy-coated tie bars used in the longitudinal construction joint shall be installed in preformed or drilled holes along the vertical edge of the first lane placed as specified in the plans. The tie bars shall be installed with an approved chemical adhesive to provide a minimum pull requirement of 1) 7750 lb for No. 5 and 5000 lb for No. 4 bars; 2) 11,000 lb for No. 6 bars; 3) 19,750 lb for No. 8

bars. Holes shall be blown clean and dry prior to placing the adhesive. The installation shall be with methods and tools conforming to the adhesive manufacturer's recommendations. The Contractor shall load test five percent of the first 500 tie bars installed. No further installation will be allowed until the initial five percent testing has been completed and approval to continue installation has been given by the Engineer. Testing will be required for 0.5 percent of the bars installed after the initial 500. For each bar that fails to pass the minimum requirements, two more bars selected by the Engineer shall be tested. Each bar that fails to meet the minimum load requirement shall be reinstalled and retested. The equipment and method used for testing shall meet the requirements of ASTM E 488. All tests shall be performed within 72 hours of installation. The tie bars shall be installed and approved before concrete is placed in the adjacent lane, and all tests shall be documented by the Resident Engineer.

2. Contraction or weakened-plane type. The longitudinal groove formed or sawed in the top of the slab shall be installed where indicated on the drawings. The groove shall be formed in the plastic concrete with suitable tools or material to obtain the width and depth specified, or it shall be sawed with approved equipment in the hardened concrete to the dimensions required. When the groove is formed in plastic concrete, it shall be true to line with not more than 1/4-inch variation in 10 feet; it shall be uniform in width and depth; and the sides of the groove shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The sawed groove shall be straight and of uniform width and depth. In either case, the groove shall be clean so that spalling will be avoided at intersections with transverse joints. Tie bars shall be installed across these joints where indicated on the plans.
3. Expansion. Longitudinal expansion joints shall be installed as indicated on the plans. The premolded filler, of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint, except for space for sealant at the top of the slab. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface. A metal cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished. After the concrete has been placed and struck off, the cap shall be carefully withdrawn leaving the space over the premolded filler. The edges of the joint shall be finished and tooled while the concrete is still plastic.
4. Doweled. Dowel bar drilling may be started at the Contractor's discretion provided that the operation does not cause any excessive or unacceptable raveling or damage to the pavement. The Resident Engineer may suspend drilling operations at any time that unacceptable results are being produced.

Dowel holes shall be drilled at the specified depth of the existing pavement, parallel to the grade and perpendicular to the centerline of the pavement with a tolerance of 1/8-inch. The drilling operation shall not crack or excessively spall the pavement.

Immediately prior to installing the dowel bars, the dowel holes shall be thoroughly cleaned of drilling debris. Dust and debris shall be blown from the joint or crack with a power brush/blower or with compressed air. If compressed air is used, the pneumatic tool lubricator must be bypassed and a filter installed on the discharge valve to keep water and oil out of the lines. The dowel bars shall be clean and free from rust.

The adhesive shall be of a consistency such that the dowel may be easily inserted into the hole, with adhesive flow completely surrounding the dowel, and without appreciable runoff of adhesive after the dowel is fully inserted. (The consistency of the adhesive should be thicker than the consistency recommended by the manufacturer's directions.) The adhesive shall be injected or rodded to the back of the dowel hole to eliminate air pockets prior to inserting the dowel. The dowel shall not be used to push the adhesive to the back of the hole. The quantity of adhesive used shall be such that the adhesive is dispersed along the entire length of the dowel and voids are completely filled. After the adhesive has been positioned at the back of the hole, the dowel shall be fully inserted, using back-and-forth twisting motion, leaving half of the dowel exposed. If it is necessary to use a hammer to aid in seating the dowel, the exposed end of the dowel shall be protected with a wood block.

D. Transverse Joints.

1. Expansion. Transverse expansion joints shall be installed at the locations and spacing as shown on the plans. The joint shall be installed at right angles to the centerline and perpendicular to the surface of the pavement. The joints shall be installed and finished to insure complete separation of the slabs. Expansion joints shall be of a premolded type conforming to these specifications and with the plans and shall be the full width of the pavement strip.

All concrete shall be cleaned from the top of the joint material. Before the pavement is opened to traffic, this space shall be swept clean and filled with approved joint sealing material.

All devices used for the installation of expansion joints shall be approved by the Engineer. They shall be easily removable without disturbing the concrete and held in proper transverse and vertical alignment. Immediately after forms are removed, any concrete bridging the joint space at the ends shall be removed for the full width and depth of the joint.

When specified, expansion joints shall be equipped with dowels of the dimensions and at the spacing and location indicated on the plans. The dowels shall be firmly supported in place and accurately aligned parallel to the subgrade and the centerline of the pavement by means of a dowel assembly which will remain in the pavement and will ensure that the dowels are not displaced during construction.

Other types of load-transfer devices may be used, when approved by the Engineer.

2. Contraction. Transverse contraction joints, weakened-plane joints, or both, shall be installed at the locations and spacing as shown on the plans. These joints will be installed by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened in the same manner as specified in Section 501-3.12 C. 2. Dowel bar assemblies shall be installed, when required, as shown on the plans.
3. Construction. Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. When the installation of the joint can be planned in advance, it shall be located at a contraction or expansion joint. The joint shall not be allowed within 8 feet of a regular spaced transverse joint. If the pouring of the concrete has stopped, causing a joint to fall within this limit, it shall not be installed, and the fresh placed concrete shall be removed back to the 8 foot limit.

501-3.13 FINAL STRIKE-OFF, CONSOLIDATION, AND FINISHING.

- A. Sequence. The sequence of operations shall be the strike-off and consolidation, floating and removal of laitance, straightedging, and final surface finish. The addition of superficial water to the surface of the concrete to assist in finishing operations generally will not be permitted. If the application of water to the surface is permitted, it shall be applied as a fog spray by means of approved spray equipment. Hand sprayers (i.e. Hudson Sprayers) are not permitted to be used unless approved by the Engineer.
- B. Finishing at Joints. The concrete adjacent to joints shall be compacted or firmly placed without voids or segregation against the joint material; it shall be firmly placed without voids or segregation under and around all load-transfer devices, joint assembly units, and other features designed to extend into the pavement. Concrete adjacent to joints shall be mechanically vibrated as required in Section 501-3.10. After the concrete has been placed and vibrated adjacent to the joints, the finishing machine shall be operated in a manner to avoid damage or misalignment of joints. If uninterrupted operations of the finishing machine, to, over, and beyond the joints, cause segregation of concrete, damage to, or misalignment of the joints, the finishing machine shall be stopped when the screed is approximately 8 inches from the joint. Segregated concrete shall be removed from the front of and off the joint; the screed shall be lifted and set directly on top of the

joint, and the forward motion of the finishing machine shall be resumed. Thereafter, the finishing machine may be run over the joint without lifting the screed, provided there is no segregated concrete immediately between the joint and the screed or on top of the joint.

- C. Machine Finishing. The concrete shall be spread as soon as it is placed, and it shall be struck off and screeded by an approved finishing machine. The machine shall go over each area as many times and at such intervals as necessary to give the proper consolidation and to leave a surface of uniform texture. Excessive operation over a given area shall be avoided. When side forms are used, the tops of the forms shall be kept clean by an effective device attached to the machine, and the travel of the machine on the forms shall be maintained true without lift, wobbling, or other variation tending to affect the precision finish. During the first pass of the finishing machine, a uniform ridge of concrete shall be maintained ahead of the front screed for its entire length. When in operation, the screed shall be moved forward with a combined longitudinal and transverse shearing motion, always moving in the direction in which the work is progressing, and so manipulated that neither end is raised from the side forms during the striking-off process. If necessary, this shall be repeated until the surface is of uniform texture, true to grade and cross section, and free from porous areas.
- D. Hand Finishing. Hand finishing methods will not be permitted, except under the following conditions: In the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade; in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical. Concrete, as soon as placed, shall be struck off and screeded. An approved portable screed shall be used. A second screed shall be provided for striking off the bottom layer of concrete when reinforcement is used.

The screed for the surface shall be at least 2 feet longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal or of other suitable material covered with metal. Consolidation shall be attained by the use of a suitable vibrator.

- E. Floating. After the concrete has been struck off and consolidated, it shall be further smoothed, trued, and consolidated by means of a longitudinal float, using one of the following methods.
1. Hand Method. The hand-operated longitudinal float shall not be less than 12 feet in length and 6 inches in width, properly stiffened to prevent flexibility and warping. The longitudinal float, operated from foot bridges resting on the side forms and spanning but not touching the concrete, shall be worked with a sawing motion, while held in a floating position parallel to the pavement centerline and passing gradually from one side of the pavement to the other. Forward movement along the centerline of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or soupy material shall be wasted over the pavement edge on each pass.
 2. Mechanical Method. The Contractor may use a machine composed of a cutting and smoothing float(s), suspended from and guided by a rigid frame. The frame shall be carried by four or more visible wheels riding on, and constantly in contact with, the side forms or pavement subgrade. If necessary, long-handled floats having blades not less than 5 feet in length and 6 inches in width may be used to smooth and fill in open-textured areas in the pavement. Long-handled floats shall not be used to float the entire surface of the pavement in lieu of mechanical methods. When strike-off and consolidation are done by hand and the crown of the pavement will not permit the use of the longitudinal float, the surface shall be floated transversely by means of a long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance shall be removed from the surface of the pavement by a straightedge 10 feet or more in length. Successive drags shall be lapped one-half the length of the blade.
- F. Straight-edge Testing and Surface Correction. After the pavement has been struck off and consolidated and while the concrete is still plastic, it shall be tested for trueness with a 16-foot straightedge. For this purpose the Contractor shall furnish and use an accurate 16-foot straightedge swung from handles 3 feet longer than one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary.

Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance shall be removed from the surface of the pavement. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the requirements for smoothness. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

501-3.14 SURFACE TEXTURE. The surface of the pavement shall be finished with either a broom or burlap drag finish for all newly constructed concrete pavements.

- A. Brush or Broom Finish. If the pavement surface texture is to be a type of brush or broom finish, it shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface, providing corrugations that are uniform in appearance and approximately 1/16 of an inch in depth. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. Any imperfections resulting from the texturing operation shall be corrected.
- B. Burlap Drag Finish. If a burlap drag is used to texture the pavement surface, it shall be at least 15 ounces per square yard. To obtain a rough-textured surface, the transverse threads of the burlap should be removed approximately 1 foot from the trailing edge. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface. The corrugations shall be uniform in appearance and approximately 1/16 of an inch in depth.

501-3.15 RESERVED

501-3.16 SURFACE TEST. As soon as the concrete has hardened sufficiently, the pavement surface shall be tested with a 16-foot straightedge or other specified device. The testing equipment shall be supplied by the Contractor for use by the Resident Engineer. Areas in a slab showing high spots of more than ¼ inch but not exceeding ½ inch in 16 feet shall be marked and immediately ground down with an approved grinding machine to an elevation that will fall within the tolerance of ¼ inch or less. Where the departure from correct cross section exceeds ½ inch, the pavement shall be removed and replaced at the expense of the Contractor when so directed by the Engineer.

Any area or section so removed shall not be less than 10 feet in length nor less than the full width of the lane involved. When it is necessary to remove and replace a section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet in length shall also be removed and replaced.

501-3.17 CURING. Immediately after the finishing operations have been completed and marring of the concrete will not occur, the entire surface of the newly placed concrete shall be cured in accordance with one of the methods below. In all cases in which curing requires the use of water, the curing shall have prior right to all water supply or supplies. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than ½ hour during the curing period. The following are alternate approved methods for curing concrete pavements.

- A. Impervious Membrane Method. The entire surface and permanently exposed edges of the pavement shall be sprayed uniformly with a curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of 1 gallon to not more than 150 square feet. The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application the compound shall be stirred continuously by effective mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. Curing compound shall not be applied to the inside faces of joints to be sealed, but

approved means shall be used to insure proper curing for 72 hours. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

- B. Polyethylene Films. The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting.

The units shall be lapped at least 18 inches. The sheeting shall be placed and weighted to cause it to remain in contact with the surface covered. The sheeting shall have dimensions that will extend at least twice the thickness of the pavement beyond the edges of the pavement. Unless otherwise specified, the sheeting shall be maintained in place for 72 hours after the concrete has been placed.

- C. Waterproof Paper. The top surface and sides of the pavement shall be entirely covered with waterproofed paper. The units shall be lapped at least 18 inches. The paper shall be placed and weighted to cause it to remain in contact with the surface covered. The paper shall have dimensions that will extend at least twice the thickness of the pavement beyond the edges of the slab. The surface of the pavement shall be thoroughly wetted prior to placing of the paper. Unless otherwise specified, the paper shall be maintained in place for 72 hours after the concrete has been placed.

- D. White Burlap-Polyethylene Sheets. The surface of the pavement shall be entirely covered with the sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully wetted and in position for 72 hours after the concrete has been placed.

- E. Curing in Cold Weather. Whenever the ambient air temperature for day or night concreting operations is below 40° F, the Contractor shall submit a cold weather concreting plan. The plan shall comply with the Illinois Department of Transportation, Division of Aeronautics, Policy Memorandum 2001-1, REQUIREMENTS FOR COLD WEATHER CONCRETING. Cold weather concrete operations shall not proceed until the Engineer has approved the Contractor's cold weather concreting plan.

When concrete is being placed and the air temperature may be expected to drop below 35 degrees F, a sufficient supply of straw, hay, grass, or other suitable blanketing material such as burlap or polyethylene shall be provided along the workplace. Any time the temperature may be expected to reach the freezing point during the day or night, the material so provided shall be spread over the pavement to a sufficient depth to prevent freezing of the concrete. The period of time such protection shall be maintained shall not be less than 10 days. A minimum of 3 days is required when high, early strength concrete is used. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather, and any concrete damaged by frost shall be removed and replaced at the Contractor's expense.

501-3.18 REMOVING FORMS. Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has set for at least 12 hours, except where auxiliary forms are used temporarily in widened areas. Forms shall be removed carefully to avoid damage to the pavement. After the forms have been removed, the sides of the slab shall be cured as outlined in one of the methods indicated in Section 501-3.17. Major honeycombed areas shall be considered as defective work and shall be removed and replaced. Any area or section so removed shall not be less than 10 feet in length nor less than the full width of the section of pavement, any remaining portion of the slab adjacent to the joints that is less than 10 feet in length shall also be removed and replaced.

501-3.19 SEALING JOINTS. The joints in the pavement shall be sealed in accordance with Item 605.

501-3.20 PROTECTION OF PAVEMENT. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents.

This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, or crossovers, etc. The plans or special provisions will indicate the location and type of device or facility required to protect the work and provide adequately for traffic. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense. In order that the concrete be properly protected against the effects of rain before the concrete is sufficiently hardened, the Contractor will be required to have available at all time materials for the protection of the edges and surfaces of the unhardened concrete. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

501-3.21 OPENING TO TRAFFIC. The Engineer shall decide when the pavement shall be opened to traffic. The pavement will not be opened to traffic until test specimens molded and cured in accordance with ASTM C 31 have attained the strength specified in section 501-3.10 Placing Concrete when tested in accordance with ASTM C 39 or C 78 as required. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion. The pavement shall be cleaned before opening for normal operations.

501-3.22 SURFACE TOLERANCES. Extreme care must be exercised in all phases of the operation to assure the pavement will pass the specified tolerances. The following tolerances are applicable:

- A. Lateral deviation from established alignment of the pavement edge shall not exceed plus or minus 0.10 foot in any lane.
- B. Vertical deviation from established grade shall not exceed plus or minus 0.04 foot at any point.
- C. Surface smoothness deviations shall not exceed ¼ inch from a 16-foot straightedge placed in any direction, including placement along and spanning any pavement joint or edge.

501-3.23 QUALITY CONTROL PLAN. The Contractor shall be required to provide all Quality Control personnel for the manufacture of all the concrete. The quality control shall be performed in accordance with IDOA's Policy Memorandum No. 87-3, Mix Design, Test Batch, Quality Control, and Acceptance Testing of P.C.C. Pavement Mixture. All quality control forms and mix verification forms shall be completed for each day's concrete production by the Contractor's quality control technician.

A Quality Control Plan must be submitted by the Contractor and approved by the Division before any paving can start. A Quality Control Plan template is available on the IDOT website for use.

The Quality Control Plan must include a listing of all Contractor personnel, and their qualifications, used to complete the quality control of the concrete. It shall indicate all tests and testing frequency to be done by the Contractor, including gradation tests, moisture test, mix verification, as well as test specimen preparation. All quality control efforts shall be documented by the Contractor and made available to the Engineer daily.

The cost of furnishing test machines, as well as the calibration of any testing machines, shall be incidental to the concrete paving cost. The Contractor shall provide all facilities necessary for the storage and operation of the beam or cylinder testing machines, complete with artificial lighting if necessary. Any additional testing that the Contractor deems necessary to control the process may be performed at the Contractor's option. The Engineer will monitor any or all of the quality control testing.

The Contractor is not permitted, at any time, to exceed the approved JMF water/cementitious ratio. Violation of the approved JMF water/cement ratio shall result in suspension of concrete production by the Engineer until the problem is resolved to the satisfaction of the Engineer. Any concrete placed that exceeds the approved JMF water/cement ratio shall not be paid for and is cause for removal of the deficient material as directed by the Division.

The Contractor shall take prompt action to correct any errors, equipment malfunction, process changes, or other assignable causes which have resulted or could result in submission of materials and completed construction which do not conform to the requirements of the specification.

METHOD OF MEASUREMENT

501-4.1 The quantity to be paid for shall be the number of square yards of either plain or reinforced pavement as specified, in place, completed and accepted.

BASIS OF PAYMENT

501-5.1 GENERAL. The quantity of Portland Cement Concrete Pavement measured as outlined in Section 501-4.1 shall be adjusted in accordance with Section 501-5.3 Price Adjustment as specified herein. Payment shall be calculated by multiplying the contract unit price per square yard of completed pavement and the adjusted square yards per LOT. Final payment shall be full compensation for furnishing and placing all materials, including any dowels, steel reinforcement, joint materials, and texturing, except for saw-cut grooving. This also includes payment for all Quality Control Engineering.

The Test Batch shall be paid at the contract unit price per each, which price shall include all material, equipment, labor and engineering necessary to complete this section.

501-5.2 Grooving shall be paid for at the contract unit price per square foot which price and payment shall be full compensation for furnishing all tools, equipment, labor and materials necessary to complete the item.

501-5.3 Price Adjustment

A. Thickness adjustment. Where the average thickness of pavement is deficient in thickness by more than 0.2 inch but not more than 1.0 inch, payment will be made at an adjusted quantity as specified in TABLE 3. Thickness deficiencies identified during or after placement will be confirmed by coring. The Contractor shall cut three cores per lot to determine the adjustment for thickness. The location of the cores shall be randomly determined by the Resident Engineer. All holes shall be filled by the Contractor with a non shrink grout approved by the Engineer. All associated costs shall be borne by the Contractor.

TABLE 3. PAVEMENT DEFICIENCY

Deficiency in Thickness Determined by Cores (Average of 3 tests)	Proportional Part of Contract Quantity Allowed (Q _t)
Inches	Percent
0.00 to 0.20	100
0.21 to 0.30	80
0.31 to 0.40	72
0.41 to 0.50	68
0.51 to 0.75	57
0.76 to 1.00	50

When the thickness of pavement is deficient by more than 1 inch and in the judgment of the Engineer the area of such deficiency should not be removed and replaced, there shall be no payment for the area retained. The Contractor may, at his/her option, remove such thin pavement and replace it with pavement of the specified thickness. The replacement pavement will be paid for at the contract unit price per square yard and no payment will be made for the thin pavement, which is removed nor for the cost of removing it.

B. Flexural or Compressive Strength Adjustment. (For Method II and Method III paving only) Acceptance of the pavement shall be on a LOT basis using the flexural or compressive strengths obtained from test specimens prepared and tested in accordance with Section 501-3.7, Field Test Specimens, specified herein. LOTS and SUBLOTS shall not be separated by mix design or by day of paving if the project is using more than one mix design. The grouping of LOTS and SUBLOTS shall be solely on the basis of cubic yards poured on the project.

1. LOT Size. A LOT shall consist of the average of four (4) SUBLOT samples, but shall not exceed six (6) SUBLOTS. The minimum number of SUBLOTS per Lot shall be three (3).

A SUBLLOT shall consist of the equivalent square yards of pavement required to place 300 cubic yards of concrete. All samples used to determine acceptance of the pavement shall be tested at 28 days.

2. LOT Early Termination. When less than three (3) SUBLOTS are produced, such as the end of construction of the pavement or at the end of the construction season, the final SUBLLOT tests shall be included with the previous LOT for payment. The final LOT may thus contain up to six (6) SUBLOTS. The final SUBLLOT of the project shall only be separated into an additional SUBLLOT if the quantity is greater than or equal to 150.0 cubic yards of concrete or more. Otherwise, this quantity shall be incorporated into the previous SUBLLOT and the LOT shall be calculated with the remaining SUBLOTS.
3. Acceptance Criteria. The acceptance of each LOT of concrete pavement shall be based on the Percentage of concrete Within specification Limits (PWL). The PWL is determined using standard statistical techniques which involve the flexural or compressive strength acceptance tests from each LOT and the Quality Index. The Quality Index is calculated using one of the following formulae depending on the strength requirements specified:

FLEXURAL TEST	COMPRESSIVE TEST
$Q = \frac{\bar{X} - 650PSI}{S}$	$Q = \frac{\bar{X} - 4000PSI}{S}$

Where

- Q = Quality Index
- \bar{X} = Mean (average) of the SUBLLOT flexural or compressive strength tests.
- S = Standard Deviation of SUBLLOT flexural or compressive strength tests.

The PWL is determined by entering TABLE 5 with the "Q" using the column for the appropriate number (N) of flexural or compressive strength LOT tests. Each LOT of concrete pavement shall be accepted for 100 percent payment when the PWL equals or exceeds 90 percent. When a LOT is below 90 percent, the LOT square yards shall be adjusted in accordance with TABLE 4.

TABLE 4 PAY ADJUSTMENT SCHEDULE ^{1/}

PWL	% ADJUSTMENT IN LOT QUANTITY
90 - 100	100
80 - 89.9	0.5 PWL + 55.0
65 - 79.9	2.0 PWL - 65.0
Below 65	^{2/}

1/ All preliminary calculations used in determining the Percent Within Limits should be carried to a minimum of four (4) digits right of the decimal point. The PWL that is determined from TABLE 4 should then be rounded to one significant figure past the decimal point to determine the percent of contract quantity to be paid. The final percent pay figure should be rounded to one significant figure past the decimal point. The Resident Engineer shall notify the Contractor, in writing, of the final percent pay for each LOT when all LOT tests are completed. The pay calculations for each LOT are **final** and no pavement coring is allowed *unless resampling has been approved by the Engineer*.

2/ The lot shall be removed and replaced. However, the Engineer may decide to accept the deficient lot. In that case, it will be paid for at 50% adjustment.

- C. Resampling and Retesting. The Contractor may request resampling and retesting in accordance with the latest version of the Division of Aeronautics Policy Memorandum 90-1, Resampling and Retesting of PCC Pavement.

TABLE 5
TABLE FOR ESTIMATING PERCENTAGE OF LOT WITHIN LIMITS (PWL)
(STANDARD DEVIATION METHOD)
QUALITY INDEX Q

PERCENT WITHIN TOLERANCE	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362	2.0656	2.0897
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630	1.8828	1.8989
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420	1.7566	1.7684
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454	1.6566	1.6655
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635	1.5721	1.5790
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4716	1.4829	1.4914	1.4981	1.5035
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265	1.4316	1.4358
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670	1.3709	1.3741
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118	1.3148	1.3172
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602	1.2623	1.2640
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115	1.2129	1.2141
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653	1.1661	1.1660
87	1.0597	1.1100	1.1173	1.1191	1.1199	1.1204	1.1208	1.1212	1.1215	1.1218
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789	1.0788	1.0787
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382	1.0377	1.0374
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990	0.9982	0.9976
83	0.9939	0.9900	0.9785	0.9715	0.9672	0.9643	0.9624	0.9610	0.9599	0.9591
82	0.9749	0.9600	0.9452	0.9367	0.9315	0.9281	0.9258	0.9241	0.9228	0.9219
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882	0.8868	0.8857
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533	0.8517	0.8505

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192	0.8175	0.8161
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858	0.7840	0.7826
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531	0.7513	0.7498
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211	0.7192	0.7177
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896	0.6877	0.6861
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587	0.6567	0.6551
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282	0.6262	0.6247
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982	0.5962	0.5947
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686	0.5667	0.5651
70	0.6787	0.6000	0.5719	0.5583	0.5504	0.5454	0.5419	0.5394	0.5375	0.5360
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105	0.5086	0.5072
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820	0.4802	0.4787
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537	0.4520	0.4506
66	0.5563	0.4800	0.4545	0.4424	0.4354	0.4310	0.4280	0.4257	0.4241	0.4227
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4031	0.4001	0.3980	0.3964	0.3951
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705	0.3690	0.3678
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432	0.3418	0.3407
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161	0.3148	0.3137
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892	0.2880	0.2870
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624	0.2613	0.2604
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358	0.2348	0.2339
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2083	0.2084	0.2076
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829	0.1821	0.1814
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566	0.1559	0.1553
55	0.1806	0.1500	0.1406	0.1353	0.1338	0.1322	0.1312	0.1304	0.1298	0.1293
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1048	0.1042	0.1038	0.1034
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0792	0.0786	0.0781	0.0778	0.0775
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521	0.0518	0.0516
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260	0.0259	0.0258
50	0	0	0	0	0	0	0	0	0	0

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260	-0.0259	-0.0258
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521	-0.0518	-0.0516
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781	-0.0778	-0.0775
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042	-0.1037	-0.1034
45	-0.1806	-0.1500	-0.1406	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304	-0.1298	-0.1293
44	-0.2164	-0.1800	-0.1688	-0.1637	-0.1607	-0.1588	-0.1575	-0.1566	-0.1559	-0.1553
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829	-0.1821	-0.1814
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093	-0.2084	-0.2076
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358	-0.2348	-0.2339
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624	-0.2613	-0.2604
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892	-0.2880	-0.2870
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161	-0.3148	-0.3137
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432	-0.3418	-0.3407
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705	-0.3690	-0.3678
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4030	-0.4001	-0.3980	-0.3964	-0.3951
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4354	-0.4310	-0.4280	-0.4257	-0.4241	-0.4227
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537	-0.4520	-0.4506
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820	-0.4802	-0.4787
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105	-0.5087	-0.5072
30	-0.6787	-0.6000	-0.5719	-0.5583	-0.5504	-0.5454	-0.5419	-0.5394	-0.5375	-0.5360
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686	-0.5667	-0.5651
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982	-0.5962	-0.5947
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282	-0.6262	-0.6217
26	-0.7904	-0.7200	-0.6920	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587	-0.6567	-0.6551
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896	-0.6876	-0.6861
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211	-0.7192	-0.7177
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531	-0.7513	-0.7498
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858	-0.7840	-0.7826
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8246	-0.8214	-0.8192	-0.8174	-0.8161
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533	-0.8517	-0.8565

**PERCENT WITHIN
TOLERANCE**

	N=3	N=4	N=5	N=6	N=7	N=8	N=9	N=10	N=11	N=12
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882	-0.8868	-0.8057
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9315	-0.9281	-0.9258	-0.9241	-0.9228	-0.9219
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9671	-0.9643	-0.9624	-0.9610	-0.9599	-0.9591
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990	-0.9982	-0.9976
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382	-1.0377	-1.0374
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789	-1.0788	-1.0787
13	-1.0597	-1.1100	-1.1173	-1.1192	-1.1199	-1.1204	-1.1208	-1.1212	-1.1215	-1.1217
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653	-1.1661	-1.1668
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115	-1.2129	-1.2141
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602	-1.2623	-1.2640
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118	-1.3148	-1.3172
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670	-1.3709	-1.3741
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265	-1.4316	-1.4358
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4716	-1.4829	-1.4914	-1.4981	-1.5035
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635	-1.5721	-1.5790
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5872	-1.6127	-1.6313	-1.6454	-1.6566	-1.6655
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6992	-1.7235	-1.7420	-1.7566	-1.7684
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8054	-1.8379	-1.8630	-1.8828	-1.8989
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362	-2.0657	-2.0897

ITEM 501115 CRACK AND SEAT PAVEMENT

DESCRIPTION

501-1.1 This item shall consist of cracking and seating the existing variable depth PCC pavement prior to construction of the HMA overlay.

This item shall also consist of cleaning all loose, spalled material from the surface of the pavement prior to paving.

EQUIPMENT

501-2.1 CRACKING HAMMER. The equipment used for cracking the designated pavements shall be capable of producing the desired cracking pattern as detailed in the plans. Should the equipment used not produce the desired cracking pattern, it shall be replaced. The Engineer shall have final approval of the equipment used and shall be able to reject the cracking equipment.

501-2.2 ROLLERS. Seating shall be accomplished with either a vibratory roller or a heavy pneumatic-tire roller.

The vibratory roller shall have a drum diameter of 48 inches, a drum length of 66 inches, vibrators with 1,600 VPM, a total applied force of 325 pounds per lineal inch; unit static force of 125 pounds per lineal inch, and adjustable eccentrics.

A heavy pneumatic-tired roller shall have a gross weight of not less than 25 tons and shall consist of not less than 4 pneumatic-tired wheels revolving in one transverse line. The width of the roller shall be not less than 8 feet, and it shall be constructed in two or more sections in such a manner that each section is free to oscillate or move independently. Under working conditions, the roller shall develop a compression of not less than 650 pounds per inch width of tire tread.

CONSTRUCTION METHODS

501-3.1 CRACKING. The existing concrete pavement, where shown on the plans or as directed by the Engineer, shall be broken in place to produce individual pavement elements approximately of the size detailed in the plans without dislodging the cracked pieces or causing surface spalling.

The cracking shall be performed only to the extent that will produce random fractures the full depth and width of the slab at the specified intervals, yet maintain aggregate interlock in the fractured faces, all to the satisfaction of the Engineer. Continued longitudinal cracks shall be prevented by varying the cracked method.

It is not the intent of this project to crush or shatter the existing concrete, but only to crack it as specified.

The Contractor shall furnish a water truck to wet down the concrete pavement to highlight the cracks in the pavement. The intent of this requirement is to prevent over fracturing the concrete pavement and to verify the specified crack pattern.

The pavement breaking hammer shall be operated on a test section designated by the Engineer. The hammer shall make a sufficient number of passes spaced equally across the pavement to produce the desired cracking pattern. The forward speed, number of flows of the hammer, and level of impact energy shall be adjusted on this test section to produce the specified cracking pattern.

501-3.2 SEATING. Seating of the cracked pavement shall be accomplished by a minimum of five passes of the roller or until no additional vertical drop in the pavement is discernible by the Engineer. A single pass shall consist of the coverage of a fixed point twice, once up and back.

501-3.3 PAVEMENT CLEANING. Following the cracking and seating operation, the pavement surface shall be cleaned of all spalled and/or loose concrete by means of a power broom and compressed air equipment. It is the intent of this specification to thoroughly clean the pavement prior to the installation

of the tack coat. Any localized holes or voids shall be tacked and filled with aggregate-bituminous or sand-bituminous material as directed by the Resident Engineer.

METHOD OF MEASUREMENT

501-4.1 The quantity of pavement cracking and seating to be paid for shall be the number of square yards of area cracked, sealed and cleaned as specified, completed and accepted.

BASIS OF PAYMENT

501-5.1 The accepted quantity of pavement cracking and seating shall be paid for at the contract unit price per square yard which price and payment shall be full compensation for furnishing all equipment and materials, and for all preparation, modification of equipment as needed, cleaning watering and for all labor, equipment, tools, and incidentals necessary to complete the item.

ITEM 501540 PCC PAVEMENT GROOVING

DESCRIPTION

501-1.1 GENERAL This item shall consist of constructing a skid resistant surface by providing saw cut grooves in the new Portland cement concrete surface.

EQUIPMENT

501-2.1 GROOVING EQUIPMENT The equipment used for grooving shall be power saw cutting equipment, equipped with diamond blades mounted on a multi-blade arbor spaced to groove the runway to the dimensions specified herein, and as shown on the plans.

A cutting head width capable of grooving the runway to the specified tolerances shall be maintained.

The grooving equipment shall be equipped with automatic groove depth control which shall automatically adjust the cutting head and maintain groove depth within the specified tolerances. Sensors for depth control shall be located immediately adjacent to the axis of the cutting head.

The grooving equipment shall be equipped to meet the requirements of this item.

The Contractor shall submit a complete list of grooving equipment to be used on the job for approval by the Engineer before start of the work.

CONSTRUCTION METHODS

501-3.1 CURE TIME The new P.C.C. shall have reached the strength specified in Item 501 prior to initiation of grooving operations unless otherwise authorized by the Engineer.

Grooving operations shall be initiated after the specified cure period.

501-3.2 GROOVE DIMENSIONS Transverse grooves saw-cut in the pavement must form a ¼ inch wide by ¼ inch deep by 1-½ inches center to center configuration. The grooves shall be continuous for the entire length of the pavement. They must be saw-cut transversely in the runway pavement to not less than 10 feet from the runway pavement edge to allow adequate space for equipment operation.

The saw-cut grooves must meet the following tolerances. The tolerances apply to each day's production and to each piece of grooving equipment used for production. The Contractor is responsible for all controls and process adjustments necessary to meet these tolerances.

- A. Alignment tolerance.
Plus or minus 1-½ inches in alignment for 75 feet.
- B. Groove tolerance.
Depth. The standard depth is ¼ inch. At least 90 percent of the grooves must be at least 3/16 inch, at least 60 percent of the grooves must be at least ¼ inch, and not more than 10 percent of the grooves may exceed 5/16 inch.

Width. The standard depth is ¼ inch. At least 90 percent of the grooves must be at least 3/16 inch, at least 60 percent of the grooves must be at least ¼ inch, and not more than 10 percent of the grooves may exceed 5/16 inch.
- C. Center-to-center spacing
The standard spacing is 1-1/2 inches.
Minimum spacing 1-3/8 inches.
Maximum spacing 1-1/2 inches.

Saw-cut grooves must not be closer than 3 inches or more than 9 inches from transverse paving joints. Grooves must not be closer than 6 inches and no more than 18 inches from in-pavement light fixtures. Grooves may be continued through longitudinal joints. Where neoprene compression seals have been

installed and the compression seals are recessed sufficiently to prevent damage from the grooving operation, grooves may be continued through the longitudinal joints. Where neoprene compression seals have been installed and the compression seals are not recessed sufficiently to prevent damage from the grooving operation, grooves must not be closer than 3 inches or more than 5 inches from the longitudinal joints.

501-3.3 TEST SECTION Before initiating grooving operations on the runway, the Contractor shall demonstrate the performance of his/her operations and machines on a section of pavement designated by the Resident Engineer of similar construction to the runway. The Contractor shall have on hand each machine and each operator he proposes to use for runway grooving. Each combination of machine and operator shall groove a test section approximately 30 feet in width and 60 feet in length. The requirements of these specifications must be met before beginning of grooving of the runway. No payment will be made for this test strip.

501-3.4 REMOVAL OF SLURRY The removal of slurry shall be continuous throughout the grooving operations. The grooving equipment shall be equipped with vacuum slurry pick-up equipment which shall continuously pick up water and sawing dust, and pump the slurry to a collection tank.

Clean-up is extremely important and should be continuous throughout the grooving operation. All grooved areas of the runway shall be flushed with clear water as soon as possible to remove any slurry material not collected by the vacuum pickup. Flushing shall be continued until all pavement surfaces are clean to the satisfaction of the Resident Engineer.

The Contractor shall dispose of the slurry off of airport property. Waste material must not be allowed to enter the airport storm or sanitary sewer, or any natural or constructed waterways.

METHOD OF MEASUREMENT

501-4.1 When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans and the Contractor and the Resident Engineer have agreed in writing by the use of form AER 981 that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the Plans have been altered or when disagreement exists between the Contractor and the Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured as herein specified.

The quantity of Grooving to be paid for shall be the number of square yards of grooving, as specified, completed and accepted.

BASIS OF PAYMENT

501-5.1 Payment will be made at the contract unit price per square yard for runway grooving, which shall be full compensation for all materials, including water, labor, equipment, tools, runway cleaning, slurry removal and incidentals necessary to complete the work.

ITEM 501550 PCC PAVEMENT MILLING

DESCRIPTION

501-1.1 This item shall consist of variable depth milling of the existing PCC surface for profile correction or HMA transitions.

CONSTRUCTION METHODS

501-2.1 EQUIPMENT. The machine used for pavement milling shall be a self-propelled diamond grinding machine capable of grinding the existing surface. The machine shall be capable of removing, in one pass, a layer of material at least 3 feet in width and ¼ inch in depth. The machine shall be capable of accurately and automatically establishing profile grades by referencing from either the existing pavement or from an independent grade control to provide a ground surface within a tolerance of ¼ inch in 16 feet when checked with a 16-foot straight-edge. It shall have an effective means of removing the excess material from the surface without permitting dust from the operation escaping into the area.

501-2.2 DISPOSAL. The material removed shall be disposed of at a location off the airport property.

METHOD OF MEASUREMENT

501-3.1 The quantity of pavement milling to be paid for shall be the number of square yards of pavement milling as measured in place, completed and accepted. Pavement milling will be paid for only once regardless of the number of passes needed to achieve a satisfactory texture or elevation. Pavement milling outside the limits designated by the Resident Engineer will not be measured for payment.

BASIS OF PAYMENT

501-4.1 Payment will be made at the contract unit price per square yard for PCC Pavement Milling. This price shall be full compensation for furnishing all materials and for all preparation, pavement milling and disposal; and all labor, tools, equipment and incidentals necessary to complete this item of work.

ITEM 501900 REMOVE PCC PAVEMENT

DESCRIPTION

501-1.1 This item of work shall consist of removing existing PCC pavement structure as described herein.

The Contractor shall remove PCC pavement of the thickness shown in the plans.

Typical construction details are shown in the plans. Exact locations of PCC pavement removal shall be determined by the Resident Engineer.

CONSTRUCTION METHODS

501-3.1 The Contractor shall saw cut the existing pavement structure full depth as shown in the plans at locations determined by the Resident Engineer. Saw cutting shall provide a vertical surface.

After completion of saw cutting, the Contractor shall remove the pavement structure using methods which will allow a vertical surface along all sides of the removal area.

Material obtained from removal operations shall be hauled to a disposal site off of airport property by the Contractor. No additional compensation will be made for hauling and disposal of the removed material. Existing aggregate base shall be compacted in accordance with Item 209. Existing subgrade shall be compacted in accordance with Item 152.

METHOD OF MEASUREMENT

501-4.1 The quantity to be paid for shall be the number of square yards of PCC pavement removal as measured in the field, completed and accepted.

BASIS OF PAYMENT

501-5.1 The accepted quantities of PCC pavement removal will be paid for at the contract unit price per square yard which price and payment shall be full compensation for furnishing all materials, equipment, labor, hauling, disposal and all other incidental items necessary to complete the work to the satisfaction of the Engineer.

ITEM 510500 TIE-DOWN/GROUND ROD

DESCRIPTION

510-1.1 This item shall consist of installing and removing tie downs and ground rods as shown on the plans or as directed by the Resident Engineer.

MATERIALS

510-2.1 The materials to be used for the tie downs and ground rods shall be as shown on the plans or as directed by the Engineer. Concrete for the construction of the tie downs shall conform to the applicable sections of Item 610. Tie Downs shall be certified as being load tested to withstand an ultimate load of 9,000 lbs. in bending.

METHOD OF MEASUREMENT

510-4.1 The quantity of tie downs and ground rods shall be measured by the number of tie downs and ground rods, as shown on the plans or as directed by the Engineer.

BASIS OF PAYMENT

510-5.1 Payment shall constitute full compensation, including all labor, tools, equipment and incidentals necessary to complete this item of work.

MISCELLANEOUS

ITEM 602 BITUMINOUS PRIME COAT

DESCRIPTION

602-1.1 This item shall consist of an application of bituminous material on the prepared base course in accordance with this specification applied at the rate specified by the Project Engineer. The type of bituminous material to be used shall be selected by the Project Engineer from those included in this specification.

602-1.2 QUANTITIES OF BITUMINOUS MATERIAL. After the base has been prepared, and when in a dry condition, the bituminous material shall be applied uniformly at a rate of 0.25 to 0.5 gal/sq. yd., the exact rate to be specified by the Engineer.

MATERIALS

602-2.1 BITUMINOUS MATERIAL. The bituminous priming material shall be MC-30. Medium curing liquid asphalt will be accepted according to the latest revision of the Bureau of Materials and Physical Research policy memorandum "Cut-Back Asphalt and Road Oil Acceptance Procedure."

CONSTRUCTION METHODS

602-3.1 WEATHER LIMITATIONS. The prime coat shall be applied only when the existing surface is dry or contains sufficient moisture to get uniform distribution of bituminous material. This work shall be done between May 1 and October 1, both dates inclusive. Bituminous materials shall be applied only when the temperature of the air in the shade is above 60° F. No work shall be started if the local conditions indicate that rain is imminent. This work may be done between October 1 and October 31 providing the temperature of the air for three consecutive days immediately preceding the day of application has been: (1) Above 60° F in the shade each day, (2) A minimum of 40° F and (3) The temperature of the air in the shade at time of application is above 60° F.

602-3.2 EQUIPMENT.

- A. Pressure Distributor. The pressure distributor used for applying liquid bituminous materials shall be a self-propelled motor vehicle and shall meet the requirements given hereinafter:
- B. Truck. The truck shall be capable of operating smoothly at speeds as low as 0.8 mph when used on heavy penetration construction, and at normal road speeds when used for transporting bituminous materials. In order to develop these speeds satisfactorily, the truck shall have at least 4 speeds forward.
- C. Tank. The tank on the distributor shall have a capacity of not less than 600 gallons. Approval shall be obtained from the Engineer for the use of a distributor having a capacity greater than 2500 gallons. The tank shall be covered with at least 1 inch of approved insulation. It shall be equipped with a removable manhole cover, and overflow pipe and a suitable strainer located at the intake or outlet to the pump to prevent the passage of any material which might clog the nozzles. A dial gauge plainly visible to the spray bar operator shall be conveniently placed to indicate the contents of the tank at various levels.
- D. Heating System. The distributor shall be equipped with an approved heating system to heat the bituminous material. The heating system shall consist of heat flues having sufficient radiation to ensure the rapid circulation of hot gases of combustion from one or more efficient smokeless burners of the torch type, a circulating device to ensure uniform heating of the material, and a suitable fuel supply tank.
- E. Pump. The distributor pump shall be of the rotary positive pressure type of sufficient size and discharge capacity to apply uniformly the specified amount of bituminous material per square yard in widths up to 24 ft. It shall be driven in the most direct method obtainable by a gasoline motor other than the vehicle propelling motor or by other methods approved by the Engineer. The pump

motor shall have sufficient power to operate the distributor pump at the required volume and pressure. If the motor pump is equipped with a transmission, it shall have a governor. Suitable housing or heating jackets shall be provided to enclose the distributor pump and piping in order to retain the heat and to ensure a constant, even flow of material.

- F. Spray Bars. Spray bars of various lengths shall be used to spray bituminous material over widths varying from 4 to 24 ft. The spray bars shall be arranged so that they may be swung from side to side over a distance of not less than 9 inches to match joints and to clear obstructions. They shall be equipped with spray nozzles of such design and size of orifice as to ensure uniform distribution of the bituminous material in the specified quantities. Means shall be provided to stop the flow of bituminous material quickly and to prevent it from dripping when the flow is shut off.

Means shall be provided for obtaining samples of the materials from the tank or from the piping leading from the tank to the spray bars.

A hand spray bar and nozzle having a suitable length of flexible hose with packed couplings shall be provided for applying material at fillets or similar locations.

- G. Thermometer. A calibrated thermometer having the stem extending into the material or into an approved well shall be placed in a suitable position in the tank to give a true average temperature of the contents of the tank.
- H. Operator's Platform. A substantial platform for the operator shall be provided at the rear of the distributor. It shall be so located that it will provide a clear view of the operation of the spray bars.
- I. Tachometer or Synchronizer. A tachometer shall be attached to the truck in such a manner as to be visible to the truck operator and to enable him/her to maintain the constant speed necessary for the correct application of the specified quantity of bitumen. Suitable charts shall be furnished by the Contractor showing the truck speeds necessary to obtain the desired results.
- J. When a synchronizer is used, the tachometer may be omitted. The synchronizer shall deliver a specified quantity of bituminous material on the pavement surface regardless of the speed of the truck.
- K. Calibration. The distributor will be calibrated by the Contractor and verified by the Resident Engineer before the work is started. The Contractor shall furnish all equipment, tools, materials and assistance necessary to verify the calibration.

602-3.3 APPLICATION OF BITUMINOUS MATERIAL. Immediately before applying the prime coat, the full width of the surface to be primed shall be swept with a power broom to remove all loose dirt and other objectionable material. The temperature of the bituminous material at the time of application shall be such that it will spray uniformly without clogging the spraying nozzles and shall be applied within the temperature range of 85°F to 90°F. Bituminous material delivered in the tank cars may be heated by steam coils; that delivered in mobile tanks may be heated in asphalt tanks or in a pressure distributor. In all cases, precautions shall be taken to avoid danger of fire. If heated in asphalt tanks, the material shall be agitated during the heating period to prevent localized overheating. If heated in a pressure distributor, the material shall be circulated while it is being heated. All flames shall be extinguished during application of the bituminous material. In all methods of heating, means shall be provided to determine the temperature of the material at frequent intervals to prevent it from being overheated or damaged.

The application of the bituminous material shall be made by means of a pressure distributor at the temperature, pressure, and in the amounts directed by the Resident Engineer. A hand spray bar shall be used at places which are not covered by the distributor. The entire length of the spray bar shall be set at the height above the surface recommended by the manufacturer for even distribution of the bituminous material. Any loss of bituminous material in handling due to faulty valves, leaking pipes, overflow loss of excess, or other reasons will be deducted from the amount due the Contractor. The distributor shall be operated in a manner such that missing or overlapping will be avoided. When required by the Resident Engineer, adjacent construction shall be protected by shields, covers, or other means. If bituminous material is applied to adjacent construction either by accident or because of inadequate protection, the Contractor shall remove such material to the satisfaction of the Engineer. If the Contractor is unable to obtain satisfactory application due to unsuitable or poorly regulated distributing equipment, or to incompetent operators, the Contractor shall immediately replace or repair such equipment or furnish competent operators.

The prime coat shall be permitted to cure until the penetration has been approved by the Engineer, but at no time shall the curing period be less than 24 hours. Pools of bituminous material occurring in the depressions shall be broomed or squeegeed over the surrounding surface the same day the prime coat is applied. At no time during curing shall traffic be allowed upon the primed surface. The prime coat shall be maintained at all times by the Contractor.

602-3.4 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY. Samples of the bituminous materials that the Contractor proposes to use, together with a statement as to their source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous materials to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials, so demonstrated by service tests, shall be acceptable.

The Contractor shall furnish vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as basis for final acceptance. All such test reports shall be subject to verification by testing samples of materials received for use on the project.

The bituminous material shall be supplied from an IDOT certified source indicated on the latest IDOT Certified Source List for Emulsified Asphalt and/or the certified source list for Asphalt Cement, Cutback Asphalt, and Road Oil, as applicable.

602-3.5 FREIGHT AND WEIGH BILLS. Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Resident Engineer, nor shall the car or tank be released until the final outage has been taken by the Resident Engineer.

Copies of freight bills and weigh bills shall be furnished to the Resident Engineer during the progress of the work.

METHOD OF MEASUREMENT

602-4.1 The bituminous prime coat to be paid for shall be the number of gallons of the material used as ordered for the accepted work, corrected to 60° F., in accordance with the temperature-volume correction tables for asphalt materials contained in ASTM D-1250.

Measurement for payment will not be made for any bituminous prime coat in excess of 105 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.) Plan quantities were calculated using the maximum application rates shown in the specifications unless shown otherwise in the plans.

BASIS OF PAYMENT

602-5.1 Payment shall be made at the contract unit price per gallon for bituminous prime coat. This price shall be full compensation for furnishing all materials and for all preparation, delivering, and applying the materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

ITEM 603 BITUMINOUS TACK COAT

DESCRIPTION

603-1.1 This item shall consist of supplying and applying bituminous material to a previously prepared, bonded and/or bituminized binder, leveling, or base course or existing pavement in accordance with these specifications and to the width shown on the typical cross section on the plans.

603-1.2 QUANTITY OF MATERIAL. The approximate amount of diluted (unless cutback asphalt is used) bituminous material per square yard for the tack coat application shall be as shown in TABLE 1. The exact application rate shall be determined in the field and approved by the Resident Engineer based on a visual inspection and existing conditions. The ratio of emulsified asphalt to water shall be as specified in 603-2.1 Bituminous Material.

MATERIALS

603-2.1 BITUMINOUS MATERIAL. The Contractor shall use any one of the applicable bituminous materials for the tack coat shown in TABLE 1. The Contractor shall dilute the emulsified asphalt at the ratio shown in TABLE 1. HFE-90 shall be diluted by the manufacturer. No additional diluting at the jobsite is allowed for HFE-90. The diluted material shall be thoroughly agitated within 24 hours of application and show no separation of water and emulsion. The diluted material shall not be returned to an approved emulsion storage tank.

CONSTRUCTION METHODS

603-3.1 WEATHER LIMITATIONS. The tack coat shall be applied only when the existing surface is dry, when the atmospheric temperature is above 60° F., and when the weather is not foggy or rainy. The temperature requirements may be waived, but only when so directed by the Engineer in writing.

Weather Limitations shall be as shown in TABLE 1.

603-3.2 EQUIPMENT.

- A. Pressure Distributor. The pressure distributor used for applying liquid bituminous materials shall be a self-propelled motor vehicle and shall meet the requirements given hereinafter:
- B. Truck. The truck shall be capable of operating smoothly at speeds as low as 0.8 mph when used on heavy penetration construction, and at normal road speeds when used for transporting bituminous materials. In order to develop these speeds satisfactorily, the truck shall have at least 4 speeds forward.
- C. Tank. The tank on the distributor shall have a capacity of not less than 600 gallons. Approval shall be obtained from the Engineer for the use of a distributor having a capacity greater than 2500 gallons. The tank shall be covered with at least 1 inch of approved insulation. It shall be equipped with a removable manhole cover, and overflow pipe and a suitable strainer located at the intake or outlet to the pump to prevent the passage of any material which might clog the nozzles. A dial gauge plainly visible to the spray bar operator shall be conveniently placed to indicate the contents of the tank at various levels.
- D. Heating System. The distributor shall be equipped with an approved heating system to heat the bituminous material. The heating system shall consist of heat flues having sufficient radiation to ensure the rapid circulation of hot gases of combustion from one or more efficient smokeless burners of the torch type, a circulating device to ensure uniform heating of the material, and a suitable fuel supply tank.
- E. Pump. The distributor pump shall be of the rotary positive pressure type of sufficient size and discharge capacity to apply uniformly the specified amount of bituminous material per square yard in widths up to 24 ft. It shall be driven in the most direct method obtainable by a gasoline motor other than the vehicle propelling motor or by other methods approved by the Engineer. The pump motor shall have sufficient power to operate the distributor pump at the required volume and

pressure. If the motor pump is equipped with a transmission, it shall have a governor. Suitable housing or heating jackets shall be provided to enclose the distributor pump and piping in order to retain the heat and to ensure a constant, even flow of material.

- F. Spray Bars. Spray bars of various lengths shall be used to spray bituminous material over widths varying from 4 to 24 ft. The spray bars shall be arranged so that they may be swung from side to side over a distance of not less than 9 inches to match joints and to clear obstructions. They shall be equipped with spray nozzles of such design and size of orifice as to ensure uniform distribution of the bituminous material in the specified quantities. Means shall be provided to stop the flow of bituminous material quickly and to prevent it from dripping when the flow is shut off.

Means shall be provided for obtaining samples of the materials from the tank or from the piping leading from the tank to the spray bars.

A hand spray bar and nozzle having a suitable length of flexible hose with packed couplings shall be provided for applying material at fillets or similar locations.

- G. Thermometer. A calibrated thermometer having the stem extending into the material or into an approved well shall be placed in a suitable position in the tank to give a true average temperature of the contents of the tank.

- H. Operator's Platform. A substantial platform for the operator shall be provided at the rear of the distributor. It shall be so located that it will provide a clear view of the operation of the spray bars.

- I. Tachometer or Synchronizer. A tachometer shall be attached to the truck in such a manner as to be visible to the truck operator and to enable him/her to maintain the constant speed necessary for the correct application of the specified quantity of bitumen. Suitable charts shall be furnished by the Contractor showing the truck speeds necessary to obtain the desired results.

When a synchronizer is used, the tachometer may be omitted. The synchronizer shall deliver a specified quantity of bituminous material on the pavement surface regardless of the speed of the truck.

- J. Calibration. The distributor will be calibrated by the Contractor and verified by the Resident Engineer before the work is started. The Contractor shall furnish all equipment, tools, materials and assistance necessary to verify the calibration.

603-3.3 APPLICATION OF BITUMINOUS MATERIAL. Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom to remove all loose dirt and other objectionable material.

The application of the bituminous material shall be made by means of a pressure distributor at the pressure, temperature, and in the amounts directed by the Resident Engineer. The bituminous material for the tack coat shall be applied in such a manner as to yield the coverage shown in TABLE 1.

Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. The cure period for the bituminous tack coat shall be as shown in TABLE 1. The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval, including any sand necessary to blot up excess bituminous material.

603-3.4 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY. Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials so demonstrated by service tests, shall be acceptable.

The Contractor shall furnish vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.

The bituminous material shall be supplied from an IDOT certified source indicated on the latest IDOT Certified Source List for Emulsified Asphalt and/or the certified source list for Asphalt Cement, Cutback Asphalt, and Road Oil, as applicable.

603-3.5 FREIGHT AND WEIGH BILLS. Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Resident Engineer, nor shall the car or tank be released until the final outage has been taken by the Resident Engineer.

Copies of freight bills and weigh bills shall be furnished to the Resident Engineer during the progress of the work.

METHOD OF MEASUREMENT

603-4.1 The bituminous tack coat to be paid for shall be the number of gallons of the diluted material used as ordered for accepted work, corrected to 60° F., in accordance with the temperature-volume correction tables for asphalt, and asphaltic emulsion materials, contained in ASTM D-1250.

Measurement for payment will not be made for any bituminous tack coat in excess of 105 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.) Plan quantities were calculated using the maximum application rates shown in the specifications unless shown otherwise in the plans.

BASIS OF PAYMENT

603-5.1 Payment shall be made at the contract unit price per gallon of bituminous tack coat. This price shall be full compensation for furnishing all materials and for all preparation, delivering, and application of these materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

TABLE 1

Proposed layer	Existing base to be tacked	Allowable tack material	Dilution rate	Application rate of diluted tack coat	Visual inspection guide	Cure time	Weather limitations
(401/403) Bituminous base/surface course	(401/403) Bituminous base/surface course	SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, RC-70, SS-1hp	Equal volume of water for all emulsions (50% emulsion/ 50% water). Does not apply for cutback asphalt	.05-.15 gal/s.y. for emulsions. .03-.08 gal/s.y. for cutback asphalt. To be determined by the Engineer based on visual inspection.	Uniform coverage of a light coating between layers and on the heavier side for existing surfaces. Avoid streaking. Areas worn from hauling operations shall be re-tacked.	When the tack coat dries ("breaks") to the satisfaction of the R.E.	In accordance with 603-3.1 Weather Limitations .
(401/403) Bituminous base/surface course	Grooved Bituminous surface course (401)	SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, SS-1hp	80% Emulsion/ 20% Water	0.1 - 0.2 gal/s.y. to be determined by the Engineer based on visual inspection.	At least 2/3 of the groove depth has been filled with residual asphalt and a light film exists on the top of the groove. May require multiple applications	Minimum 24 hours. The tack coat must be dry (cured) to the satisfaction of the R.E.	In accordance with 603-3.1 Weather Limitations .
(401/403) Bituminous base/surface course	Porous Friction Course (402)	SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, SS-1hp	80% Emulsion/ 20% Water	0.1 - 0.25 gal/s.y. to be determined by the Engineer based on visual inspection.	Uniform coverage of a light coating between layers and on the heavier side for existing surfaces. Avoid streaking. Areas worn from hauling operations shall be re-tacked.	Minimum 24 hours. The tack coat must be dry (cured) to the satisfaction of the R.E.	In accordance with 603-3.1 Weather Limitations .
Porous Friction Course (402)	Porous Friction Course (402)	SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, SS-1hp	90% Emulsion/ 10% Water	0.15 - 0.30 gal/s.y. to be determined by the Engineer based on visual inspection.	Uniform coverage of tack with a thickness of .06 inches (about the thickness of a penny) on the aggregate particles. The surface voids should be filled and the surface should show some texture from the tips of the larger size stone showing through the tack material. May require multiple applications.	Minimum 48 hours. The tack coat must be dry (cured) to the satisfaction of the R.E.	In accordance with 603-3.1 Weather Limitations , except raise temperature to 60° F and rising.

Note: Multiple applications may be required for rates greater than .25 gal/s.y. When multiple applications are required, cure time per application shall be a minimum of 24 hours.

Table 1, Continued

Proposed layer	Existing base to be tacked	Allowable tack material	Dilution rate	Application rate of diluted tack coat	Visual inspection guide	Cure time	Weather limitations
Porous Friction Course (402)	Grooved Bituminous surface course (401)	SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, SS-1hp	90% Emulsion/ 10% Water	0.15 - 0.30 gal/s.y. to be determined by the Engineer based on visual inspection.	At least 2/3 of the groove depth has been filled with residual asphalt and a residual asphalt of .06inches (about the thickness of a penny) on the top of the grooves. May require multiple applications.	Minimum 48 hours. The tack coat must be dry (cured) to the satisfaction of the R.E.	In accordance with <u>603-3.1 Weather Limitations</u> , except raise temperature to 60° F and rising.
Porous Friction Course (402)	(401/403) Bituminous base/surface course	SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, SS-1hp	80% Emulsion/ 20% Water	0.1 - 0.25 gal/s.y. to be determined by the Engineer based on visual inspection.	Uniform coverage .06 inches thick (about the thickness of a penny). May require two (2) applications. Avoid streaking. Areas worn from hauling operations shall be retacked.	Minimum 48 hours. The tack coat must be dry (cured) to the satisfaction of the R.E.	In accordance with <u>603-3.1 Weather Limitations</u> , except raise temperature to 60° F and rising.
(401/403) Bituminous base/surface course	(501) P.C. Concrete	SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, RC-70, SS-1hp	Equal volume of water for all emulsions (50% emulsion/ 50% water). Does not apply for cutback asphalt	.05-.15 gal/s.y. for emulsions. .03-.08 gal/s.y. for cutback asphalt. To be determined by the Engineer based on visual inspection.	Uniform coverage of a light coating on the heavier side for existing surfaces. Avoid streaking. Areas worn from hauling operations shall be retacked.	When the tack coat dries ("breaks") to the satisfaction of the R.E.	In accordance with <u>603-3.1 Weather Limitations</u> .
(401/403) Bituminous base/surface course	(501) P.C. Concrete	SS-1, SS-1h, CSS-1, CSS-1h, HFE 90, SS-1hp	80% Emulsion/ 20% Water	0.15 - 0.30 gal/s.y. to be determined by the Engineer based on visual inspection.	At least 2/3 of the groove depth has been filled with residual asphalt and a light fog on the top of the grooves.	Minimum 24 hours. The tack coat must be dry (cured) to the satisfaction of the R.E.	In accordance with <u>603-3.1 Weather Limitations</u> , except raise temperature to 60° F and rising.

Note: Multiple applications may be required for rates greater than .25 gal/s.y. When multiple applications are required, cure time per application shall be a minimum of 24 hours.

ITEM 605 JOINT SEALING FILLER

DESCRIPTION

605-1.1 This item shall consist of providing a resilient and adhesive joint sealing filler capable of effectively sealing joints and cracks in Portland cement concrete pavements and structures.

MATERIALS

605-2.1 NON-SILICONE JOINT SEALING MATERIALS. The joint sealing materials shall conform to one or more of the types listed below for all joints as specified by the Project Engineer.

- A. Federal Specification SS-S-200E(2) Sealants, Joint, Two-Component, Jet-Blast Resistant, Cold Applied.
- B. ASTM D 3406 Standard Specification for Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements
- C. ASTM D 3569 Standard Specification for Joint Sealants, Hot Applied, Elastometric, Jet Fuel Resistant type, for Portland Cement Concrete Pavements
- D. ASTM D 6690 Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
- E. ASTM D 7116 Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types, for Portland Cement Concrete Pavements

Each lot or batch of sealing compound, as specified, shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, and the safe heating temperature and shall be accompanied by the manufacturer's certification stating that the compound meets the requirements of this specification.

Mixing of components, temperature and application of the above joint sealing materials shall be as recommended by the manufacturer.

- F. ASTM D 2628 - Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements for all contraction and expansion joints and longitudinal dummy groove joints.

The size and dimensional tolerances of the joint sealer shall be as shown on the drawings or as specified. The sealer shall consist of preformed strips which shall be heat and blast-resistant and shall not support combustion. They shall be oil and jet-fuel resistant also. Unless detailed on the plans, the shape of any joint sealer, from any manufacturer, shall be approved by the Engineer prior to delivery to the job site. Such approval shall be requested in writing and shall be accompanied by a 15-foot length of the proposed sealer.

When approved, the material as delivered to the job shall be accompanied by the manufacturer's certification stating that it meets the requirements of ASTM D-2628, except that specimens for the high-temperature recovery test (70 hours/212° F.) shall be tested as received, without talc dusting. The hardness test (type A durometer) shall be made using sufficient plies of buffed samples to achieve the minimum required sample thickness. Samples shall be of sufficient width and length to cover the testing shoe.

The manufacturer shall also certify that, when tested at 70°, ± 5° F. the sealer will resist compression when properly aligned between parallel plates by exerting a pressure of at least 4 pounds per lineal inch when compressed to 80% of its nominal width, and no more than 12 pounds per lineal inch when compressed to 50% of its nominal width.

The lubricant used to install the preformed elastic joint sealer shall be a one-component polychloroprene compound containing only soluble phenolic resins blended together with anti-

oxidants and acid acceptors in aromatic hydrocarbon solvent mixture and shall have the following physical properties:

Average net weight per gallon - 7.84 lbs.
Solids Content - 22-28%, by weight.

The viscosity shall be such that the lubricant will perform suitably with the installation equipment.

The lubricant shall remain fluid from 5° F. to 120° F.

Film strength (ASTM D-412) - 2,300 psi minimum tensile strength, 750% minimum elongation before breaking.

The lubricant shall be stored at a temperature of 50° F. to 80° F. Any lubricant not used within 270 days of its manufacture shall be unacceptable.

Each lot of the lubricant shall be delivered in containers plainly marked with the manufacturer's name or trademark, lot number, and date of manufacture and shall be accompanied by the manufacturer's certification as to conformance to this specification.

The Engineer reserves the right to sample and test this material in accordance with ASTM D 2835 subsequent to delivery at the project site.

605-2.2 SILICONE JOINT SEALING MATERIALS. The silicone joint sealing material shall be Dow Corning 888 non-sag silicone joint sealer, Pecora 301 or an approved equal.

605-2.3 REQUIREMENTS FOR SILICONE JOINT SEALER. A written certification from the manufacturer shall be submitted to the Resident Engineer, prior to the installation, which includes the date of manufacture for each lot. Material more than six months old will not be accepted.

605-2.4 BACKER ROD. The backer rod shall conform to ASTM D 5249, Type 3, and to the dimensions shown on the plans.

CONSTRUCTION METHODS

605-3.1 TIME OF APPLICATION. The joints shall be sealed immediately following the curing period or as soon thereafter as weather conditions permit, and before the pavement is opened to traffic, including construction traffic.

At the time of application of the sealing compound, the atmospheric and pavement temperature shall be above 40° F. for the installation of preformed joint seal and above 50° F. for application of poured joint sealing material. The weather shall not be rainy or foggy. The temperature requirements may be waived only when so directed by the Engineer in writing.

605-3.2 EQUIPMENT. All equipment necessary for the proper construction of this work shall be on the project and in first-class working condition. The equipment shall be as recommended by the manufacturer of the sealer and approved by the Engineer before construction is permitted to start. It shall also meet the following requirements:

- A. For non-silicone joint sealers: The heating apparatus for Hot-Poured sealers shall consist of a heating kettle or tank, constructed as a double boiler, with a space between the inner and outer shells filled with oil, asphalt, or other material for heat transfer. The heater shall be equipped to provide positive temperature control of the sealing material. Direct methods of heating shall not be permitted. The material shall not be heated in excess of the temperature recommended by the manufacturer. Once the material has been heated, it shall be maintained at an even temperature until placed into the joint.

The joint-pouring equipment for Hot or Cold-Poured sealers shall consist of a mechanical-pouring kettle mounted on wheels with a pouring shoe or the pouring shoe may be mounted on a swivel jointed discharge line at the rear of a truck on which the mixing or heating unit is carried. A hand pouring pot shall not be allowed.

The joint sealing equipment for Cold-Poured sealers of two or more components shall consist of a power-driven apparatus capable of extruding the material as a continuous feed. The extruding nozzle tip of the machine shall be of such design as to fill the groove uniformly from the bottom to the top. The joint-sealing machine shall include a mechanical mixer capable of thoroughly mixing the sealing components into a uniform, homogeneous mass.

The installation equipment for the Preformed Elastomeric Joint Material shall be capable of installing the sealer in the upright position, without cutting, nicking, distorting, or otherwise damaging the seal. Lubricant shall be applied to the concrete or the preformed seal, or both, and the seal shall be installed in a substantially compressed condition and at the depth below the surface of the pavement as shown in the plans. The method of installation shall be such that the joint sealer will not be stretched more than 5 percent of the minimum theoretical length, or compressed more than 2 percent. The method of installation shall be checked for stretching or compression, using transverse joint sealer. The check shall consist of installing sealer in five joints of at least 25 feet in length, removing the sealer immediately after installation, and checking the length. This check may be modified by pre-marking or precutting the sealer to length prior to installation if this is compatible with the equipment being used. If the measured length of any of these five sealers indicates that the sealer is stretched or compressed beyond these limits, the installation shall be modified to correct the situation. Once satisfactory sealing operations have started, one joint length per every hundred shall be removed and checked. If the limits are exceeded, the joint sealers on either side should be removed until the condition disappears. The affected joints shall be resealed in a satisfactory manner at no cost to the owner, and the method of installation shall be checked again for satisfactory procedure. The seal shall be installed in the longest practicable lengths in longitudinal joints and shall be cut at the joint intersections for continuous installation of the seal in the transverse joints.

The equipment for cleaning joint openings shall consist of such plows, powered and hand brooms or wire brushes, air compressors, sand blasters, and, if necessary, joint cleaning and grooving machines as are necessary to produce a satisfactory clean and dry joint. Similar equipment shall be provided for cleaning joints previously sealed.

- B. For silicone joint sealers: Sawing equipment shall be capable of sawing Portland cement concrete to the specified width and depth. Compressed air equipment shall have traps to prevent the inclusion of water and/or oil in the airline. The high pressure water washer shall be capable of spraying water with a pressure of 3,000 psi (20,500 kPa). The joint sealing equipment shall consist of a power driven apparatus capable of extruding the material as a continuous feed. The extruding nozzle tip of the machine shall be of such design as to fill the joint uniformly

605-3.3 PREPARATION OF JOINTS.

- A. For non-silicone joint sealer: Immediately before filling, the joints shall be thoroughly cleaned of all laitance, curing compound, protrusions of hardened concrete, dirt, dust, and other objectionable material and the faces of the joints shall be dry.

When joints are to be resealed, the existing joint material shall be removed to the depth as shown on the plans or as directed. When joints are to be resealed with joint sealer other than that originally used, it will be necessary to remove all existing joint sealer and asphalt stains from the joint opening. It may be necessary to widen the joint with a grooving machine so that the joint sealer will develop a satisfactory bond with the clean concrete.

When it is necessary to seal random cracks, they shall be cut, grooved, and cleaned in a manner satisfactory for sealing by methods and equipment similar to that used for the joints.

Joints which are to be sealed with Preformed Elastomeric Joint Material shall be constructed to the width, depth, and shape shown on the plans or as specified. Maximum tolerances shall be $\pm 1/16$ inch for width or beveled edge, and $\pm 1/8$ inch for depth. When contraction joints greater than $3/8$ inch in width are constructed in two stages, the second-stage sawing shall not be done sooner than 72 hours after the concrete at the joint has been placed.

If the joint has opened $1/16$ inch or more as measured at the slab edge at the time of final sawing, the sawed width shall be increased so that the net width will meet the above tolerance when the joint is closed. Any irregularity in the joint face resulting from tearing, spalls, saw misalignment,

etc., and which would prevent contact between the lip of the sealer and the joint face, shall be corrected prior to installation of the sealer.

The Contractor shall not install any joint sealer material until the Resident Engineer has inspected and approved the condition of the joints immediately prior to the installation of the sealer.

B. For silicone joint sealers: The joints shall be sawed and prepared according to the following procedure:

1. Joint Sawing and Cleaning. The minimum allowable joint width is 1/2". The width to depth ratio for the silicone joint sealer shall be 2:1. (Example: A 1/2" wide joint will have a silicone joint sealer thickness of 1/4") The joint sealer shall be recessed 3/8" below the surface of the pavement. The depth of the second stage saw cut shall be enough to allow for the joint sealer recess, the joint sealer thickness and the height of the compressed backer rod. (A compressed backer rod may be slightly taller than its uncompressed diameter.)

a. New Portland Cement Concrete Pavement. The joint shall be sawed to the dimensions shown on the plans in two stages. The first stage shall consist of sawing joints to prevent random cracking according to Item 501.

The second stage saw cut shall then be performed no earlier than 72 hours after the concrete has been placed. Immediately after performing the second stage saw cut, both faces of the joint shall be cleaned of all laitance and contaminants using a high pressure water wash with a minimum pressure of 3000 psi (20,500 kPa). The joint shall be allowed to dry for at least 7 total days of dry weather since the placement of the concrete.

Existing Portland Cement Concrete Pavement. The joint shall be sawed to the dimensions dimensions shown on the plans. Immediately after performing the saw cut, both faces of the joint shall be cleaned of all laitance and contaminants using a high pressure water wash with a minimum pressure of 3,000 psi (20,500 kPa). The joint shall be allowed to dry overnight before sand blasting.

2. Joint Preparation. Joint preparation and sealant installation shall be accomplished within the same day. These operations will only be allowed to proceed when the joint is dry and the air temperature is above 41° F (5° C).

Both faces of the joint shall be sandblasted using a separate pass for each face. The nozzle shall be held at an angle of 30-90 degrees to the joint face at a distance of 1-2 inches (25-50 mm). Sandblasting shall be considered acceptable when the entire joint width of both joint faces has a rough texture to a joint face depth of at least 1.75 times the joint width. There shall be no evidence of saw marks on the joint faces. After sandblasting, the joint shall be cleaned of debris using clean compressed air at a minimum pressure of 90 psi (620 kPa). Gas or electric powered blowers are not acceptable. After the joint has been cleaned with compressed air, the backer rod shall be installed to a uniform depth as shown on the plans.

The Contractor shall not install any joint sealer material until the Resident Engineer has inspected and approved the condition of the joints immediately prior to the installation of the sealer.

605-3.4 PLACING JOINT SEALER.

A. For non-silicone joint sealer: Sufficient joint sealer shall be placed into the joints so that upon completion of the work, the surface of the sealer in the joint shall be within 1/4 inch but below the level of the adjacent pavement surface, or at the elevation as directed by the Resident Engineer. The Contractor shall "spot up" or refill all unsatisfactory joints before final acceptance. Any excess filler on the surface of the pavement shall be removed and the surface shall be left in a clean condition.

The Preformed Elastomeric Joint Sealer shall be installed in the joints and thoroughly secured in place with the lubricant which shall cover both sides of the sealer over the full area in contact with the sides of the concrete joint. The lubricant may be applied to the concrete or sealer or both. For beveled joints the sealer shall be installed in a compressed condition at the depth of not less than

1/16 inch nor more than 3/16 inch below the bottom edge of the bevel. For joints with vertical sides, the joint sealer shall be installed in a compressed condition at a depth of ¼ inch \pm 1/16 inch, below the level of the pavement surface.

In transverse joints the minimum length of sealer without cuts or splices shall be 25 feet. Sealer shall not be spliced between adjacent joints or slab edge. Where different sizes of sealer intersect, the larger may be notched to accommodate a thorough installation of the smaller.

- B. For silicone joint sealer: Joint preparation and sealant installation shall be accomplished within the same day. These operations will only be allowed to proceed when the joint is dry and the air temperature is above 41°F (5°C). The sealant shall be applied using equipment recommended by the manufacturer at the thickness shown on the plans. If a non-sag sealer is used, the surface of the sealant shall then be tooled such that full contact is obtained between the sealant and the joint face and the required recess is obtained. If the joint becomes wet and/or dirty during sealing, sealing will not be permitted to resume until the joint has been restored to a clean and dry state.

605-3.5 FIELD TEST. Before sealing the joints, the Contractor shall be required to demonstrate that the equipment and procedures for preparing, mixing, and placing the sealing compound will produce a satisfactory joint seal. The demonstration shall include a preparation of at least two small batches and the application of the resulting material. During the course of the work, any batches that do not have good consistency for application shall be rejected.

METHOD OF MEASUREMENT

605-4.1

(a) For non-silicone joint sealant: The joint sealant to be paid for shall be the lineal feet of filler or sealer as specified, in place, complete and accepted. When required in the construction of new concrete pavements or structures, no measurement will be made for direct payment of filler, as the cost of furnishing and installing shall be considered as a subsidiary obligation in the completion of the construction of the concrete pavement.

(b) For silicone joint sealant: The joint cleaning, sawing, and sealing for the proposed PCC pavement shall be incidental to Item 501. No separate measurement for payment will be made for this item.

BASIS OF PAYMENT

605-5.1 For non-silicone joint sealers, payment will be made at the contract unit price per lineal feet for joint sealing filler except in those cases when the cost of sealing the joints is to be considered a subsidiary obligation in the completion of the concrete pavement. This price shall be full compensation for furnishing all materials and for all preparation, delivering, and application of these materials and for all labor, equipment, tools, and incidentals necessary to complete the item.

605-5.2 For silicone joint sealers, payment for joint sealing in the new PCC pavement shall be incidental to Item 501.

ITEM 609 SEAL COATS AND BITUMINOUS SURFACE TREATMENTS

DESCRIPTION

609-1.1 This item shall consist of a bituminous surface treatment as a wearing course composed of single (seal coat) or multiple applications of bituminous material and aggregate cover placed on the prepared primed base or properly cured wearing surface, in accordance with these specifications, and shall conform to the dimensions and typical cross section shown on the plans, and with lines and grades established by the Resident Engineer.

609-1.2 QUANTITIES OF MATERIALS PER SQUARE YARD. The approximate amounts of materials per square yard for the bituminous surface treatment shall be as provided in TABLE 1 for the treatment specified on the plans or in the special provision. The exact amounts to be used shall be determined by the Resident Engineer.

TABLE 1. QUANTITIES OF MATERIALS

MATERIALS	AMOUNTS
First Application:	
Bituminous material	0.15 to 0.25 gallon per square yard.
Aggregate material	35 to 55 pounds per square yard.
Second Application:	
Bituminous material	0.30 to 0.50 gallon per square yard.
Aggregate material	20 to 35 pounds per square yard.
Third Application:	
Bituminous material	0.20 to 0.30 gallon per square yard.
Cover aggregate material	10 to 20 pounds per square yard.

MATERIALS

609-2.1 AGGREGATE MATERIALS. The aggregate material shall be either crushed stone or crushed gravel. The cover material shall be screenings; sand may be used when specified.

If the material is to be crushed stone, it shall be manufactured from sound, hard, durable rock of accepted quality and crushed to specification size. All strata, streaks, and pockets of clay, dirt, sandstone, soft rock, or other unsuitable material accompanying the sound rock shall be discarded and not allowed to enter the crusher.

If the material is to be crushed gravel, it shall consist of hard, durable, fragments of stone or gravel of accepted quality and crushed to specification size. All strata, streaks, and pockets of sand, excessively fine gravel, clay, or other unsuitable material including all stones, rocks, and boulders of inferior quality shall be discarded and not allowed to enter the crusher. The crushing of the gravel shall result in a product in which the material retained on the separate No. 4, 3/8 inch, and 1/2 inch sieves shall have at least 75% of particles with at least one fractured face.

The crushed aggregate shall not contain more than 8%, by weight, of elongated or flat pieces and shall be free from wood, roots, vegetable, organic, or other extraneous matter. The crushed coarse aggregate shall have a percentage of wear not more than 45 at 500 revolutions, as determined by ASTM C 131 (Los Angeles Rattler Test).

The aggregate shall show no evidence of disintegration nor show a total loss greater than 15% when subjected to five cycles of the sodium sulphate accelerated soundness test specified in ASTM C 88.

The crushed aggregate for the applications shall meet the requirements for gradation given in TABLE 2 when tested in accordance with ASTM C 117 and C 136.

TABLE 2. REQUIREMENTS FOR GRADATION OF AGGREGATE

Aggregate for first application	
Sieve Designation (square openings)	Percentage by Weight Passing Sieves
1 inch	100
3/4 inch	90-100
1/2 inch	40-70
No. 4	5-15
No. 16	0-6
(IDOT Gradation)	(CM-11)
Aggregate for second application	
Sieve Designation (square openings)	Percentage by Weight Passing Sieves
1/2 inch	100
3/8 inch	94-100
No. 4	15-45
No. 16	0-4
(IDOT Gradation)	(CA-16)
Aggregate for third application	
Sieve Designation (square openings)	Percentage by Weight Passing Sieves
3/8 inch	100
No. 4	45-85
No. 16	25-65
No. 50	10-30
No. 200	5-15
(IDOT Gradation)	(CA-17)

The gradations in the table represent the limits which shall determine suitability of aggregate for use for the specified applications from the sources of supply. The final gradations decided on, within the limits designated in the table, shall be uniformly graded from coarse to fine.

The cover aggregate used in the third application shall be a light-colored material whose color and reflectivity shall be approved by the Engineer.

The aggregate to be used shall show no evidence of stripping or swell when tested in accordance with AASHTO T 182. The use of antistrip agents for the control of stripping shall be used if necessary.

609-2.2 BITUMINOUS MATERIAL. The types, grades, controlling specifications, and application temperatures for the bituminous materials are given below. The Project Engineer shall designate the specific material to be used.

TYPE AND GRADE	SPECIFICATION	TEMPERATURE
Asphalt Cement		
120 - 150 penetration	ASTM D 946	285° - 350° F.
200 - 300 penetration	ASTM D 946	275° - 325° F.

CONSTRUCTION METHODS

609-3.1 WEATHER LIMITATIONS. Bituminous material shall not be applied to wet aggregate material or during sand, dust, or rain storms. The pavement shall be free of surface moisture during the Contractor's operating periods.

In general, it will be the policy not to permit the application of any bituminous material when the atmospheric temperature is less than 70° F. and the Resident Engineer may require the Contractor to delay the application of bituminous material until the atmospheric and pavement surface conditions are satisfactory. No bituminous material shall be placed which cannot be cared for during daylight hours.

609-3.2 OPERATION OF PITS AND QUARRIES. The aggregate material shall be obtained from approved sources. The Contractor shall make all necessary arrangements for obtaining the material, and all work involved in clearing and stripping pits or quarries and handling unsuitable material shall be performed by the Contractor at his/her own expense. The material in the pits shall be handled so that a uniform and satisfactory product shall be secured. Unless otherwise directed, pits shall be adequately drained and shall be left in a neat and presentable condition with all slopes dressed uniformly. Quarries shall be left as neat and presentable as practicable.

609-3.3 EQUIPMENT AND ORGANIZATION. Each unit required in the execution of these specifications shall be under the continuous supervision of a competent superintendent thoroughly experienced in this type of work. Experienced operators will be required on all equipment used in hauling and applying bituminous material and aggregates.

All equipment necessary to perform this work properly shall be on the project, in first-class working condition, and approved by the Resident Engineer before construction is permitted to start.

The following equipment will be the minimum required for this type of construction, and additional machinery shall be secured if, in the opinion of the Resident Engineer, it is necessary to fulfill the conditions of these specifications or to complete the item within the time specified:

- A. The distributor shall have pneumatic tires of such width and number that the load produced on the pavement surface shall not exceed 650 pounds per inch of tire width and it shall be designed and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at readily controlled rates from 0.05 to 2.0 gallons per square yard. The bituminous material shall be applied within a pressure range of 25 to 75 pounds per square inch and with an allowable variation from any specified rate not to exceed 5%. Distributor equipment shall include a tachometer, pressure gauges, volume measuring devices, and a thermometer for reading temperatures of tank contents.
- B. The aggregate spreader shall be adjustable to spread accurately and evenly the required amounts per square yard.
- C. The steel-wheel rollers shall be of the self-propelled tandem or three-wheel type rollers. The wheels on the rollers shall be equipped with adjustable scrapers which shall be used when necessary to clean the wheel surfaces. Rollers shall be equipped with tanks and sprinkling apparatus which shall be used to keep the wheels wet and prevent the surfacing materials from sticking.
- D. The pneumatic roller shall consist of pneumatic tires arranged in a manner to provide a satisfactory compacting unit. The roller shall have an effective rolling width of at least 60 inches and shall give a compression of at least 275 pounds per inch of tread width when fully loaded.
- E. A power broom or power blower, broom dragging equipment, and equipment for heating aggregate shall be included, when needed.

The Contractor shall supply such auxiliary equipment as needed and all equipment shall meet the approval of the Resident Engineer.

Bituminous binder and aggregate shall not be spread over a greater yardage than can be rolled and finished in one day's operation. The yardage over which the binder is spread in advance of placing the aggregate shall be as determined by the Resident Engineer.

609-3.4 PREPARING UNDERLYING COURSE. The surface of the underlying course shall be prepared, shaped, and conditioned to a uniform grade and section, as shown on the plans and as specified. Loose dirt and other objectionable material shall be removed from the surface.

On those type of bases where a prime coat is required and specified, the prime shall be applied and satisfactorily cured before starting the bituminous surface treatment.

When specified, the Contractor shall be required to patch, with premixed material, any holes or other malformations deviating from the true cross section and grade. The premixed material shall be made

of the bituminous material specified in the proposal or plans and prepared by the method as directed by the Resident Engineer. All small patches shall be thoroughly hand tamped while the large patches shall be rolled with a power or pneumatic roller.

609-3.5 APPLICATION OF BITUMINOUS MATERIAL. Bituminous material shall be applied upon the properly prepared surface at the rate and temperature specified using a pressure distributor to obtain uniform distribution at all points. To insure proper drainage, the strips shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope. During all applications, the surfaces of adjacent structures shall be protected in such manner as to prevent their being spattered or marred. Bituminous materials shall not be discharged into borrow pits or gutters or upon the airport area.

609-3.6 APPLICATION OF AGGREGATE MATERIAL. Immediately after the application of the bituminous material or when directed, the aggregates at the rate specified for each designated application shall be spread uniformly over the bituminous material with the aggregate equipment specified. Trucks spreading aggregate shall be operated backward so that the bituminous material will be covered before the truck wheels pass over it. The aggregate shall be spread in the same width of application as the bituminous material and shall not be applied in such thickness as to cause blanketing. Back-spotting or sprinkling of additional aggregate material, and pouring additional bituminous material over areas that show up having insufficient cover or bitumen, shall be done by hand whenever necessary. Additional spreading of aggregate material shall be done by means of a motor-patrol grader equipped with broom moldboard, a broom drag, or a power broom, as directed by the Resident Engineer.

Power rollers shall be used immediately after the aggregate is spread. Following the rolling with the steel-wheel roller, the course shall be further rolled with a pneumatic roller to the satisfaction of the Resident Engineer to insure proper embedding into the bitumen. The rolling shall be continued until no more aggregate material can be worked into the surface. In the construction of the second and third application, blading with the wire-broom moldboard attachment or broom dragging shall begin as soon as possible after the rolling has started and after the surface has set sufficiently to prevent excessive marking. Further blading and rolling on the strip being placed and on adjacent strips previously placed, shall be done as often as necessary to keep the aggregate material uniformly distributed. These operations shall be continued until the surface is evenly covered and cured to the satisfaction of the Resident Engineer.

Succeeding applications shall not be applied until the preceding application has set and in no case until at least 24 hours have elapsed. If dust, dirt, or other foreign matter accumulates on the surface between the applications, the Contractor shall be required to sweep and clean the surface as specified herein. The bituminous material and the aggregate shall be spread upon the clean and properly cured surface and handled as required. Extreme care shall be taken in all applications to avoid brooming or tracking dirt or any foreign matter on any portion of the pavement surface under construction.

All surplus aggregate from the final application shall be swept off the surface and removed prior to final acceptance of the work.

609-3.7 CORRECTION OF DEFECTS. Any defects, such as raveling, low centers, lack of uniformity, or other imperfections caused by faulty workmanship, shall be corrected to the satisfaction of the Resident Engineer.

All defective materials resulting from over-heating, improper handling, or application shall be removed by the Contractor and replaced with approved materials as provided for in these specifications.

609-3.8 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY. Samples of the bituminous materials that the Contractor proposes to use, together with a statement as to their source and character, shall be submitted and approval obtained before use of such materials begins.

The Contractor shall furnish vendor's certified test reports for each carload, or equivalent, of bitumen shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing sample materials as received for use on the project.

609-3.9 FREIGHT AND WEIGH BILLS. Before the final estimate is allowed the Contractor shall file with the Engineer receipted bills where railroad shipments are made, and certified weight bills when materials are received in any other manner, of the bituminous and covering materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Resident Engineer, nor shall the car or tank be released until the final outage has been taken by the Resident or by converting the Engineer.

Copies of all freight bills and weigh bills shall be furnished to the Resident Engineer during the progress of the work.

METHOD OF MEASUREMENT

609-4.1 The unit of measurement for bituminous material shall be the gallon. The gallonage to be paid for shall be the number of gallons of bituminous material used as ordered for the accepted work. Gallonage shall be determined by measuring the material at a temperature of 60° F. or by converting the gallonage measured at other temperatures to gallonage at 60° F. in accordance with the temperature-volume correction tables for asphalt, and asphalt emulsion materials contained in ASTM D 1250.

Measurement for payment will not be made for any bituminous material in excess of 105 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.) Plan quantities were calculated using the application rates shown in the plans.

609-4.2 The quantity of aggregate materials for the first application to be paid for shall be the number of tons of aggregate used as ordered for the accepted work.

609-4.3 The quantity of aggregate material for the second application to be paid for shall be the number of tons of aggregate used as ordered for the accepted work.

609-4.4 The quantity of aggregate for the third application to be paid for shall be the number of tons of aggregate used as ordered for the accepted work.

609-4.5 Measurement for payment will not be made for any aggregate materials in excess of 110 percent of plan quantity plus (or minus) theoretical quantities authorized by the Engineer. (Maximum payment percentages apply only to those pay items paid for on the basis of volume or weight.) Plan quantities were calculated using the application rates shown in the plans.

609-4.6 The quantities as measured in 609-4.2, 609-4.3, and 609-4.4, are applicable for aggregates having bulk specific gravities between 2.55 and 2.75, as determined by ASTM C 127 and C 128. Proportionate corrections shall be made when the aggregates furnished for the job are outside these limits. Where the specific gravity is below 2.55, the correct quantity for payment shall be the product of the number of tons used multiplied by the ratio of 2.55 to the bulk specific gravity of the job aggregate. Where the specific gravity is above 2.75, the corrected quantity for payment shall be the product of the number of tons used multiplied by the ratio of 2.75 to the bulk specific gravity of the job aggregate.

BASIS OF PAYMENT

609-5.1 Payment shall be made at the contract unit price per gallon for bituminous material for surface treatment and per ton for aggregate for each application. These prices shall be full compensation for furnishing all materials and for all preparation, hauling and application of the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

ITEM 610 STRUCTURAL PORTLAND CEMENT CONCRETE

DESCRIPTION

610-1.1 This item shall consist of either plain or reinforced structural Portland cement concrete, prepared and constructed in accordance with these specifications, at the locations and of the form and dimensions shown on the plans. The concrete shall be composed of coarse aggregate, fine aggregate, Portland cement, and water.

This item shall include all formwork, furnishing and placing of reinforcement and concrete used in the construction of all fencing, drainage, lighting installation, and other miscellaneous concrete construction.

MATERIALS

610-2.1 GENERAL. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. They may be subjected to inspection and tests at any time during the progress of their preparation or use. The source of supply of each of the materials shall be approved by the Engineer before delivery or use is started. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be stored and handled to insure the preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed therein.

In no case shall the use of pit-run or naturally mixed aggregates be permitted. Naturally mixed aggregate shall be screened and washed, and all fine and coarse aggregates shall be stored separately and kept clean. The mixing of different kinds of aggregates from different sources in one storage pile or alternating batches of different aggregates will not be permitted.

An Item 501 PCC mix design is acceptable for use if no IDOT Class SI mix is available.

610-2.2 COARSE AGGREGATE. The coarse aggregate for concrete shall be a crushed stone and meet the requirements of Class A quality in accordance with the IDOT quality specifications and shall be freeze-thaw rated in accordance with IDOT specifications.

The coarse aggregate shall meet the IDOT 022CA07 or 022CA11 Gradation.

610-2.3 FINE AGGREGATE. The fine aggregate for concrete shall meet the requirements of Class A quality in accordance with the IDOT quality specifications and shall be Gradation FA 1 or FA 2.

The fine aggregate shall consist of washed sand. Washed stone sand, or a blend of stone and natural sand, will only be permitted with the written approval of the Engineer.

610-2.4 CEMENT. The cement used shall be Portland cement conforming to the requirements of the type specified:

- A. Portland cement ----- ASTM C 150
- B. Air-entraining Portland cement ----- ASTM C 150

The Contractor shall furnish vendor's certified test reports for each carload, or equivalent, of cement shipped to the project, if requested by the Engineer, and shall be delivered to the Engineer before permission to use the cement is granted.

The cement used shall be IDOT-approved Portland cement type (I) conforming to the requirements of ASTM C 150 and be from an approved manufacturer listed on the current IDOT "Approved List of Qualified Cement Plants". Other cement types may only be used when approved in writing by the Division.

610-2.5 WATER. The water used in concrete shall be free from sewage, oil, acid, sugar, strong alkalis, vegetable matter, and clay and loam. If the water is of questionable quality, it shall be tested in

accordance with the requirements of AASHTO T 26, ASTM D 516, ASTM D 512, ASTM C 151, ASTM C 266 and ASTM C 109 tests as deemed necessary by the Engineer. Water known to be of potable quality may be used without testing.

610-2.6 ADMIXTURES. The use of any material added to the concrete mix shall be approved by the Engineer and must be IDOT-approved admixtures listed on the current IDOT Bureau of Materials and Physical Research's "Approved List of Concrete Admixtures". This list contains the recommended dosage rates of each admixture, but the Contractor shall determine final dosage rate for the mix as part of the Quality Control on the material. The dosage determined shall not delay the initial set of concrete by more than one hour.

All concrete shall be air-entrained by the use of an admixture.

A retarding admixture is required to be added to the concrete mixture when the concrete temperature is 85 degrees F or above.

610-2.7 PREMOLDED JOINT MATERIAL. Premolded joint material for expansion joints shall meet the requirements of one of the following: ASTM D 994, D 1751, or D 1752.

610-2.8 JOINT FILLER. The filler for joints shall meet the requirements of Item 605, unless otherwise specified in the proposal.

610-2.9 STEEL REINFORCEMENT. Reinforcement bars shall conform to the requirements of ASTM A 706, Grade 60 deformed bars. Welded wire fabric shall conform to the requirements of AASHTO M 55, ASTM A 82, or ASTM A 185, plain type, flat stock only.

610-2.10 COVER MATERIALS FOR CURING. Curing materials shall conform to one of the following specifications:

- | | |
|--|------------|
| A. Waterproof Paper for Curing Concrete | ASTM C 171 |
| B. Polyethylene Sheeting for Curing Concrete | ASTM C 171 |
| C. Burlap Cloth | ASTM C 171 |
| D. Liquid Membrane-Forming Compounds for Curing Concrete
(Type 2) | ASTM C 309 |

610-2.11 CALCIUM CHLORIDE. When calcium chloride is permitted by the Engineer in the concrete as an accelerator, it shall meet the requirements of ASTM D 98.

CONSTRUCTION METHODS

610-3.1 GENERAL. The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified herein. All machinery and equipment owned or controlled by the Contractor, which he proposes to use on the work, shall be of sufficient size to meet the requirements of the work, and shall be such as to produce satisfactory work; all work shall be subject to the inspection and approval of the Engineer. The Contractor shall employ, at all times a sufficient force of workmen of such experience and ability that the work can be prosecuted in a satisfactory and workmanlike manner.

610-3.2 CONCRETE PROPORTIONS. The concrete shall consist of a mixture of coarse aggregate, fine aggregate, Portland cement, and water. All aggregates and bulk cement shall be measured by weight. In proportioning aggregates and mixing water, compensation shall be made for the weight of moisture in the aggregates, and this shall be determined periodically.

The air content by volume shall be between 5% and 8%, by volume, based on measurements made on concrete immediately after discharge from the mixer in accordance with ASTM C 138 or C 231.

Concrete provided under this item shall be IDOT approved Class SI concrete, air entrained with crushed stone coarse aggregate and shall be pre-approved by the Division prior to use. An Item 501 PCC Pavement mix can be used in lieu of a Class SI mix, with the approval of the Division.

The Contractor shall be responsible for obtaining the job mix formula meeting the requirements of this item. The Contractor shall refer to the Illinois Division of Aeronautics latest edition of Policy Memorandum 96-1, "Item 610, Structural Portland Cement Concrete: Job Mix Formula Approval and Production Testing", located on the internet on the IDOT website.

The Contractor shall provide actual batch weight tickets for every batch of Item 610 concrete used on the project to be collected by the Resident Engineer upon delivery of each batch of concrete. The actual batch weight tickets shall be kept with the project records by the Resident Engineer and shall be available upon request of the Department of transportation.

Concrete provided under this item shall be a workable plastic concrete having a compressive strength of not less than 3,500 pounds per square inch at the age of 14 days when tested in accordance with ASTM C 39.

The concrete shall have a maximum slump of three inches (3") when tested in accordance with ASTM C 143.

610-3.3 CONTROL TESTS. When directed by the Resident Engineer, the Contractor shall make test cylinders from the concrete as mixed for the work as herein specified.

Concrete cylindrical test specimens shall be made in accordance with ASTM C 31. The Contractor shall cure and store the test specimens under such conditions as directed. The Engineer will make the actual tests on the specimens at no expense to the Contractor.

610-3.4 PROPORTIONING AND MEASURING DEVICES. When package cement is used, the quantity for each batch shall be equal to one or more whole sacks of cement. The aggregates shall be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge shall be contained in each batch compartment. Weighing boxes or hoppers shall be approved by the Engineer and shall provide means of regulating the flow of aggregates into the batch box so that the required and exact weight of aggregates can be readily obtained.

610-3.5 CONSISTENCY. The consistency of the concrete shall be checked by the slump test specified in ASTM C 143 and have a range of 1" – 3"

610-3.6 MIXING. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. Whichever mixing process is used, concrete of the specified proportions and consistency shall be produced.

610-3.7 MIXING CONDITIONS. The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40° F. without permission of the Engineer. If permission is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50° F or more than 100° F. The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his/her expense.

Retempering of concrete by adding water or any other material shall not be permitted.

The delivery of concrete to the job shall be in such a manner that the batches of concrete will be deposited at uninterrupted intervals.

610-3.8 FORMS. The design and engineering of formwork, as well as its construction shall be the responsibility of the Contractor. Forms shall be of wood, metal, or other material approved by the Engineer and shall be designed, fabricated, braced, and maintained such that the finished concrete conforms to the true lines and dimensions specified in the plans. Forms shall be tight and of sufficient rigidity to prevent distortion due to the pressure of the concrete and other construction loadings, including vibration.

The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall not be greater than 1/240 of the span between structural members. 3/4" chamfer strips shall be placed in the corners of the column, beam, and wall forms where the concrete will be exposed to view.

Where necessary to maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork due to the weight and pressure of the fresh concrete and due to construction loads.

Temporary openings shall be provided at the base of wall forms and at other points where necessary to facilitate cleaning and inspection immediately before concrete is deposited.

Form accessories to be partially or wholly embedded in the concrete, such as ties and hangars, shall be a commercially manufactured type. The portion remaining within the concrete shall leave no metal within one inch of the surface when the concrete is exposed to view. Spreader cones on ties shall not exceed one inch in diameter.

Plywood or other wood surfaces shall be sealed against absorption of moisture from the concrete by either (1) a field applied, approved, form oil or sealer, or (2) a factory applied non-absorptive liner.

When forms are coated to prevent bond with concrete, it shall be done PRIOR to placing of the reinforcing steel. Excess coating material shall not be allowed to stand in puddles in the forms nor allowed to come in contact with concrete against which fresh concrete will be placed.

Forms shall be wetted with water or with a non-staining mineral oil which shall be applied shortly before the concrete is placed.

If forms are to be reused, the Contractor shall maintain the shape, strength, rigidity and surface smoothness of all reused sections. Any formwork which is warped or contains bulges shall be repaired or discarded. All reused formwork shall be subject to approval of the Engineer.

Formwork for walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations, particularly when form ties will be bent by the removal operations.

Formwork for beam soffits and slabs and other parts that support the weight of concrete, shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified or permitted.

610-3.9 PLACING REINFORCEMENT. All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concreting. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

610-3.10 EMBEDDED ITEMS. Before placing concrete, any items that are to be embedded shall be firmly and securely fastened in place as indicated. All such items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The embedding of wood shall be avoided. The concrete shall be spaded and consolidated around and against embedded items.

610-3.11 PLACING CONCRETE. All concrete shall be placed during daylight, unless otherwise approved. The concrete shall not be placed until the depth and character of foundation, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved. Concrete shall be placed as soon as practical after mixing and in no case later than 45 minutes after water has been added to the mix. The method and manner of placing shall be such to avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. Dropping the concrete a distance of more than 5 feet, or depositing a large quantity at one point, will not be permitted. Concrete shall be placed upon clean, damp surfaces, free from running water, or upon properly consolidated soil.

The concrete shall be consolidated with suitable mechanical vibrators operating within the concrete. When necessary, vibrating shall be supplemented by hand spading with suitable tools to assure proper and adequate compaction. Vibrators shall be manipulated so as to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The vibration at any joint shall be of sufficient duration to accomplish compaction but shall not be prolonged to the point where segregation occurs. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie, a closed bottom dump bucket, or other approved method and shall not be disturbed after being deposited.

Concrete shall be placed in conformance with ACI 304. The method and manner of placing concrete shall be such as to avoid segregation or separation of the aggregates or the displacement of reinforcing steel.

Chutes shall extend as nearly as practicable to the point of deposit. For wall placement in excess of six feet vertical height, a tremie shall be used in placing the concrete. If reinforcing steel or formwork is such that a tremie cannot be used, the method of placement shall be approved by the Engineer.

Placement of concrete shall be regulated so that the pressures caused by the wet concrete will not exceed those used in the design of the forms. Concrete placed in vertical forms shall be placed in lifts of not more than two feet which shall be kept practically level.

610-3.12 CONSTRUCTION JOINTS. When the placing of concrete is suspended, necessary provisions shall be made for joining future work before the placed concrete takes its initial set. For the proper bonding of old and new concrete, such provisions shall be made for grooves, steps, keys, dovetails, reinforcing bars or other devices as may be prescribed. The work shall be arranged so that a section begun on any day shall be finished during daylight of the same day. Before depositing new concrete on or against concrete which has hardened, the surface of the hardened concrete shall be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

610-3.13 EXPANSION JOINTS. Expansion joints shall be constructed at such points and of such dimensions as may be indicated on the drawings. The premolded filler shall be cut to the same shape as that of the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place in such manner that it will not be displaced when concrete is deposited against it.

610-3.14 DEFECTIVE WORK. Any defective work disclosed after the forms have been removed shall be immediately removed and replaced. If any dimensions are deficient, or if the surface of the concrete is bulged, uneven, or shows honeycomb, which in the opinion of the Engineer cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.

610-3.15 SURFACE FINISH. All exposed concrete surfaces shall be true, smooth, free from open or rough spaces, depressions, or projections. The concrete in horizontal plan surfaces shall be brought flush with the finished top surface at the proper elevation and shall be struck-off with a straightedge and floated. Mortar finishing shall not be permitted, nor shall dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.

When directed, the surface finish of exposed concrete shall be a rubbed finish. If forms can be removed while the concrete is still green, the surface shall be pointed and wetted and then rubbed with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, a carborundum stone shall be used to finish the surface. When approved, the finishing can be done with a rubbing machine.

610-3.16 CURING AND PROTECTION. Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures, and shall be maintained with a minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete.

Initial curing shall immediately follow the finishing operation, and shall continue for a minimum of 24 hours after placement. Concrete shall be kept continuously moist by one of the following methods listed below:

- A. Polyethylene Sheeting. The unformed surfaces shall be covered with polyethylene sheeting as soon as the concrete has hardened sufficiently to prevent marring the surface. The surface of the concrete shall be wetted immediately before sheeting is placed. Use of a layer of wetted burlap beneath the sheeting may be required at the option of the Engineer. The edges of the sheeting shall have sufficient lap and shall be fastened securely by any means satisfactory to the Engineer to provide an airtight cover. Tears or holes in the sheeting will not be permitted.
- B. Membrane Curing. After the concrete has been finished and immediately after the water sheen is no longer visible on the surface of the concrete, the surface shall be cured with membrane curing

compound. Curing compounds may be used to cover all exposed surfaces. Membrane curing will not be permitted at construction joints or on vertical wall surfaces. Application shall be such to completely cover all exposed surfaces and rate of coverage shall be in accordance with the manufacturers' recommendations.

- C. **Waterproof Paper Method.** The surface of the concrete shall be covered with waterproof paper as soon as the concrete has hardened sufficiently to prevent marring the surface. Any waterproof paper used shall meet the approval of the Engineer. The surface of the concrete shall be wetted immediately before the paper is placed. The paper shall be lapped a minimum of 12 inches end to end and such laps and ends shall be securely held in place to form a closed joint. Tears or holes in the paper will not be permitted. The edges shall be weighted securely by a means that is satisfactory to the Engineer to provide an air-tight cover.
- D. **Wetted Burlap.** The surface of the concrete shall be covered with wetted burlap blankets as soon as the concrete has hardened sufficiently to prevent marring the surface. The blankets shall overlap 6 inches and shall be kept saturated by means of a mechanically operated sprinkling system. At least two layers of wetted burlap shall be placed on the finished surface. In place of the sprinkling system, at the Contractor's option, two layers of burlap covered with impermeable covering may be used. The burlap shall be kept saturated with water. Plastic-coated burlap may be substituted for one layer of burlap and impermeable covering. The blankets shall be placed so that they are in contact with the edges of the concrete, and that portion of the material in contact with the edges shall be kept saturated with water.

Immediately following the initial curing and before the concrete has dried, additional curing shall be accomplished by one of the following methods:

1. Continuing the method used in initial curing.
2. Waterproof Paper.
3. Other moisture-retaining coverage materials which are practical and meet the approval of the Engineer.

The final curing shall continue until the cumulative number of days of initial and final curing totals not less than seven (7) days. Rapid drying at the end of the curing period shall be prevented.

Steel forms heated by the sun and all wood forms in contact with the concrete during the final curing period shall be kept wet. If forms are to be removed during the curing period, one of the above curing methods shall be employed immediately. Such curing shall be continued for the remainder of the curing period.

610-3.17 DRAINS OR DUCTS. Drainage pipes, conduits, and ducts that are to be encased in concrete shall be installed by the Contractor before the concrete is placed. The pipe shall be held rigidly so that it will not be displaced or moved during the placing of the concrete.

610-3.18 COLD WEATHER PROTECTION. When concrete is placed at temperatures below 40° F., the Contractor shall provide satisfactory methods and means to protect the mix from injury by freezing. Protection shall be in accordance with Division of Aeronautics' Policy Memo 2001-1.

610-3.19 FILLING JOINTS. All joints which require filling shall be thoroughly cleaned, and any excess concrete shall be cut out with proper tools. Joint filling shall not be started until after final curing and shall be done only when the concrete is completely dry. The cleaning and filling shall be carefully done with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

METHOD OF MEASUREMENT

610-4.1 RESERVED

610-4.2 RESERVED

BASIS OF PAYMENT

610-5.1 No direct payment will be made for structural Portland cement concrete. The cost of furnishing and installing structural concrete shall be considered incidental to the contract unit prices for the respective pay items utilizing the concrete. These prices shall be full compensation for furnishing all materials and for all preparation, delivering and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete the item.

ITEM 620 PAVEMENT MARKING

DESCRIPTION

620-1.1 This item shall consist of the painting of numbers, markings, and stripes on the surface of runways and taxiways applied in accordance with these specifications and at the locations shown on the plans, or as directed by the Resident Engineer.

MATERIALS

620-2.1 MATERIAL ACCEPTANCE. Paint and reflective glass beads shall be pre-approved by the Illinois Department of Transportation. The Contractor shall provide to the Resident Engineer an LA-15 with Test ID number (Supplier's Certification of Shipment of Approved Materials) or a manufacturer's certification listing the IDOT approval number for each batch/lot of paint and beads. Certification or LA-15's shall be submitted to the Resident Engineer upon delivery of materials (or prior to delivery of materials) to the jobsite. The manufacturer's certification shall include a statement that the material meets the specification requirements. It shall also include a batch or lot number that correlates with a batch or lot number on the material container. The Division of Aeronautics, however, reserves the right to perform verification testing for acceptance of these materials.

620-2.2 PAINT. Paint shall be one of the following types, as specified:

A. WATERBORNE. The waterborne paint shall meet the following requirements:

NOTE TO THE CONTRACTOR: The requirements for yellow and white paint are the same as the requirements found in the current Illinois Department of Transportation's *Standard Specifications for Road and Bridge Construction*.

All materials shall meet the following paint specification unless a shortage of raw materials precludes the production of paint which will meet the materials portion of this section. If the shortage can be documented to the satisfaction of the Engineer, then an alternate formulation will be allowed. Any alternate formulation shall comply with the latest volatile organic matter (VOM) content limits published by the IEPA in Title 35, Part 223 of the Illinois Administrative Code.

The finished paint shall be formulated and manufactured from first-grade materials. It shall be free from defects and imperfections that might adversely affect the serviceability of the finished product. It shall be completely free from dirt and other foreign material and shall dry within the time specified to a good, tough, serviceable film. The paint shall show no evidence of excessive settling, gelling, skinning, spoilage or livering upon storage in the sealed shipping containers under normal above freezing temperatures within twelve months of delivery. Any settled portion shall be easily brought back into suspension by hand mixing. When the settled portion is brought back into suspension in the vehicle, the paint shall be homogenous and shall not show a viscosity change of more than 5 KU from the original viscosity. Any paint that has settled within the period of twelve months after delivery to the degree that the settled portion cannot be easily brought into suspension by hand mixing shall be disposed of by the vendor and immediately replaced with acceptable material entirely at the vendor's expense, including handling and transportation charges. The paint, when applied by spraying methods to a hot-mix asphalt pavement, shall not be discolored due to the solvent action of the paint on the surface.

1. Ingredient Materials.

- a. TITANIUM DIOXIDE. This material shall comply with the latest revisions of the Specifications for Titanium Dioxide Pigments, ASTM D 476, Type II, Rutile. A notarized certificate of compliance from the pigment manufacturer shall be required.
- b. YELLOW PIGMENT. This material shall be non-toxic organic pigment, Yellow 65: Engelhard 1244 or equivalent
- c. CALCIUM CARBONATE. This material shall comply with the latest revision of the Specification for Calcium Carbonate Pigments, ASTM D 1199, Type GC, Grade I, with

minimum of 95 percent Calcium Carbonate or Type PC, minimum 98 percent Calcium Carbonate.

- d. ACRYLIC EMULSION POLYMER. This material shall be Rohm and Haas 2706, Dow Chemical DT-211, or approved equal.
- e. METHYL ALCOHOL. This material shall comply with the latest revision of the Specification for Methyl Alcohol, ASTM D 1152.
- f. CARBON BLACK. This material shall be a carbon black pigment, either powdered or pre-dispersed form.
- g. MISCELLANEOUS MATERIALS.
 - i. Water: Potable
 - ii. Dispersant: Tamol 850 (Rohm and Haas) or equivalent
 - iii. Surfactant: Triton CF-10 (Union Carbide) or equivalent
 - iv. Defoamer: Colloids 654 (Rhône-Poulenc) or equivalent
 - v. Rheology Modifier: Natrasol 250 HBR (Aqualon Company) or equivalent
 - vi. Coalescent: Texanol (Eastman Chemical) or equivalent
 - vii. Preservative: Troy 192 (Troy Chemical) or equivalent

- 2. Manufacture. All ingredient materials shall be delivered in the original containers and shall be used without adulteration. The containers shall be marked with the type of material, name of manufacturer and lot number.

The manufacturer shall furnish to the Division the batch formula which will be used in manufacturing the paint.

No change shall be made in this formula without prior approval by the Division and no change will be approved that adversely affects the quality or serviceability of the paint.

The following Standard Formulas shall be the basis for the paint. The finished products shall conform on a weight basis to the composition requirements of these formulas. No variations will be permitted except for the replacement of volatile lost in processing. Amounts are shown in kilograms (pounds) of material.

	WHITE	YELLOW	BLACK
	--	--	9.53 (21)**
C.I. Pigment Yellow 65	--	14.52 (32)	--
Titanium Dioxide, Rutile, Type II	45.36 (100)	9.53 (21)	--
Calcium Carbonate, Type PC	68.04 (150)	68.04 (150)	362.87 (800)***
Calcium Carbonate, Type GC	195.05 (430)	210.92 (465)	***
Rheology Modifier	0.23 (0.5)	0.23 (0.5)	.23 (0.5)*
Acrylic Emulsion, 50% Solids	245.40 (541)	242.68 (535)	196.77 (434)
Coalescent	10.89 (24)	10.43 (23)	9.53(21)
Defoamer	2.27 (5)	2.27 (5)	2.27(5)
Dispersant	3.63 (8)	4.08 (9)	3.18 (7)
Surfactant	0.91 (2)	0.91 (2)	1.13 (2.5)
Methyl Alcohol	13.15 (29)	12.70 (28)	13.61 (30)
Preservative	0.68 (1.5)	0.68 (1.5)	0.68 (1.5)
Aqua Ammonia	--	--	0.23 (0.5)
Water	4.54 (10)	4.54 (10)	26.79 (59)**
<i>Total Kilograms (Pounds)</i>	<i>590.15 (1301)</i>	<i>581.53 (1282)</i>	<i>626.82 (1382)</i>

* Rheology Modifier may be varied by up to 0.05 kg (0.1 pound) to adjust viscosity to desired range.

** Carbon black and water content may vary depending upon the pigment form used. Both must be adjusted to meet the paint properties specified herein.

*** The amount shown is total calcium carbonate, Type PC and Type GC.

3. Paint Properties. The finished paint shall be according to the following.

a. PIGMENT. Analysis of the extracted pigment shall be according to the following.

	WHITE	YELLOW	BLACK
Carbon Black (%)	--	--	Min. 1.5
Organic Yellow 65 (%)	--	Min. 4.8	--
Titanium Dioxide (%)	Min. 13.4	Min. 2.8	--
Calcium Carbonate (%)	Max. 86	Max. 93	Min. 58

The percent pigment by weight of the furnished product shall not be less than 50 percent nor more than 54 percent for white and yellow paint and not less than 59 percent for black paint.

b. VEHICLE. The non-volatile portion of the vehicle shall be composed of a 100 percent acrylic polymer and shall not be less than 44 percent by weight for white and yellow paint and not less than 38 percent by weight for black paint.

c. ORGANIC VOLATILES. The finished paint shall contain less than 150 grams of volatile organic matter per liter of total paint. (ASTM D 3960)

d. TOTAL SOLIDS. The finished paint shall not be less than 73 percent total non-volatile by weight for white and yellow paint and not less than 75 percent for black paint. (ASTM D 2369)

e. UNIT WEIGHT. The unit weight at 77° F (25° C) of the production batches shall not vary more than plus or minus 0.20 lb/gal (0.024 kg/L) from the weight of the qualification samples.

f. VISCOSITY. The consistency of the paint shall not be less than 83 nor more than 98 Krebs units at 77° F (25° C) for white and yellow paint and not less than 78 nor more than 88 Krebs units at 77° F (25° C) for black paint.

g. DRY OPACITY. The minimum contrast ratio shall be 0.97 when tested in accordance with Federal Specification, Method 141 a, No. 4121, Procedure B when applied at a wet film thickness of 15 mils (0.38 mm).

h. COLOR AND DIRECTIONAL REFLECTANCE (white and yellow paint). The paint, applied at a wet film thickness of 15 mils (0.38 mm) and allowed to dry 24 hours, shall meet the following requirements for daylight reflectance and color, when tested, using a color spectrophotometer with 45 degrees circumferential/zero degree geometry, illuminant C, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

White	Daylight Reflectance (Y)	85% min.
Yellow*	Daylight Reflectance (Y)	50% min.

*Shall match Federal 595 Color No. 33538 and chromaticity limit as follows:

x	0.490	0.475	0.485	0.530
y	0.470	0.438	0.425	0.456

i. WATER RESISTANCE. The paint shall conform to Federal Specification TT-P-1952D, Section 3.2.5.

j. FREEZE-THAW STABILITY. The paint shall show no coagulation or change in consistency greater than 10 Krebs Units, when tested in accordance with Federal Specification TT-P-1952D, Section 4.3.8.

- k. ACCELERATED PACKAGE STABILITY. The paint shall show no coagulation, discoloration, or change in consistency greater than 10 Krieb Units when tested in accordance with Federal Specification TT-P-1952D, Section 4.3.4.
 - l. DILUTION TEST. The paint shall be capable of dilution with water at all levels without curdling or precipitation such that the wet paint can be readily cleaned up with water only.
 - m. STORAGE STABILITY. After 30 days storage in a three-quarters filled, closed container, the paint shall show no caking that cannot be readily re-mixed to a smooth, homogenous state, no skinning, livering, curdling or hard settling. The viscosity shall not change more than 5 Krieb Units from the viscosity of the original sample.
 - n. NO PICK-UP TIME. The no pick-up time shall be less than 10 minutes. The test shall follow the requirements of ASTM D 711 with a wet film thickness of 15 mils (0.38 mm).
 - o. GRIND. The paint shall have a grind of not less than 3 on a Hegman Grind Gauge.
 - p. FLEXIBILITY. The paint shall show no cracking or flaking when tested in accordance with Federal Specification TT-P-1952D, Section 4.3.5.
 - q. DRY THROUGH TIME. The paint, when applied to a non-absorbent substrate at a wet film thickness of 15 mils (0.38 mm) and placed in a humidity chamber controlled at 90 ± 5 percent R.H. and a $72.5 \pm 2.5^\circ$ F ($22.5 \pm 1.4^\circ$ C) shall have a "dry through time" not greater than 15 minutes of the IDOT standard formula. The dry through time shall be determined according to ASTM D 1640, except that the pressure exerted shall be the minimum needed to maintain contact with the thumb and film.
 - r. NO-TRACKING TIME FIELD TEST. The paint shall dry to a no-tracking condition under traffic in three minutes maximum when applied at 15 ± 1 mil (0.38 ± 0.03 mm) wet film thickness at $130 - 150^\circ$ F ($54.4 - 65.6^\circ$ C), and from three to ten minutes when applied at ambient temperatures with 6 pounds (0.72 kg) of glass beads per gal (L) of paint for white and yellow paint and without beads for black paint. "No tracking" shall be the time in minutes required for the line to withstand the running of a standard automobile over the line at a speed of approximately 40 mph (65 km/hr), simulating a passing procedure without tracking of the reflectorized line when viewed from a distance of 50 feet (15 m).
- B. EPOXY. The epoxy paint shall be according to the following.

NOTE TO THE CONTRACTOR: These requirements are the same as the requirements found in the current Illinois Department of Transportation's *Standard Specifications for Road and Bridge Construction*.

1. The epoxy marking material shall consist of a 100 percent solid two part system formulated and designed to provide a simple volumetric mixing ratio of two components (must be two volumes of Part A and one volume of Part B). No volatile or polluting solvents or fillers will be allowed. Total solids shall not be less than 99 percent when determined, on the mixed material, according to ASTM D 2369, excluding the solvent dispersion.
2. The Epoxide Value (WPE) of Component A shall be tested according to ASTM D 1652 on a pigment free basis. The WPE shall not vary more than plus or minus 50 units of the qualification samples.
3. The Total Amine Value of Component B shall be tested according to ASTM D 2074. The Total Amine Value shall not vary more than plus or minus 50 units of the qualification samples.
4. Composition by Weight of Component A as Determined by Low Temperature Ashing. A 0.5 gram sample of component A shall be dispersed with a paperclip on the bottom of an aluminum dish, weighed and then heated in a muffle furnace at 1000° F (538° C) for one hour and weighed again. No solvents shall be used for dispersion. The difference in the weights shall be calculated and meet the following.

PIGMENT*	WHITE	YELLOW
Titanium Dioxide ASTM D 476 Type II	21-24%	--
Organic Yellow. Titanium Dioxide, Other	--	± 2%
Epoxy Resin	76-79%	± 2%

*No extender pigments are permitted.

**From the pigment and epoxy resin content determined on qualification samples.

5. Upon heating to application temperature, the material shall not exude fumes which are toxic or injurious to persons or property.
6. The daylight directional reflectance of the paint (without glass spheres) applied at 14 to 16 mils (0.35 to 0.41 mm) shall meet the following requirements, using a color spectrophotometer with a 45 degree circumferential/zero degrees geometry, illuminant C, and two degree observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

White	Daylight Reflectance (Y)	80% min.
Yellow*	Daylight Reflectance (Y)	50% min.

*Shall meet the coordinates of the following color tolerance chart.

x	0.490	0.475	0.485	0.530
y	0.470	0.438	0.425	0.456

In addition, the color of the yellow epoxy shall visually match Color Number 33538 of Federal Standard 595a to the satisfaction of the Division.

7. The epoxy pavement marking material, when mixed in the proper ratio and applied at 14 to 16 mils (0.35 to 0.41 mm) wet film thickness and with the proper saturation of glass spheres, shall exhibit a dry no-tracking time of twenty minutes or less when tested according to ASTM D 711.
8. The epoxy pavement marking materials when mixed in the proper ratio and tested according to ASTM D 7234, shall have a degree of adhesion which results in a 100 percent concrete failure in the performance of this test.
9. The epoxy pavement marking materials when tested according to ASTM D 2240, shall have a shore D hardness of between 75 and 100. Films shall be cast on a rigid substrate at 14 to 16 mils (0.35 mm to 0.41 mm) in thickness and allowed to cure at room temperature for 72 hours before testing.
10. The abrasion resistance shall be evaluated, according to ASTM D 4060, on a Taber Abrader with a 1,000 gram load and CS 17 wheels. The duration of test shall be 1,000 cycles. The loss shall be calculated by difference and be less than 82 mgs. The tests shall be run on cured samples of material which have been applied at a film thickness of 14 to 16 mils (0.35 mm to 0.41 mm) to code S-16 stainless steel plates. The films shall be allowed to cure at room temperature for at least 72 hours before testing.
11. When tested according to ASTM D 638, the epoxy pavement marking materials shall have a tensile strength of not less than 6,000 psi (41,300 kPa). The Type IV specimens shall be cast in a suitable mold not more than 1/4 inch (6.3 mm) thick and pulled at a rate of 1/4 in./min (6.3 mm/min.) by a suitable dynamic testing machine. The samples shall be allowed to cure at room temperature for at least 72 hours before testing.
12. When tested according to ASTM D 695, the catalyzed epoxy pavement marking materials shall have a compressive strength of not less than 12,000 psi (83,000 kPa). The cast sample shall be conditioned at room temperature for a minimum of 72 hours before performing the indicated tests. The rate of compression of these samples shall be 1/4 in./min. (6.3 mm/min.) or less.
13. The epoxy paint shall be applied to an aluminum alloy panel (Federal Test Std. No. 141, Method 2013) at a film thickness of 14 to 16 mils (0.35 mm to 0.41 mm) and allowed to cure for

72 hours at room temperature. Subject the coated panel for 75 hours to accelerated weathering using the light and water exposure apparatus (fluorescent UV - condensation type) as specified in ASTM G 53 (equipped with UVB-313 lamps).

The cycle shall consist of four hours UV exposure at 122° F (50° C), followed by four hours of condensation at 104° F (40° C). UVB 313 bulbs shall be used. At the end of the exposure period, the panel shall show no more than 10 Hunter Lab Delta E units or substantial change in gloss from the original, non-exposed paint.

14. The material shall be shipped to the job-site in substantial containers and shall be plainly marked with the manufacturer's name and address, the name and color of the material, date of manufacture, and batch number.
15. Prior to approval and use of the epoxy pavement marking materials, the manufacturer shall submit a notarized certification of an independent laboratory, together with the results of all tests, stating these materials meet the requirements as set forth herein. The certified test report shall state the lot tested, manufacturer's name, brand name of epoxy and date of manufacture. The certification shall be accompanied by 1 pt (1/2 L) samples each of Part A and Part B. After approval by the Division, certification by the epoxy manufacturer shall be submitted for each batch used. New independent laboratory certified test results and samples for testing by the Division shall be submitted any time the manufacturing process or paint formulation is changed. All costs of testing (other than tests conducted by the Division) shall be borne by the manufacturer.
16. Acceptance samples shall consist of two 1 pt (1/2 L) samples of Part A and 1 pt (1/2 L) of Part B, of each lot of paint. The samples shall be submitted to the Division for testing, together with a manufacturer's certification. The certification shall state the formulation for the lot represented is essentially identical to that used for qualification testing. All acceptance samples shall be taken by a representative of the Illinois Department of Transportation. The epoxy pavement marking materials shall not be used until tests are completed and they have met the requirements as set forth herein.
17. When concrete pavement is to be painted, it shall attain an age of 28 days before the curing compound is removed and the paint is applied.

620-2.3 REFLECTIVE MEDIA. The glass beads shall be sampled and pre-approved for use by the Illinois Department of Transportation. Type B beads shall be used and shall have a silicone, moisture resistant coating and pass IDOT tests for moisture resistance, as well as packaging specifications and any other relevant IDOT tests.

CONSTRUCTION METHODS

620-3.1 WEATHER LIMITATIONS. The painting shall be performed only upon a dry surface, when the atmospheric temperature is above 45° F. and when the weather is not foggy or windy.

620-3.2 EQUIPMENT. All equipment for the work shall be approved by the Engineer and shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, and such auxiliary hand painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross sections and clear-cut edges without running or spattering.

620-3.3 PREPARATION OF SURFACE. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other foreign material which would reduce the bond between the paint and the pavement. The area to be painted shall be cleaned by sweeping and blowing or by other methods as required to remove all dirt, laitance, and loose materials. Markings shall be applied to the cleaned surface on the same calendar day. If this cannot be accomplished, the surface area shall be re-cleaned prior to applying the markings. No markings shall be placed until the Resident Engineer approves the cleaning.

Paint shall not be applied to Portland cement concrete pavement until the concrete in the areas to be painted is clean of curing material. Sand blasting or high pressure water shall be used to remove curing material from concrete surfaces.

620-3.4 LAYOUT OF MARKINGS. On those sections of pavement where no previously applied markings are available to serve as a guide, the proposed markings shall be laid out in advance of the paint application.

620-3.5 APPLICATION. Markings shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface have been approved by the Resident Engineer.

The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine in two applications, each at the rate(s) shown in TABLE 1. The addition of thinner will not be permitted.

TABLE 1. Application Rates for Paint and Glass Beads

Paint Type	Paint Square feet per gallon, ft ² /gal (Square meters per liter, m ² /l) (Per application)	Glass Beads, Type I, Gradation A Pounds per gallon of paint, lb/gal (Kilograms per liter of paint, kg/l) (Applied to second coat only)
Waterborne	115 ft ² /gal maximum (2.8 m ² /l)	7 lb/gal minimum (0.85 kg/l)
Epoxy	90 ft ² /gal maximum (2.2 m ² /l)	15 lb/gal minimum (1.8 kg/l)

A period of 14 days minimum shall elapse between placement of a HMA surface course or seal coat and application of the paint unless waterborne paint is used. When waterborne paint is used, a minimum of 24 hours shall elapse.

The edges of the markings shall not vary from a straight line more than ½ inch in 50 feet, and the dimensions shall be within a tolerance of plus or minus 5 percent. Glass spheres shall be distributed to the surface of the marked areas immediately after application of the paint. A dispenser shall be furnished which is properly designed for attachment to the marking machine and suitable for dispensing glass spheres. When painting Item 402 Porous Friction Course with waterborne paints, the paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine from two directions at the rate(s) shown in TABLE 1 from each direction.

Glass spheres shall be required on all pavement markings with the exception of black markings.

The Contractor shall furnish certified test reports for the materials shipped to the project. The reports shall not be interpreted as a basis for final acceptance. The Contractor shall notify the Resident Engineer upon arrival of a shipment of paint to the job site. All emptied containers shall be returned to the paint storage area for checking by the Resident Engineer. The containers shall not be removed from the airport or destroyed until authorized by the Resident Engineer.

620-3.6 PROTECTION. After application of the paint, all markings shall be protected damage until the paint is dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings of paint.

620-3.7 PAVEMENT MARKING REMOVAL. The Contractor shall remove existing and temporary markings as shown in the plans or as directed by the Engineer using sandblasting, water blasting, shot blasting, or other approved method.

620-3.8 TEMPORARY PAVEMENT MARKING. Temporary pavement marking shall be applied with one coat at the rate shown in TABLE 1.

Glass beads will be required where shown on the plans.

METHOD OF MEASUREMENT

620-4.1 The quantity of runway and taxiway markings to be paid for shall be the number of square feet of painting performed in accordance with the specifications and accepted by the Engineer.

When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans and the Contractor and the Resident Engineer have agreed in writing by the use of form AER-981 that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the Plans have been altered or when disagreement exists between the Contractor and the Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured as herein specified.

The quantity of permanent pavement marking, temporary pavement marking and removal of permanent and temporary markings to be paid for shall be the number of square feet of painting or removal performed in accordance with the specifications and accepted by the Engineer.

BASIS OF PAYMENT

620-5.1 Payment shall be made at the contract unit price per square foot for pavement marking, temporary marking, and pavement marking removal. This price shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the item. The application of the reflective media shall be considered incidental to the item of pavement marking for which it is used and no additional compensation will be allowed.

ITEM 625 TAR EMULSION PROTECTIVE SEAL COAT

(For HMA Pavements)

DESCRIPTION

625-1.1 This item shall consist of an application of a rubberized coal-tar emulsion seal coat, with mineral aggregate, and with the use of a latex rubber, which may or may not contain a silicone additive applied on an existing, previously prepared HMA surface, in accordance with these specifications for the area shown on the plans or as designated by the Engineer.

625-1.2 QUANTITIES AND COMPOSITION OF MATERIALS PER SQUARE YARD. The rubberized coal-tar pitch emulsion seal coat shall consist of a mixture of coal-tar pitch emulsion, water, latex rubber and aggregate in the proportions shown in TABLE 1. The amount of water added to the rubberized coal-tar pitch emulsion sand slurry, to achieve application consistency, shall not exceed 100 percent of the coal-tar pitch emulsion. The amount of water added to the coal-tar pitch emulsion sand slurry shall not exceed 100 percent of the coal-tar pitch emulsion. The final composition shall be determined by the Engineer within the limitations of TABLE 1.

TABLE 1. COMPOSITION OF MIXTURE

Type of Seal Coat	Water gal/gal of Emulsion	Sand lb/gal of Emulsion	Rubber gal/gal of Emulsion	Application Rate gal/sq yd (per app)
Rubberized Sand Slurry	0.70-1.00	6-14	0.07-0.12	0.25-0.55

The rubberized sand slurry coal-tar emulsion seal coat shall consist of two coats applied at a rate specified in TABLE 1.

MATERIALS

625-2.1 MINERAL AGGREGATE. The aggregate shall either be a natural or manufactured product and shall be composed of clean, hard, durable, uncoated particles, free from lumps of clay and all organic matter. The aggregate should meet the gradation in TABLE 2, when tested in accordance with ASTM C 136.

TABLE 2 - GRADATION OF AGGREGATES

SIEVE	WEIGHT PASSING
No. 16 (1.18 mm)	100
No. 20 (0.85 mm)	85-100
No. 30 (0.60 mm)	15-85
No. 40 (0.40 mm)	2-15
No. 100 (0.15 mm)	0-2

Note: These are recommended gradations and subject to approval by the Engineer. If this gradation cannot be met, any substitution must be approved by the Engineer before being used.

The moisture of the mineral aggregate at the time of batching shall be such that the material will readily flow into the batching box for correct measurement.

625-2.2 BITUMINOUS MATERIAL. The bituminous material shall be a coal-tar pitch emulsion prepared from a high-temperature, coal-tar conforming to the requirements of ASTM D 490, Grade 12. Oil and water gas tars shall not be used even though they comply with ASTM D 490. The coal-tar pitch emulsion shall conform to all requirements of ASTM D 5727 except the water content shall not exceed 50 percent. Alternate materials may be submitted for consideration of the Engineer.

625-2.3 WATER. The water used in mixing shall be potable and free from harmful soluble salts. The temperature of the water shall be at least 50° F (10° C).

625-2.4 LATEX RUBBER. The rubber shall be copolymer latex containing 51-70 parts butadiene and 30-49 parts acrylonitrile or styrene with silicones at 3 percent of the rubber content. The average particle size shall be between 300 and 1500 angstroms and the rubber shall be compatible with the coal-tar pitch emulsion used by the Contractor. The rubber must mix homogeneously with the coal-tar emulsion, water, and sand in the proportions specified to produce a mixture that will adequately suspend the sand.

CONSTRUCTION METHODS

625-3.1 WEATHER LIMITATIONS. The slurry sealing treatment shall not be applied when the surface is wet or when the weather is foggy, when rainy or rain threatens, or when there is a forecast of temperatures below 32° F within 24 hours from the time of placement of the mixture. No mixture shall be placed unless the ambient temperature is at least 50° F and rising, and the temperature on the pavement surface is at least 50° F.

625-3.2 EQUIPMENT AND TOOLS. All equipment, tools, and machinery used for handling the materials and for performing any part of the work shall be subject to the approval of the Engineer. All equipment, tools, and machinery shall be kept-clean and shall be maintained in satisfactory working condition at all times. Whenever any equipment, tools, or machinery is found to be unsatisfactory, it shall be changed or improved-as required.

- A. Distributors. Distributors used for the application of the tar emulsion shall be self-propelled, equipped with pneumatic tires, and capable of uniformly applying 0.15 to 0.50 gallons per square yard (0.69 to 2.3 liter per square meter) of tar emulsion over the required width of application. Distributors shall be equipped with removable manhole covers, tachometers, pressure gauges, and volume-measuring devices.
- B. Mixing equipment. The mixing machine shall be a continuous flow mixing unit capable of accurately delivering and proportioning the aggregate, emulsion, rubber and water to a revolving multi-blade twin shafted mixer and discharging the mixed product on a continuous flow basis. The machine shall have sufficient storage capacity for aggregate, emulsion, rubber and water to maintain an adequate supply to the proportioning controls. The machine may be equipped with self-loading devices, which provide for the loading of materials while continuing to place the mixture.
- C. Proportioning devices. Individual volume or weight controls for proportioning each material to be added to the mix, i.e., aggregate, emulsion, rubber and water shall be provided and properly marked. These proportioning devices are usually revolution counters or similar devices and are used in material calibration and for determining the materials output at any time.
- D. Spreading equipment. The slurry sealing mixture shall be spread uniformly by means of a mechanical type spreader box attached to the mixer, equipped with paddles to agitate and spread the materials throughout the box. A front seal shall be provided to insure no loss of the mixture at the pavement contact point. The rear seal shall act as a final strike-off and shall be adjustable. The mixture shall be spread to fill cracks and minor surface irregularities and leave a uniform skid resistant application of the mixture on the surface. The spreader box and rear strike-off shall be so designated and operated that a uniform consistency is achieved to produce a free flowing material to the rear strike-off. The longitudinal joint where two passes join shall be neat appearing, uniform, and lapped. All excess material shall be removed from the job prior to opening the paved area to traffic. The spreader box shall have a suitable means provided to side shift the box to compensate for variation in pavement geometry.
- E. Auxiliary equipment. Suitable crack and surface cleaning equipment, traffic control devices, barricades, hand tools, and support equipment shall be provided as necessary to properly perform the work.
- F. Machine calibration. Each mixing unit to be used in the performance of the work shall be calibrated in the presence of the Resident Engineer prior to the start of the work. At the option of the Engineer, previous calibration documentation data covering the exact materials to be used may be acceptable, provided that the documentation data was made during the previous 6 months. The documentation shall include the individual calibration of each material at various settings, which can be related to the machine's metering devices.

625-3.3 PREPARATION OF PAVEMENT SURFACE. HMA surfaces which have been softened by petroleum derivatives or have failed due to any other cause shall be removed to the full depth of the damage and replaced with new HMA similar to that of the existing pavement. Areas of the pavement surface to be treated shall be in a firm consolidated condition and sufficiently cured so that there is no concentration of oils on the surface. This can usually be determined by pouring water on the surface to be treated. If the water, after standing for a short period, picks up a film of oil, the surface is not sufficiently cured for the application of the emulsion. A 30 day minimum should be required for curing of newly placed HMA.

Prior to placing the slurry sealing mixture, unsatisfactory areas shall be repaired and the surface of the pavement shall be clean and free from any vegetation, dust, dirt, or other loose foreign matter, grease oil, or any type of objectionable surface film. The pavement shall be swept with hand brooms or power sweepers or cleaned with pressure streams of water, provided that flushing with pressure streams of water shall not be permitted in areas having significant amounts of surface cracking. Grates, manholes, tie downs, or other such appurtenances shall be protected from the surfacing material.

Areas that have been subjected to fuel or oil spillage shall be wire brushed to remove any dirt accumulations. The area shall then be primed with tack coat to prevent the seal coat from debonding.

No separate payment will be made for surface preparation. The cost of the surface preparation shall be considered incidental to the unit price bid for this item.

625-3.4 CLEANING EXISTING SURFACE. Prior to placing the seal coat, the surface of the pavement shall be clean and free from dust, dirt, or other loose foreign matter, grease, oil, or any type of objectionable surface film. When directed by the Resident Engineer, the existing surface shall be swept with hand brooms or with power sweepers or cleaned with a power blower. When required, pavement shall be flushed with a fire hose, if hydrants are convenient, or with a water-flushing truck. To remove accumulations of oil or grease, some sections may require cleaning with a strong caustic solution. The residue from this treatment shall be flushed and washed with pressure streams of water taking extreme care that all caustic is removed from the surface; otherwise, the emulsion will not cure properly. If this does not provide a water break free surface, the affected areas shall be removed and replaced with new pavement. All large cracks shall be cleaned by removing accumulated dirt or any vegetation and by blowing out with compressed air. Cracks larger than 1/16 inch shall be routed out to 3/8 inch and poured with a suitable joint sealer before the emulsion is applied.

All painted stripes or markers on the HMA surface to be treated shall be removed.

After the pavement surface has been thoroughly cleaned, it shall be flushed with water to provide a damp surface, free from standing water, for the application of the seal coat.

Areas which are to receive a sand-slurry seal shall be primed with undiluted emulsion at the rate of 0.075 to 0.10 gallon per square yard. The primed area shall be allowed to dry thoroughly, and in no case shall the curing period be less than 4 hours.

625-3.5 APPLICATION OF EMULSION. After the pavement surface has been inspected, and approved by the Engineer, the emulsion shall be applied over the dampened pavement, free from standing water, in two coatings in accordance with the method described below in subparagraph A. Hand Method or B. Distributor or Applicator. Due to the settling that may take place in transit, the emulsion shall be thoroughly agitated before use by power mixers so that a homogeneous consistency is assured for proper and uniform application.

- A. Hand Method. The emulsion shall be applied in two coats in the amounts per square yard as stated in TABLE 1. The undiluted material shall be poured in strips on the pavement and spread with a squeegee or brush, smoothing out with a brush. This procedure shall be continued until the entire area is covered. The first coat shall be allowed to dry or cure sufficiently to prevent pickup before the second coat is applied. When spreading the second coat, it shall be spread crosswise to the placing of the first coat when practicable.
- B. Distributor or Applicator. When applied by distributor or approved type of applicator, the emulsion shall be applied uniformly to the surface of the pavement at the prescribed pressures and in the amounts per square yard as specified in TABLE 1. The emulsion shall be thoroughly mixed before

use. When it is necessary to dilute the emulsion in order to aid proper application, the emulsion may be diluted with the minimum amount of clean, fresh water necessary to produce the desired application, but not exceeding 10%. The rate of application of the diluted emulsion shall be increased to provide the amount of undiluted emulsion specified in TABLE 1.

The first application shall be cured sufficiently to drive over without damage before the second application is applied. When conditions permit, the second application shall be spread crosswise to the first application. During the application, surfaces of adjacent structures shall be protected to prevent them from being spattered or marred. In areas inaccessible to the distributor, application may be by the hand method.

625-3.6 APPLICATION OF SAND SLURRY. When the emulsion, aggregate, waters and rubbers are blended, the material shall be premixed to produce a homogeneous mixture of uniform consistency. The quantities of materials to be combined in each batch shall be in accordance with the proportions shown in TABLE 1.

Before application, the materials shall be proportioned accurately and mixed by suitable mixing equipment. The emulsion and the water shall first be charged into the mixer and blended to a desired consistency. Aggregate shall then be added at a slow and uniform rate while the mixing is continued. The latex rubber shall then be added. After all the constituents are in the mixer, the mixing shall continue for approximately five minutes or longer, if necessary. The mixing shall produce a smooth, free flowing homogeneous mixture of uniform consistency. Slow mixing shall be continuous from the time the bitumen is placed into the mixer until the slurry is applied by distributor truck or poured into the spreading equipment. During the entire mixing process, no breaking, segregating, or hardening of the emulsion nor balling, lumping, or swelling of the aggregate shall be permitted. The slurry shall be applied at a uniform rate to provide the desired amount. A sufficient amount of slurry shall be fed in the spreader box to keep a full supply against the full width of the squeegee, so that complete coverage of all surface voids and cracks is obtained.

In areas where a spreader box cannot be used, the slurry shall be applied by means of a hand squeegee.

Upon completion of the work, the seal coat shall have no pinholes, bare spots, or cracks through which liquids or foreign matter could penetrate to the underlying pavement. The finished surface shall present a uniform texture.

The rubberized sand slurry coal-tar emulsion seal coat shall consist of two coats applied at a rate specified in TABLE 1.

Each application shall be allowed to dry thoroughly before the next coat is applied.

625-3.7 CURING. The mixture shall be permitted to dry for a minimum of 24 hours after the final application before opening to traffic and shall be sufficiently cured to drive over without damage to the seal coat. Any damage to the uncured mixture will be the responsibility of the Contractor to repair.

625-3.8 HANDLING. The emulsion shall be continuously circulated or agitated from the time it has been mixed until its application on the pavement surface. The distributor or applicator, pumps, and all tools shall be maintained in satisfactory working condition. Spray bar nozzles, pumps, or other equipment can be cleaned with coal-tar toluene or xylene.

625-3.9 EMULSION MATERIAL CONTRACTOR'S RESPONSIBILITY. The Contractor shall furnish the manufacturer's certification that each consignment of emulsion shipped to the project meets the requirements of ASTM D 5727, except the water content shall not exceed 50 percent. The Contractor shall furnish certification to the Engineer that the latex rubber shipped to the project meets the requirements of the material specified in Section 625-2.4. The certifications shall be delivered to the Engineer prior to the beginning of work. The manufacturer's certification for the emulsion and rubber shall not be interpreted as a basis for final acceptance. Any certification received shall be subject to verification by testing samples received for project use.

METHOD OF MEASUREMENT

625-4.1 When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans and the Contractor and the Resident Engineer have agreed in writing by the use of form AER-981 that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the Plans have been altered or when disagreement exists between the Contractor and the Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured as herein specified.

This item shall be measured by the number of square yards of pavement surface area satisfactorily constructed in conformance with these specifications. No separate measurement for emulsified asphalt and aggregate will be made for payment.

BASIS OF PAYMENT

625-5.1 Payment shall be made at the contract unit price per square yard for Tar Emulsion Seal Coat. These prices shall be full compensation for furnishing all materials, for preparing, mixing and applying these materials, and for all labor, equipment, tools and incidentals necessary to satisfactorily complete the item.

DIVISION III- FENCING (WIRE FENCES)

ITEM 161 WIRE FENCE WITH STEEL POSTS

(Class C Fence)

DESCRIPTION

161-1.1 This item covers the requirements for furnishing materials and constructing new wire fences and gates with steel posts in accordance with the details included herein and as shown on the plans. The Class "C" fence and gates will be installed at the locations shown on the construction plans and in accordance with this specification and in accordance with the Illinois Department of Transportation's Standard Specifications for Road and Bridge Construction, latest edition, IDOT Standard 665001-01. The Class "C" fence shall be of the height shown on the construction plans. The proposed gates will be of the height and width shown on the construction Plans.

This work shall also include Class C fence and gate relocations, and Class C fence and gate removals at the locations shown on the plans.

MATERIALS

161-2.1 WIRE.

- A. Woven wire (zinc coated). The woven wire fencing shall be 7-bar, 26-inch field fence with top and bottom wires No. 10 gauge, and filler and stay wires No. 12-1/2 gauge. Stay wires shall be spaced 6 inches apart. All wire shall be smooth galvanized steel wire conforming to ASTM A 121, Type B. All wires shall be two-dip and spaced as shown on the plans.
- B. Barbed Wire (zinc coated). Zinc coated barbed wire shall be 2-strand twisted No. 12 1/2 ASW gauge galvanized steel wire with 4 point barbs of No. 14 ASW gauge galvanized steel wire. All wire shall conform to ASTM A 121, Type A with a minimum coating of 0.80 ounces per square foot of wire surface. The barbs shall be spaced approximately 4 inches apart.
- C. Bracing Wire (Zinc-coated). Wire used for cable for bracing shall be No. 9 smooth galvanized soft wire.

161-2.2 FENCE POSTS, GATES, RAILS, BRACES, AND ACCESSORIES. These items, when specified, shall conform to the requirements of Fed. Spec. RR-F-191 and shall be zinc coated.

161-2.3 CONCRETE. Concrete shall be produced and placed in accordance with Item 610.

CONSTRUCTION METHODS

161-3.1 GENERAL. The fence shall be constructed in accordance with the details on the plans and as specified herein using new materials, and all work shall be performed in a workmanlike manner satisfactory to the Engineer. Prior to the beginning of the work or upon the request of the Contractor, the Resident Engineer shall locate the position of the work by establishing and marking the property line or fence line. When directed, the Contractor shall span the opening below the fence with barbed wire fastened to stakes of the required length at locations of small natural or drainage ditches where it is not practical to conform the fence to the general contour of the ground surface. The new fence shall be permanently tied to the terminals of existing fences whenever required by the Project Engineer. The finished fence shall be plumb, taut, true to line and ground contour, and complete in every detail. When directed, the Contractor shall stake down the woven wire fence at several points between posts.

When directed, in order to keep stock on adjoining property enclosed at all times, the Contractor shall arrange the work so that construction of the new fence will immediately follow the removal of existing fences. The length of unfenced section at any time shall not exceed 300 feet or such length that the stock can be kept in the proper field. The work shall progress in this manner and at the close of the working day the newly constructed fence shall be tied to the existing fence. Any openings in the fence shall be guarded when stock is using the adjoining property.

Any disturbed area, with the exception of farming areas, shall be seeded and mulched in accordance with Items 901 and 908. The cost of seeding and mulching of the areas disturbed by this work shall be incidental to the associated item of work.

161-3.2 CLEARING FENCE LINE. The site of the fence shall be sufficiently cleared of obstructions, and surface irregularities shall be graded so that the fence will conform to the general contour of the ground. The fence line shall be cleared to a minimum width of 2 feet on each side of the centerline of the fence. This clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions which will interfere with proper construction of the fence. Stumps within the cleared area of the fence shall be placed a uniform distance above ground, as specified in the plans. When shown on the plans or as directed by the Resident Engineer, the existing fences which coincide with, or are in a position to interfere with, the new fence location shall be removed by the Contractor as a part of the construction work, unless such removal is listed as a separate item in the bid schedule. All holes remaining after post and stump removal shall be refilled with suitable soil, gravel, or other material acceptable to the Resident Engineer and shall be compacted properly with tampers.

The work shall include the handling and disposal of all material cleared, excavated or removed, regardless of the type, character, composition, or condition of such material encountered.

161-3.3 INSTALLING POSTS. All posts shall be spaced as shown on the plans. Corner, brace, anchor, end, and gate posts shall be set in concrete bases as shown on the plans. The top of the base shall be slightly above the ground surface, trowel finished, and sloped to drain. Holes of full depth and size for the concrete bases for posts shall be provided even if blasting of rock or other obstructions is necessary. All line posts may be either driven or set in dug holes to a penetration of 3 feet. All post setting shall be done carefully and to true alignment. Dirt removed for placing posts, anchor bars, flanges, etc., shall be replaced, tamped, and leveled. When posts are driven, care shall be exercised to prevent marring or buckling of the posts. Damaged posts shall be replaced at the Contractor's expense. No extra compensation will be made for rock excavation. Rock excavation shall not be grounds for extension of time.

A high early strength concrete may be used. The concrete mix design will be approved for use by the Illinois Division of Aeronautics prior to using it on the project.

161-3.4 BRACING. All corner, anchor, end, and gate posts shall be braced as shown on the plans. Anchor posts shall be set at approximately 500-foot intervals and braced to the adjacent posts.

161-3.5 INSTALLING WIRE. All barbed wire and woven wire shall be placed on the side of the posts away from the airport, or as directed, at the height indicated on the plans. The woven wire shall be carefully stretched and hung without sag and with true alignment. Care shall be taken not to stretch the wire so tightly that it will break in cold weather or pull up corner and brace posts. All horizontal wires shall be fastened securely to each post by fasteners or clips designed for use with the posts furnished. The woven wire shall be wrapped around end, corner, and gate posts, and the ends of all horizontal wires shall be tied with snug, tight twists. The wire shall be secured to prevent slipping up and down the post. Barbed wire strands shall be stretched and each strand secured to each post to prevent slipping out of line or becoming loose. At end, corner, and gate posts the barbed wire shall be securely wrapped and anchored once about the post from outside and secured against slipping by tying the ends with snug, tight twists. However, on spans of less than 100 feet both ends of the span need not be wrapped around the posts. The bottom wire of the woven wire fencing shall clear the ground by not more than 4 inches or less than 1 inch at any place.

161-3.6 SPLICING WIRE. Splices in barbed and woven wire will be permitted if made with an approved galvanized bolt-clamp splice or a wire splice made as follows: The ends of each wire shall be carried 3 inches past the splice tool and wrapped around the other wire for at least six turns in opposite directions. After the tool is removed, the space occupied by it shall be closed by pulling the ends together. The unused ends of the wire shall be cut close to make a neat, workmanlike job.

161-3.7 INSTALLING GATES. The gates shall be hung on gate fittings as shown on the construction plans. They shall be attached in such a manner that the gate cannot be lifted off the hinges. Gates shall be erected to swing in the direction indicated and shall be provided with gate stops, as specified or as shown on the plans. Gates shall be erected at suitable places, as directed by the Resident Engineer or as shown on the plans.

161-3.8 EXISTING FENCE CONNECTIONS. Wherever the new fence joins an existing fence, either at a corner or at the intersection of straight fence lines, a corner or anchor post shall be set at the junction and braced and anchored the same as herein described for corner posts.

If the connection is made at other than the corner of the new fence, the last span of the old fence shall contain a brace span.

161-3.9 CLEANING UP. The Contractor shall remove from the vicinity of the completed work all tools, building, equipment, etc., used during construction.

161-3.10 FENCE AND GATE REMOVAL. This work shall consist of the removal and disposal of existing wire fence and gates. The fence shall be removed completely including posts and foundations. The fence posts shall be pulled not cut off. All holes shall be filled and compacted. The removed material shall be disposed of off airport property.

161-3.11 FENCE AND GATE RELOCATION. The Contractor will remove all fences, gates, posts (metal and/or wood), concrete, fence fabric, clips and other miscellaneous fittings associated with the fence to be relocated. The fence shall then be constructed and all reusable materials will be reassembled in the proposed location shown on the construction plans. The existing gate, corner and anchor posts will be replaced with new posts; the old posts will be disposed off of airport property. The new posts will be considered incidental to this pay item and no additional compensation will be provided for the new posts or the disposal of the old posts off of airport property.

METHOD OF MEASUREMENT

161-4.1 Fence, Class C, shall be measured in place from outside to outside of end posts or corner posts and shall be the length of fence actually constructed, except for the space occupied by the gates.

Driveway gates and walkway gates shall be measured in units for each gate installed and accepted.

161-4.2 Class C Fence Relocation shall be measured from outside to outside of end posts, gate posts, or corner posts and shall be the length of relocated fence actually constructed, except for the space occupied by the gates.

161-4.3 Class C Fence Removal to be paid for shall be the actual length of fence (including post widths) removed, except for the space occupied by the gates.

161-4.4 Class C Gate Relocations shall be measured in units for each gate relocated and accepted.

161-4.5 Class C Gate Removals shall be measured in units for each gate removed.

BASIS OF PAYMENT

161-5.1 Payment shall be made at the contract unit price per linear foot for Class C wire fence. This price shall be full compensation for furnishing all materials and for all preparation, erection, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made at the contract unit price per each for each size for driveway or for walkway gates. This price shall be full compensation for furnishing all materials and for all preparation, erection, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

161-5.2 Payment shall be made at the contract unit price per linear foot for Class C Fence Relocation. This price shall be full compensation for furnishing all materials and for all preparation, removals, relocation, erection, installation and disposal, and for all labor, equipment, tools, and incidentals necessary to complete this item.

161-5.3 Payment shall be made at the contract unit price per linear foot for Class C Fence Removal. This price shall be full compensation for furnishing all materials and for all removals, restoration,

including grading, backfilling, seeding and mulching, and disposal, and for all labor, equipment, tools, and incidentals necessary to complete this item.

161-5.4 Payment shall be made at the contract unit price per each for existing Class C Gate relocation. This price shall be full compensation for furnishing all materials and for all preparation, removals, relocation, erection, installation and disposal, and for all labor, equipment, tools, and incidentals necessary to complete this item.

161-5.5 Payment shall be made at the contract unit price per each for Class C Gate Removal. This price shall be full compensation for furnishing all materials and for all removals, restoration, including grading, backfilling, seeding and mulching, and disposal, and for all labor, equipment, tools, and incidentals necessary to complete this item.

ITEM 162 CHAIN-LINK FENCES

(Class E)

DESCRIPTION

162-1.1 This item of work shall consist of furnishing and installing new Class E (chain link) fence and gates at the locations shown on the construction plans. This shall be in accordance with this specification and in accordance with the Illinois Department of Transportation's Standard Specifications for Road and Bridge Construction, latest edition and IDOT Standard 664001-01, except as modified by plans or specifications. The Class "E" fence and gates shall be of the height and configuration as shown on the construction plans.

This work shall also include Class E fence relocations, Class E gate relocations, Class E fence removals and Class E gate removals at the locations shown on the plans.

The fence shall be the product of a manufacturer who has demonstrated by actual installation of a similar nature that the product is of the type required. The Contractor shall include all supplementary parts necessary or required for a complete and satisfactory installation within the true meaning and intent of the drawings. All runs of the fence shall present the same general appearance and the product of one manufacturer only will be accepted, except for items which do not influence the appearance of the completed fence. No used, rerolled, or open-seam steel shall be permitted in posts, gate frames, rails or braces.

MATERIALS

162-2.1 FABRIC. The chain-link fence fabric shall be of the following types, as specified:

- Zinc coated steel
- Aluminum coated steel
- Aluminum alloy
- Vinyl coated
- Zinc-5% aluminum-mischmetal alloy-coated steel

The fabric may be woven with either zinc coated steel wire, aluminum coated steel wire, vinyl coated steel wire of aluminum alloy wire in a 2-inch mesh. Coated wire and aluminum-alloy wire shall have a diameter of 0.148 inches. The outside diameter of coated wire includes the thickness of the coating. The fabric shall meet the following requirements:

- A. Zinc coated steel fabric shall conform to the requirements of AASHTO M 181, Type I, Class D. The fabric shall be galvanized after weaving.
- B. Aluminum coated steel fabric shall conform to the requirements of AASHTO M 181, Type II. The unit weight of coating shall be determined in accordance with AASHTO T 213. The aluminum coated steel fabric shall be given a clear organic coating after fabrication.
- C. Aluminum alloy fabric shall be made from wire conforming to the requirements of AASHTO M 181, Type III.
- D. Vinyl coated fabric shall conform to the requirements of AASHTO M 181, Type IV, Class B. Bonding shall be done by the thermal fusion method.

The vinyl coating shall be self extinguishing and shall not support combustion when subject to the Horizontal Flame Test of ASTM D 470.

The color of the coating shall be dark green and shall meet the approval of the Engineer.

- E. Zinc-5% aluminum-mischmetal alloy-coated steel shall conform to the requirements of ASTM F 1345, Class 2.

162-2.2 BARBED WIRE. All wires shall be spaced as shown on the plans. Barbed wire may be either galvanized steel barbed wire or aluminum coated steel barbed wire consisting of 2-strand of 12-1/2 gauge wire with 4-point barbs of 14-gage wire spaced 5 inches apart conforming to the following requirements:

- A. Barbed Wire (Zinc-coated). Galvanized barbed wire shall conform to the Specifications for zinc-coated (galvanized) steel barbed wire, AASHTO M 280, Class 3 with a minimum coating of 0.80 ounce per square foot of wire surface.
- B. Barbed Wire (Aluminum-coated). Aluminum-coated steel barbed wire shall conform to the Specifications for galvanized steel barbed wire, except the wire shall be aluminum coated. The wire shall have not less than 0.25 ounce coating of aluminum alloy per square foot of uncoated surface. The weight of the aluminum alloy coating shall be determined in accordance with AASHTO T 213.

Three strands of barbed wire shall be used above the top rail on arms as shown on the construction plans. Barbed wire shall have 4 point barbs spaced a maximum of 5" apart. The barbs shall be sharp and tightly wrapped about a uniformly twisted 12-1/2 (.0985") gauge line wires, galvanized or aluminized.

162-2.3 FENCE POSTS, POST TOPS AND EXTENSIONS, RAILS, GATES, BRACES, STRETCHER BARS, AND CLIPS. When these items are furnished for use in conjunction with zinc coated steel fabric, or aluminum coated steel fabric, they shall be of zinc coated steel. When these items are furnished for use in conjunction with aluminum alloy fabric, they shall be of aluminum alloy conforming to the requirements of AASHTO M 181.

Top rail will be required unless specified otherwise. The top rail shall be 1.66" O.D. and 1.83 lbs/ft with minimum bending strength of 202 lbs at center of a 10' span.

For Type A, Type B and Type C metal pipe for 8-ft and 10-ft chain link fence shall meet the requirements of the latest edition of IDOT's Standard Specifications for Road and Bridge Construction and shall conform to the minimum dimensions shown in Federal Specification RR-F-191/3E.

- A. Metal posts (line, corner, end, pull and gate posts) shall be the shapes, dimensions and weight shown on the plans. When vinyl coated fabric is used, the posts shall be vinyl coated in accordance with the same requirements as the coating of the fabric. Posts shall be galvanized prior to vinyl coating.

Type A, Type B, and Type C metal pipe for 8-ft and 10-ft chain link fence shall meet the requirements of the latest edition of IDOT's Standard Specifications for Road and Bridge Construction and shall conform to the dimensions of Federal Specification RR-F-191/3.

1. Steel pipe, Type A shall be hot-dipped galvanized conforming to the requirements of ASTM F 1083.
2. Steel pipe, Type B, shall be manufactured from cold rolled electric resistance welded, heated and tempered steel. The steel strip used in the manufacture of the pipe shall conform to ASTM A 569 or ASTM A 607. The wall thickness shall not be less than that shown on the plans. The product of the yield strength and section modulus of the pipe shall not be less than that of pipe meeting the requirements of ASTM F 1083.

The protective coatings shall be as follows:

- a. External and internal hot-dipped zinc coating according to ASTM F1083.
- b. External coating shall be in-line hot-dipped zinc coating after fabrication followed by a chromate conversion coating with an electrostatic thermoplastic finish. The zinc coating shall be not less than .9 ounces per square foot of surface. The chromate coating weight shall be 30 micrograms \pm .0002 inches.
- c. The internal surface shall be given corrosion protection by in-line application of a full zinc base organic coating after fabrication. The coating shall be 87% zinc powder by weight

and capable of providing galvanic protection. The thickness shall be a minimum of .5 mil. The external protective coating shall be capable of withstanding the following tests:

Exposure Test	ASTM Designation	Exposure Time
Salt Spray	ASTM B 117	1000 Hrs. min.
Humidity	ASTM D 2247	500 Hrs. min.
Weathering	ASTM G 23	500 Hrs. min.

The internal protective coating shall be capable of withstanding exposure to salt spray, ASTM B 117, for a minimum of 500 hours.

3. Steel pipe, Type C shall be manufactured by roll forming aluminized steel type 2 strip and electric resistance welding into tubular form.

The outside of the weld area shall be metalized with commercially pure aluminum to a thickness sufficient to provide resistance to corrosion equal to that of the remainder of the outside of the tube. The aluminum coating weight shall be a minimum of 0.75 ounces per square foot, triple spot test, 0.70 ounces per square foot, single spot test, as measured in accordance with ASTM A 428. The steel strip used in the manufacture of the pipe shall conform to ASTM A 787 Type 1 and have a minimum yield strength of 50,000 psi. The weight of the pipe shall not be less than that shown on the plans and the product of the yield strength and section modulus of the pipe shall not be less than that of pipe meeting the requirements of ASTM F 1083.

4. Structural shapes shall be fabricated from steel conforming to the requirements of AASHTO M 281, Grades A or B. Rolled formed sections shall be fabricated from steel conforming to the requirements of ASTM A 570, Grades 36 thru 50, with a maximum tensile strength of 80,000 pounds per square inch. All structural shapes and rolled formed sections shall be galvanized in accordance with AASHTO M 111, using zinc of any grade conforming to the requirements of AASHTO M 120. The zinc coating shall be not less than 2.0 ounces per square foot of surface.
5. Square hollow structural tubing shall conform to the requirements of ASTM A 500, Grade B or ASTM A 501. The tubing shall be galvanized inside and outside in accordance with ASTM F 1043, Type A internal and external coating.
6. Roll formed steel C sections shall conform to the requirements of ASTM F 1043 or ASTM F 1083, Group II A, and be galvanized in accordance with requirements of ASTM F 1043, Type A.

- B. Metal Braces. Metal braces shall have the shapes and dimensions shown on the plans. They shall be according to the Specifications for metal posts, either steel pipe, structural shape or rolled formed section and shall be galvanized as specified for metal posts. When vinyl coated fabric is used, the braces shall be vinyl coated in accordance with the same requirements as the coating of the fabric. Braces shall be galvanized prior to vinyl coating.

- C. Gates. Gates shall be of the type and size shown on the plans and shall conform to the details shown on the plans.

1. Slide Gates

Slide gates shall be cantilever gates conforming to the dimensions and details shown on the plans. Gate Operators, card readers, and electric power and control shall be as detailed on the plans and as specified in the Special Provisions.

2. Pedestrian and Drive Gates:

Drive gates shall be two swing gates placed side by side to span the required opening as shown on the plans. Gate frames shall be constructed of 2" O.D. galvanized pipe. Gate frame shall be welded at all corners to form a rigid panel, and filled with fabric, and topped with three strand

barbed wire when specified for the fence. The hinges shall allow the gate to swing 180 degrees. The latches shall be heavy duty and have a provision for a pad lock.

162-2.4 RESERVED

162-2.5 WIRE TIES AND TENSION WIRE. Wire fabric ties, wire ties, and tension wire furnished for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with the fabric type. Zinc-coated steel wire, aluminum-coated steel wire, and aluminum alloy wire shall conform to requirements of AASHTO M 181, Type I Class 2 or Type II.

The top tension wire will be deleted in lieu of the top rail when top rail is required. The bottom tension wire is required.

162-2.6 MISCELLANEOUS FITTINGS AND HARDWARE. Miscellaneous fittings and hardware shall be of design standard with the manufacturer. Miscellaneous fittings and hardware furnished for use with other than aluminum alloy fabric shall be as follows:

- A. Bolts and Nuts. All bolts and nuts shall conform to the requirements of ASTM A 307 and shall be zinc-coated in accordance with AASHTO M 298, Class 50 or ASTM A 153.
- B. Fittings. All other fittings shall be made of malleable cast iron or pressed steel and shall be galvanized in accordance with ASTM A 153. When vinyl coated fabric is used, fittings shall be vinyl coated in accordance with the same requirements as the coating of the fabric. Fittings shall be galvanized prior to vinyl coating.

162-2.7 CONCRETE. Concrete shall be produced and placed in accordance with Item 610.

A high early strength concrete may be used. The concrete mix design shall be approved for use by the Illinois Division of Aeronautics prior to using it on the project.

162-2.8 RESERVED

162-2.9 WELDING. Structural members of gates which are in contact shall be fully welded by a method that will procure a continuous weld on all sides and faces of joints at exposed edges. Surplus welding material shall be removed.

162-2.10 SIGNS. The Contractor shall provide and install Restricted Area signage as shown on the plans.

CONSTRUCTION METHODS

162-3.1 CLEARING FENCE LINE. The site of the fence shall be sufficiently cleared of obstructions, and surface irregularities shall be graded so that the fence will conform to the general contour of the ground. The fence line shall be cleared to a minimum width of 2 feet on each side of the centerline of the fence. This clearing shall consist of the removal of all stumps, brush, rocks, trees, or other obstructions which will interfere with proper construction of the same fence. Stumps within the cleared area of the fence line shall be grubbed or excavated. The bottom of the fence shall be placed a uniform distance above the ground, as specified on the plans. When shown on the plans or as directed by the Resident Engineer, the existing fences which coincide with, or are in a position to interfere with, the new fence location shall be removed by the Contractor as a part of the construction work, unless such removal is listed as a separate item in the bid schedule. All holes remaining after post and stump removal shall be refilled with suitable soil, gravel, or other material acceptable to the Resident Engineer and shall be compacted properly with tampers.

The work shall include the handling and disposal of all material cleared, excavated, or removed, regardless of the type, character, composition, or condition of such material encountered.

162-3.2 INSTALLING POSTS. All posts shall be spaced not more than 10 feet apart as shown on the plans. Terminal (end, corner, pull, and brace) and gate posts shall be set 36 inches in concrete bases as shown on the plans. All line posts shall be set 30 inches in concrete bases as shown on the plans. The top of the concrete bases shall be slightly above the ground, trowel finished, and sloped to drain

away from the posts. Holes of full depth and size for the concrete bases for posts shall be dug to the size and depth as shown on the plans.

Blasting of rock or other obstructions shall be done if necessary. All post settings shall be done carefully so that all posts shall be vertical and in true alignment and rigidly secured in position.

On terminal (end, corner, pull, and brace) and gate posts, the post tops and brace rail clamps around the posts shall be placed before setting the posts in concrete bases. In setting the gate posts, great care must be taken to make sure that gate posts are set the exact distance apart as shown on the plans. For example, posts for a 6-foot gate must be set so as to leave an opening exactly 6 feet wide. A line drawn across from the top of one gate post to the other must be level, regardless of the grade at the ground line.

If the ground is not level, the upgrade gate post shall be set first to get the proper height for the downgrade gate post. The concrete bases for end, corner, pull, brace, and gate posts shall be placed first and allowed to cure for 14 days. The concrete bases for line posts shall be allowed to cure for 7 days. Stretcher bar bands and truss bands as specified on the plans shall be spread and slipped on end, corner, pull, brace, and gate posts as the next operation. Post tops are then inserted on all other posts. No extra compensation shall be made for rock excavation. Rock excavation shall not be grounds for extension of time.

All posts shall be set to a minimum depth of 36 inches below the existing ground line. The fence shall not be erected until the concrete encasement around the post has cured 7 days or reached a compressive strength of 2,500 psi. If a high-early strength concrete is used the fence may be erected once the concrete has reached a compressive strength of 2,500 psi. The Contractor will be responsible for concrete testing other than at 7 and 14 days.

162-3.3 INSTALLING TOP RAILS. To start the installation, a length of top rail shall be run through the first couple of post tops; a rail clamp shall be assembled on the end, corner, or gate post, as the case may be. The end of the rail already placed shall be butted into the clamp and fastened. The top rail shall be installed along the run of the fence and the various sections joined with sleeve couplings. At no more than every 100 feet an expansion coupling shall be placed to take care of expansion and contraction of the rail. The rail shall be clamped in the end, corner, or gate post at the end of the run of the installation of top rail.

162-3.4 INSTALLING BRACES. All horizontal braces shall be attached together with truss rods at all terminal (end, corner, and pull) and gate posts to the brace posts as shown on the plans.

162-3.5 INSTALLING FABRIC. The fabric shall be unrolled on the outside of the fence line with the bottom edge of the fabric against the posts. The various rolls shall be spliced by bringing the ends close together and weaving in a picket in such a way that it will engage both of the roll ends and catch with each twist each separate mesh of the end pickets of both rolls of fabric. The fabric shall be raised and tied loosely to the top rail with a temporary tie wire at intervals of about 20 feet. The fabric shall be installed by a method approved by the Engineer. One method used is given below.

- A. At end, corner, or gate posts, the stretcher bar shall be slipped through the end picket of the fabric and the stretcher bar bands at the same time. Then the bolts in the stretcher bar band shall be tightened. Additional rolls of fabric shall be spliced and placed as the erection progresses along the fence.
- B. In long sections, the fence shall be stretched at intervals of about 100 feet. After the stretching is complete, the fabric shall be tied to the top rails with No. 6 gauge galvanized wire clips securely clinched at the back of the rail. The fastenings shall be spaced not more than 24 inches on centers for the top rail.
- C. The fabric shall be attached to the line posts with No. 6 gauge galvanized wire clips securely clinched to the back of the line posts. The fastenings shall be spaced more than 14 inches on centers for line posts. The topmost clip shall be placed on the line post as near the top of the fabric as possible and the lowest clip as near the bottom of the fabric as possible.

- D. At terminal (end, corner, and pull) and gate posts the fabric shall be fastened with stretcher bars and bands. The fastenings shall be spaced not more than 14 inches on centers for terminal (end, corner, and pull) and gate posts. The topmost band shall be placed on these posts as near the top of the fabric as possible and the lowest band as near the bottom of the fabric as possible.

Standard chain-link fence stretching equipment shall be provided for stretching the fabric before tying it to the rails and posts. The stretching and tying operations shall be repeated about every 100 feet until the run of fence is completed. Equipment of one type for performing the stretching operation may be composed of four pieces of lumber (2 x 4's or larger) cut into a slightly shorter length than the width of the fabric. The pieces shall be bored for six bolts of about 1/2 or 5/8-inch diameter and shall be assembled as shown on the plans. One pair shall be used for stretching the fabric and both pairs shall be used for making a closure of a run of the fence.

Before making a closure, the other end of the run shall be fastened to the end, corner, or gate post as described previously. The operation of making a closure of a run shall be as follows. The stretching equipment as described above shall be clamped on the ends of the fabric parallel to each other and about 5 feet apart when the tension is first applied. The stretching shall continue until the slack has been removed from both sections of the fabric. If the ends overlap, the fabric shall be cut to match. The ends shall be joined by the insertion of a picket similar to the method of connecting two rolls of fabric.

162-3.6 ELECTRICAL GROUNDS. Continuous fence shall be grounded at intervals not exceeding 500 ft. There shall be a ground within 100 ft. of gates in each section of the fence adjacent to the gate.

Fence under a power line shall be grounded by three grounds, one directly under the crossing and one on each side 25 to 50 ft away. A single ground shall be located directly under each telephone wire or cable crossing.

The ground shall be accomplished with a copper clad rod 8 feet long and a minimum of 5/8 inch in diameter driven vertically until the top is 6 inches below the ground surface. A No. 6 solid copper conductor shall be clamped to the rod and to the fence in such a manner that each element of the fence is grounded. Installation of ground rods shall not constitute a pay item and shall be considered incidental to fence construction.

162-3.7 GENERAL. The fence shall be constructed in accordance with the details on the plans and as specified herein using new materials, and all work shall be performed in a workmanlike manner satisfactory to the Engineer. Prior to the beginning of the work or upon the request of the Contractor, the Resident Engineer shall locate the position of the work by establishing and marking the property line or fence line. When directed, the Contractor shall span the opening below the fence with barbed wire fastened to stakes of the required length at locations of small natural or drainage ditches where it is not practical to conform the fences to the general contour of the ground surface, as required. The new fence shall be permanently tied to the terminals of existing fences whenever required by the Resident Engineer. The finished fence shall be plumb, taut, true to line and ground contour, and complete in every detail. When directed, the Contractor shall be required to stake down the chain-link fence at several points between posts.

When directed, in order to keep stock on adjoining property enclosed at all times, the Contractor shall arrange the work so that construction of the new fence will immediately follow the removal of existing fences. The length of unfenced section at any time shall not exceed 300 feet or it shall be of such length that the stock can be kept in the proper field. The work shall progress in this manner and at the close of the working day the newly constructed fence shall be tied to the existing fence. Openings in the fence shall be guarded when stock is using the adjoining property.

162-3.8 INSTALLING GATES. The gates shall be hung on gate fittings as shown on the plans. The lower hinge (ball and socket type) shall be placed on top of the concrete footing in which the gate post is set; the concrete in the footings shall extend up to the bottom of the lower hinge. The sockets for the cane or foot bolts shall be set in concrete so that the plunger pin will fit perfectly in the socket when the gate is in a closed position. Gates shall be erected to swing in the direction indicated and shall be provided with gate stops as specified or as shown on the plans. All hardware shall be thoroughly secured, properly adjusted, and left in perfect working order. Hinges and diagonal bracing in gates shall be adjusted so that the gates will hang level.

162-3.9 EXISTING FENCE CONNECTIONS. Wherever the new fence joins an existing fence, either at a corner or at the intersection of straight fence lines, a corner post with a brace post shall be set at the junction and braced the same as herein described for corner posts or as shown on the plans.

If the connection is made at other than the corner of the new fence, the last span of the old fence shall contain a brace span.

162-3.10 CLEANING UP. The Contractor shall remove from the vicinity of the completed work all tools, buildings, equipment, etc., used during construction.

162-3.11 FENCE AND GATE REMOVAL. This item shall consist of complete removal of existing fence and gates (fabric, posts, signs and other hardware) as shown on the plans. The Airport Management shall have the option of keeping the removed fence. If the Airport Management chooses, the removed fence material shall become the property of the Contractor, and shall be removed from the airport property.

162-3.12 FENCE AND GATE RELOCATION. The Contractor will remove all fence, gates, posts (metal and/or wood), concrete, fence fabric, clips and other miscellaneous fittings associated with the fence to be relocated. The fence shall then be constructed and all reusable materials will be reassembled in the proposed location shown on the construction plans. The existing gate, corner, line and anchor posts will be replaced with new posts, the old posts will be disposed off of airport property. The new posts will be considered incidental to this pay item and no additional compensation will be provided for the new posts or the disposal of the old posts off of airport property. The new posts will be considered incidental to this pay item and no additional compensation will be provided for the new posts or the disposal of the old posts off of airport property.

METHOD OF MEASUREMENT

162-4.1 Fences, Class E, shall be measured in place from outside to outside of end posts or corner posts and shall be the length of fence actually constructed, except the space occupied by the gates. Driveway gates and walkway gates shall be measured in units for each gate installed and accepted.

162-4.2 Class E Fence Relocation shall be measured from outside to outside of end posts, gate posts, or corner posts and shall be the length of relocated fence actually constructed, except for the space occupied by the gates.

162-4.3 Class E Fence Removal to be paid for shall be the actual length of fence (including post widths) removed, except for the space occupied by the gates.

162-4.4 Class E Gate Relocations shall be measured in units for each gate relocated and accepted.

162-4.5 Class E Gate Removals shall be measured in units for each gate removed.

BASIS OF PAYMENT

162-5.1 Payment will be made at the contract unit price per linear foot for chain-link fence. This price shall be full compensation for furnishing all materials and for all preparation, erection, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made at the contract unit price per each for driveway or for walkway gates. This price shall be full compensation for furnishing all materials, and for all preparation, erection, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

162-5.2 Payment shall be made at the contract unit price per linear foot for Class E Fence Relocation. This price shall be full compensation for furnishing all materials and for all preparation, removals, relocation, erection, installation and disposal, and for all labor, equipment, tools, and incidentals necessary to complete this item.

162-5.3 Payment shall be made at the contract unit price per linear foot for Class E Fence Removal. This price shall be full compensation for furnishing all materials and for all removals, restoration, including grading, backfilling, seeding and mulching, and disposal, and for all labor, equipment, tools, and incidentals necessary to complete this item.

162-5.4 Payment shall be made at the contract unit price per each for existing Class E Gate relocation. This price shall be full compensation for furnishing all materials and for all preparation, removals, relocation, erection, installation and disposal, and for all labor, equipment, tools, and incidentals necessary to complete this item.

162-5.5 Payment shall be made at the contract unit price per each for Class E Gate Removal. This price shall be full compensation for furnishing all materials and for all removals, restoration, including grading, backfilling, seeding and mulching, and disposal, and for all labor, equipment, tools, and incidentals necessary to complete this item.

DIVISION IV- DRAINAGE

ITEM 701 PIPE FOR STORM SEWERS AND CULVERTS

DESCRIPTION

701-1.1 This item shall consist of pipe of the types, classes, sizes, and dimensions required on the plans, furnished and installed at the places designated on the plans and profiles, or by the Resident Engineer, in accordance with these specifications and with the lines and grades given.

The item shall include the bid price per linear foot of pipe in place, the cost of common excavation and backfill, the cost of furnishing and installing all trench bracing, all fittings required to complete the pipe drain as shown on the plans, and the material for and the making of all joints, including all connections to existing drainage pipe and structures.

MATERIALS

701-2.1 GENERAL. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements:

Metallic-Coated Corrugated Steel Pipe (Type I, IR or II)	ASTM A 760
Galvanized Steel Corrugated Structural Plates and Fasteners for Pipe, Pipe- Arches, and Arches	ASTM A 761
Precoated (Polymeric) Galvanized Steel Sewer and Drainage Pipe	ASTM A 762
Non-Reinforced Concrete Pipe	ASTM C 14
Reinforced Concrete Pipe	ASTM C 76
Reinforced Concrete D-Load Pipe	ASTM C 655
Reinforced Concrete Arch Pipe	ASTM C 506
Reinforced Concrete Elliptical Pipe	ASTM C 507
Precast Reinforced Concrete Box Sections	ASTM C 789 and C 850
Bituminous-Coated Corrugated Steel Pipe and Pipe Arches	AASHTO M 190
Corrugated Aluminum Alloy Culvert Pipe	ASTM B 745
Bituminous-Coated Corrugated Aluminum Alloy Culvert Pipe	AASHTO M 190 and M 196
Bituminous-Coated Structural Plate Pipe, Pipe Arch, and Arches	AASHTO M 167 and 243
Aluminum Alloy Structural Plate for Pipe, Pipe Arch, and Arches	AASHTO M 219
Polyvinyl Chloride (PVC) Pipe	ASTM D 3034
Corrugated Polyethylene Drainage Tubing	AASHTO M 252
Polyvinyl Chloride (PVC) Corrugated Sewer Pipe	ASTM F 949

701-2.2 RESERVED

701-2.3 CONCRETE. Concrete for pipe cradles shall conform to the requirements of Item 610. Concrete for all connections to existing and proposed drainage structures shall conform to Item 610.

701-2.4 RUBBER GASKETS. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C 443. Rubber gaskets for PVC pipe shall conform to the requirements of ASTM F 477. Rubber gaskets for metallic-coated steel pipe and precoated galvanized pipe shall conform to the requirements of ASTM D 1056, for the "RE" closed cell grades. Rubber gasket joints will be required on all reinforced concrete pipes.

701-2.5 RESERVED

701-2.6 JOINT FILLERS. Poured filler for joints shall conform to the requirements of ASTM D 1190.

701-2.7 RESERVED

701-2.8 CONTROL LOW STRENGTH MATERIAL (CLSM). CLSM shall meet all requirements in IDOT approved design as set forth in the current IDOT *Standard Specifications for Road and Bridge Construction*.

701-2.9. HANDLING HOLES. Handling holes in precast concrete pipe shall be filled with a precast concrete plug or sealed and covered with mastic or mortar.

CONSTRUCTION METHODS

701-3.1 EXCAVATION.

- A. Common. The Contractor shall do all common excavation to the depth shown on the plans. Common excavation shall consist of all excavation not included under rock excavation.
- B. Rock. The Contractor shall do all rock excavation to the specified depth shown on the plans plus the required additional depth for bedding. Rock excavation shall consist of the removal of boulders and detached rock, 1/2 cubic yard in volume or greater, and of all rock in place in ledge or masses which can be removed only by the use of bars and sledges or by blasting.

Where rock, or soil containing rocks or gravel, hard pan, or other unyielding foundation material is encountered in trench excavation, the pipe shall be bedded in accordance with the requirements of one of the classes of bedding but with the following additions: The hard unyielding material shall be excavated below the elevation of the bottom of the pipe or pipe bell to a depth of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. The cushion shall consist of a fine compressive material, such as silty clay or loam, lightly compacted, and shaped as required for the specified class of bedding. The cost of furnishing and placing the cushion material shall be included in the bid price per cubic yard for rock excavation. Before any rock is removed, the Resident Engineer shall have the opportunity to obtain the necessary data to determine the yardage to be used for payment. The bottom of the trench shall be excavated to a horizontal section as far as practicable.

- C. General. Excavated material not required or acceptable for backfill shall be disposed of by the Contractor as directed by the Resident Engineer. Common excavation shall not be carried below the required depth; but when it is, the trench shall be backfilled at the Contractor's expense with material approved by the Resident Engineer and compacted to the density of the surrounding earth material as determined by the compaction control tests in Division VII.

When directed, unstable soil shall be removed for the full width of the trench and replaced with sand or with approved granular material. The Resident Engineer shall determine the depth of removal of unstable soil and the amount of backfill necessary. The backfill shall be compacted and shaped to a firm but slightly yielding condition to form the bed for the pipe. When not specified in the special provisions, the cost of removing unstable soil and replacing it with approved material shall be covered by a change order or a supplemental agreement for the cubic yards of excavation and of approved material.

The depth of cut shown on the plans is from the surface grade to the invert of the pipeline. In case the depth of cut is changed from that shown on the plans, the change shall not exceed 6 inches without a revision in the contract unit price per linear foot of pipe. However, if the depth of cut is changed more than 6 inches, compensation or deduction of work involved, whether increased or decreased, shall be provided for in a change order or a supplemental agreement.

The minimum width of the trench at the top of the pipe, when placed, shall be a width which will permit the proper construction of joints and compaction of backfill around the pipe. The sides of the trench shall be vertical, unless otherwise approved by the Resident Engineer. The maximum allowable width of the trench shall not exceed 12 inches on each side of the pipe when placed, unless otherwise approved by the Resident Engineer. The bed for the pipe shall be so shaped that at least the lower quarter of the pipe circumference shall be in continuous contact with the bottom of the trench.

The Contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. The bracing, sheathing, or shoring shall not be removed in one operation but shall be done in successive stages as determined by the Engineer to prevent overloading of the pipe during backfilling

operations. The cost of the bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price bid per foot for the pipe.

701-3.2 CRADLES. Granular cradle shall be constructed and compacted prior to the placement of the storm sewer for the entire length of the pipe. The granular cradle material shall consist of crushed stone meeting the material requirements set forth in Item 208-2.2. The material gradation shall be as follows:

Sieve Size	<u>SIEVE SIZE PERCENT PASSING</u>	
	<u>Dry Trench Conditions (IDOT CA-6)</u>	<u>Wet Trench Conditions (IDOT CA-7)</u>
1-1/2"	100	100
1"	95 ± 5	95 ± 5
1/2"	75 ± 15	45 ± 15
No. 4	43 ± 13	5 ± 5
No. 16	25 ± 15	-----
No. 200	8 ± 4	-----

All granular cradles shall be compacted to 90% of the maximum density, except when CA-7 is used, in accordance with ASTM D-698, Method A or B (Standard Proctor). If CA-7 is used, the cradle shall be compacted to the satisfaction of the Engineer.

701-3.3 LAYING AND INSTALLING PIPE.

A. **Concrete Pipe.** The Contractor shall provide the necessary mason's lines and supports to insure installation of the pipe to line and grade, as staked by the Resident Engineer. The Contractor's facilities for lowering the pipe into the trench shall be such that neither the pipe nor the trench will be damaged or disturbed.

The Engineer or his authorized representative shall inspect all pipe before it is laid, and reject any section that is damaged by handling or is defective to a degree which will materially affect the function and service of the pipe.

The laying of the pipe in the finished trench shall be started at the lowest point and proceed upgrade. When bell and spigot pipe is used, the bell shall be laid upgrade. If tongue and groove pipe is used, the grooved end shall be laid upgrade.

The pipe shall be firmly and accurately set to line and grade so that the invert will be smooth and uniform. The pipe shall be protected from water during placing.

When bell and spigot pipes are used, spaces for the pipe bells shall be dug in the pipe subgrade to accommodate the bells. These spaces shall be deep enough to insure that the bells do not bear the load of the pipe; they shall not be excessively wide in relation to the longitudinal direction of the trench. When the pipes are laid, the barrel of each section of pipe shall be in contact with the quadrant-shaped bedding throughout its full length, exclusive of the bell, to support the entire load of the pipe.

Pipe shall not be laid on frozen ground.

When placing reinforced concrete elliptical or arched pipe, the pipe shall be oriented in accordance with the manufacturer's markings of top or bottom.

The upgrade end of pipelines not terminated in a structure shall be plugged or capped as approved by the Resident Engineer.

Pipe which is not true in alignment, or which shows any settlement after laying, shall be taken up and relaid without extra compensation.

The Contractor shall provide, as may be necessary, for the temporary diversion of steam flow in order to permit the installation of the pipe under dry conditions.

- B. Corrugated Steel and Aluminum Pipe. Corrugated steel pipe shall be laid with separate sections joined firmly together with coupling bands conforming to the requirements of ASTM A 670. Corrugated aluminum alloy pipe couplings shall conform with the requirements of AASHTO M 196.

Proper facilities shall be provided for lowering the pipe when it is to be placed in a trench. The pipe shall be laid carefully and true to lines and grades on a bed which is uniformly firm throughout its length. Any pipe which is not in true alignment, or which shows any undue settlement after being laid or is damaged, shall be taken up and relaid without extra compensation.

The pipe shall be placed so that the element of the cylindrical pipe constituting the centerline of the paved section shall coincide with the flow line of the culvert or sewer. Sections of paved pipe shall be laid so that the flow line is smooth and continuous across joints.

All pipe shall be handled so as to prevent bruising, or breaking of the spelter coating or the bituminous coating. All spots on the pipe where the spelter or bituminous coating has been injured or destroyed shall be painted with two coats of asphaltic paint, or otherwise repaired in a satisfactory manner.

701-3.4 PIPE JOINTS. Pipe joints for concrete pipe may be of the bell and spigot type or the tongue and groove type unless one type is specified by the Resident Engineer. One of the following methods of jointing pipe shall be used:

- A. Rubber Gasket Joints. The gasket shall be installed in accordance with the manufacturer's instructions.
- B. Composition Gasket Joints. The gasket shall be installed in accordance with the manufacturer's instructions.
- C. Joint-sealing Compound. Joint-sealing compound, hot-pour, mineral-filled, shall be used in filling joints of bell and spigot sewer pipe. The bell and spigot pipe shall be installed and centered so that the annular space is uniform. This annular space shall be calked and then shall be sealed with a joint compound conforming to the requirements of ASTM D 1190. When jointing pipe in its final position, a suitable joint runner previously coated to facilitate removal shall be placed around the pipe, leaving an opening at the top of the runner. The joint shall be poured until completely filled with the compound; the pouring shall be made as rapidly as possible without entrapping air. After the compound has cooled and set, the runner may be removed. The joint shall be inspected for unfilled spaces or unsatisfactory jointing. Alternate joints may be poured before the pipe is lowered into the trench. In this case, the joint shall be poured with the pipe in a vertical position without the use of the runner. The compound shall be thoroughly set before the pipe is moved. When previously jointed, the pipe shall be handled carefully so as not to move or deform the jointing.
- D. PVC and Polyethylene Pipe. Joints for PVC pipe shall conform to the requirements of ASTM D 3212. Fittings for polyethylene pipe shall conform to the requirements of AASHTO M 252.

701-3.5 BACKFILLING. All trenches and excavations shall be backfilled within a reasonable time after the pipes are installed, unless other protection of the pipe is directed. Material which is placed at the sides of the pipe and 1 foot over the top shall be material which can be readily compacted. It shall not contain stones retained on a 2-inch sieve, frozen lumps, chunks of highly plastic clay, or any other material which is objectionable to the Engineer. The material shall be moistened or dried, if necessary, to be compacted by the method in use. Backfill material shall be approved by the Resident Engineer.

The backfill shall be placed in loose layers not to exceed 6 inches in depth along each side of the pipe. Special care shall be taken to secure thorough compaction under the haunches and at the sides of the pipe. This backfill shall be brought up evenly on each side of the structure to an elevation of 1 foot over the top of the pipe, or such greater elevation as directed by the Resident Engineer. Backfilling shall be done in a manner to avoid injurious top or side pressures on the pipe.

In embankments and for other areas outside of pavements, the fill shall be compacted at each side of the pipe for a lateral distance equal to twice the outside diameter or 12 feet, whichever is less, and carried up to an elevation of at least 1 foot above the top of the pipe. The backfill for areas outside of pavement areas shall be compacted to the density required for embankments in unpaved areas under

Item 152 and shall be from excavation or borrow, unless indicated otherwise on the plans. Under paved areas, the subgrade and any backfill shall be compacted to the density required for embankments for paved areas under Item 152.

Movement of construction machinery over a culvert shall be at the Contractor's risk. Any pipe damaged thereby shall be replaced at the expense of the Contractor.

At the locations shown on the plans (existing, proposed and future paved areas), the trench excavation shall be backfilled with select granular backfill material. The material shall meet the requirements set forth for granular cradle for dry trench conditions as set forth in Section 701-3.2 Cradles. Selected granular backfill materials shall be compacted in lifts no greater than 6" thick to 95% of the maximum density in accordance with ASTM D-698, Method C or D (Standard Proctor). The Contractor shall have a nuclear density gauge and qualified operator onsite for purposes of quality control (QC) testing. When the Contractor is satisfied that a lift has been compacted in accordance with the percentage of the maximum density as specified herein, the Resident Engineer shall be informed that the lift is ready for acceptance testing. The Contractor shall not proceed to construct another lift of backfill until the previous lift has been accepted by the Resident Engineer. Any areas deemed unacceptable to the Resident Engineer shall be reworked and re-compacted at no additional cost to the contract.

701-3.6 EQUIPMENT. All equipment necessary and required for the proper construction of storm sewers and culverts shall be on the project, in first-class working condition, and approved by the Resident Engineer before construction is permitted to start.

The Contractor shall provide appropriate hoisting equipment to handle the pipe while unloading and placing it in its final position without damage to the pipe.

The Contractor shall provide hand tampers and pneumatic tampers to obtain the required compaction of the pipe bed and the backfill, as specified.

701-3.7 CONNECTIONS. Where the plans call for connections to existing or proposed structures, these connections shall be watertight and made so that a smooth uniform flow line will be obtained throughout the drainage system.

701-3.8 CLEANING AND RESTORATION OF SITE. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankment, shoulders, or as ordered by the Resident Engineer. Except for paved areas of the airport, the Contractor shall restore all disturbed areas to their original condition.

After all work is completed, the Contractor shall remove all tools and other equipment, leaving the entire site free, clear, and in good condition.

Performance of the work described in this section is not payable directly but shall be considered as a subsidiary obligation of the Contractor covered under the contract unit price for the pipe.

701-3.9 INSPECTION. Prior to final approval of the drainage system, the Engineer, accompanied by the Contractor's representative, shall make a thorough inspection, by an appropriate method, of the entire installation. Any indication of defects in material or workmanship, or obstruction to flow in the pipe system, shall be further investigated and corrected. Defects due to the Contractor's negligence shall be corrected by the Contractor without additional compensation and as directed by the Engineer.

701-3.10 PIPE REMOVAL. This work shall consist of removal of existing pipes of various types and sizes. Trenches resulting from pipe removal shall be backfilled and compacted in accordance with Item 152, Excavation and Embankment. Pipe shall be disposed of by the Contractor off airport property.

701-3.11 SEQUENCING OPERATIONS AND MAINTAINING DRAINAGE.

The Contractor shall sequence and conduct his/her operations in such a manner as to maintain positive drainage at all times. It shall be the Contractor's responsibility to provide temporary ditches, pumps, inlets, culvert pipes and other items and appurtenances which might be required to achieve maintenance of drainage during construction. All such work will be incidental to the project. This work shall include maintenance of field tile flows.

The Contractor shall pay particular attention to locating field tiles while excavating.

METHOD OF MEASUREMENT

701-4.1 The footage of pipe to be paid for shall be the number of linear feet of pipe in place, completed, and approved to be measured along the centerline of the pipe from end of pipe or inside face of structure to the end of pipe or inside face of structure, whichever is applicable. The several classes, types, and sizes shall be measured separately. All fittings shall be included in the footage as typical pipe sections in the pipeline being measured.

Measurement of pipe will be based on the size and class identified on the plans. The size and class will be listed in the bid items.

Round pipe sizes are defined as internal diameter in inches. The class of pipe shall be as shown on the plans. The class of pipe or culvert shown on the plans is not based only on the depth of cover, but takes into account existing depth of cover, potential future depth of cover, potential future vehicle loadings and anticipated construction loadings.

701-4.2 When specified, the volume of concrete for pipe cradles to be paid for shall be the number of cubic yards of concrete completed in place and accepted as determined from the dimensions shown on the plans or as ordered by the Engineer.

701-4.3 When encountered, rock required to be removed shall be computed by the cubic yard for the specified width of the trench and to a depth of 4 inches below the bed or the pipe. No payment shall be made for the cushion material placed for the bed of the pipe or for additional backfill material.

BASIS OF PAYMENT

701-5.1 The contract unit price per linear foot for storm sewers and pipe removal shall be full payment for furnishing and installing all materials, and for all excavation, earth backfill, granular cradle, select granular backfill placement, compaction, connections to existing structures, concrete collars, and surface grading; and for all labor, equipment and tools necessary to complete this item of the size and type to the satisfaction of the Engineer.

All farm field tiles encountered during the construction must be either protected, replaced, or connected to the proposed storm sewers and culverts as directed by the Resident Engineer.

Protection, replacement, and connection of farm field tiles will not be measured for payment, but shall be considered incidental to the associated storm sewer or culvert.

Backfill required for pipe installed under proposed or future pavements will not be paid for separately, but shall be considered incidental to the pipe.

Backfill required for pipe removal under proposed or future pavements will not be paid for separately, but shall be considered incidental to the pipe.

ITEM 702 SLOTTED DRAINS

DESCRIPTION

702-1.1 This item shall consist of the construction of steel slotted drains or cast iron slotted vane drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans. Type detail shall be shown on the plans.

MATERIALS

702-2.1 GENERAL. All slotted drains shall meet the requirements shown on the plans and specified below. All slotted drains shall meet specified hydraulic design requirements and shall support the loadings specified.

702-2.2 PIPE.

- A. Steel slotted Drain. Pipe shall be metallic coated (galvanized or aluminized steel type II) corrugated steel type I meeting the requirements of ASTM A760. Pipe diameter and gage shall be as shown on the plans.

The corrugated steel pipe shall have a minimum of two rerolled annular ends.

- B. Cast Iron Slotted Vane Drain. Polyvinyl Chloride (PVC) pipe shall meet the requirements of ASTM D 3034. Pipe diameter shall be as shown on the plans. The pipe shall have an open slot to accept the cast iron slotted vane drain castings.

702-2.3 GRATES AND CASTINGS.

- A. Steel Slotted Drain. Grates shall be manufactured from ASTM A 36 or A 570, Grade 36 steel. Spacers and bearing bars (sides) shall be 3/16-inch (5 mm) material. The spacers shall be welded to each bearing bar with four 1-1/4-inch long 3/16-inch wide (32 mm long by 5 mm wide) fillet welds on each side of the bearing bar at spacings not exceeding 6 inches (150 mm). The grates shall be 6 inches (150 mm) high or as shown on the plans and shall have a maximum 1-3/4-inch (45 mm) opening in the top.

Grates shall be galvanized in accordance with ASTM A 123 except with a 2 ounce per square foot (0.61 kg per square meter) galvanized coating.

The grates shall be fillet welded to the corrugated steel pipe with a minimum weld 1 inch (25 mm) long on each side of the grate at every other corrugation. Weld areas and the heat affected zones where the slot is welded to the corrugated pipe shall be thoroughly cleaned and painted with a zinc-rich paint in accordance with repair of damaged coatings in ASTM A 760.

Each 20-foot (6.1 m) length of drain delivered to the job site shall be within the following tolerances: vertical bow +/- 3/8 inch (9.5 mm), horizontal bow +/- 5/8 inch (16 mm), twist +/- 1/2 inch (12.5 mm).

- B. Cast Iron Slotted Vane Drain. Castings shall meet the requirements of ASTM A 48, Class 35B gray iron. Castings shall be furnished with no coatings.

Castings shall be designed to fit on open slots in 15-inch (380 mm) PVC pipe. Casting sections shall not exceed three feet (915 mm) in length. Casting sections shall have a built-in vane configuration with bar spacings not exceeding 6 inches (150 mm). The opening at the surface shall not exceed 3-3/4 inches (95 mm), and the vane shall be constructed on a radius so that the opening shall be less than 1-1/2 inches (38 mm) at a depth of 1-1/2 inches (38 mm) as measured vertically from the surface. Casting sections shall integrally lock into the concrete by use of top and bottoms flanges and shear tabs. Castings shall accept bolts for bolting sections together and shall accept wire for fitting to pipe.

The Engineer should note that certain standard details can be found in AASHTO AGC-ARTBA publication "A Guide to Standardized Highway Drainage Products". All products used shall meet the strict airport loading and tire pressure requirements.

702-2.3 CONCRETE.

- A. Steel Slotted Drain. Concrete shall have a minimum compressive strength of 1,000 psi (6.9 Mpa) at 28-days when tested in accordance with ASTM C 39.
- B. Cast Iron Slotted Vane Drain. Concrete shall have a minimum compressive strength of 3,000 psi (20.7 Mpa) at 28-days when tested in accordance with ASTM C 39.

Plain or reinforced concrete used shall conform to the requirements of Item 610.

If design requirements indicate the need for structural concrete, the Engineer should include Item 610 Structural Portland Cement Concrete.

CONSTRUCTION METHODS

702-3.1 EXCAVATION. The width of the trench shall be sufficient to permit satisfactory installation and jointing of the slotted drain and placing of a high slump concrete backfill material under and around the drain, but shall not be less than the external pipe diameter plus 6 inches (150 mm) on each side. The depth of the trench shall be a minimum of 2 inches (51 mm) below the invert for steel slotted drain and 6 inches (150 mm) below the invert for cast iron slotted vane drain.

The trench may be roughly shaped to the slotted drain bed.

702-3.2 INSTALLATION. Steel slotted drain shall be laid in sections joined firmly together with coupling bands, or as shown on the plans. Cast iron drains shall be wired to the top of the PVC pipe in the slot cut in to receive the castings. The top of all drains shall be held firmly in place to the proper grade, to preclude movement during the backfilling operation.

702-3.3 JOINING. Slotted steel drain joints shall be firmly joined by modified hugger type bands, or as indicated, to secure the pipe and prevent infiltration of the backfill. When the slotted steel drain is banded together, the adjacent grates shall have a maximum 3 inch (76 mm) gap. Cast iron drains castings shall be bolted together.

702-3.4 BACKFILLING. Slotted drains shall be inspected before any backfill is placed. Damaged drains shall be aligned or replaced at the expense of the Contractor.

The slotted drain assembly shall be backfilled with concrete that will easily flow under and around the drain and the trench wall. The opening in the top of grates and castings shall be covered to prevent unwanted material from entering the drain during the backfilling and subsequent surfacing operations.

METHOD OF MEASUREMENT

702-4.1 The length of slotted drain shall be measured in linear feet (meters) of slotted drain in place, completed, and approved. It shall be measured along the centerline of the drain from end or inside face of structure to the end or inside face of structure, whichever is applicable. The several classes, types, and sizes shall be measured separately. All fittings shall be included in the footage as typical pipe sections being measured.

BASIS OF PAYMENT

702-5.1 Payment shall be made at the contract unit price per linear foot (meter) for each kind of slotted drain type and size designated and at the contract unit price per cubic yard (cubic meter) of concrete for backfill.

These prices shall be full compensation for all materials, all preparation, excavation and installation of these materials; and all labor, equipment, tools, and incidentals necessary to complete the item.

ITEM 705 PIPE UNDERDRAINS FOR AIRPORTS

DESCRIPTION

705-1.1 This item shall consist of pipe underdrains of the type, classes, sizes, and dimensions required on the plans, furnished and installed at the places designated on the plans and profiles, or by the Resident Engineer, in accordance with these specifications and with the lines and grades given.

The item shall include in the bid price per linear foot of pipe in place, the cost of excavation, the cost of furnishing and installing all trench bracing, all fittings required to complete the underdrain as shown on the plans, and the material for the making of all joints including all connections to existing drainage pipes and structures.

MATERIALS

705-2.1 GENERAL. The pipe shall be of the type called for on the plans or in the proposal and shall be in accordance with the following appropriate requirements. The Project Engineer may specify other materials upon written approval of the Engineer.

705-2.2 RESERVED

705-2.3 RESERVED

705-2.4 RESERVED

705-2.5 POROUS BACKFILL. Porous backfill shall be free of clay, humus, or other objectionable matter, and shall also conform to particle size specified.

Porous backfill material shall conform to the requirements for IDOT CA-16.

705-2.6 RESERVED

705-2.7 RESERVED

705-2.8 RESERVED

705-2.9 RESERVED

705-2.10 RESERVED

705-2.11 RESERVED

705-2.12 CORRUGATED POLYETHYLENE (PE) TUBING AND IGS FITTINGS.

Corrugated polyethylene (PE) tubing and IGS fittings (perforated and non-perforated) shall conform to the following requirements:

1. Corrugated PE Pipe, Perforated Corrugated PE Pipe, Corrugated PE Pipe with a Smooth Interior, and Perforated Corrugated PE Pipe with a Smooth Interior: The pipe shall be according to AASHTO M 252 (nominal size - 3 to 10 in.). When used for underdrains, the pipe shall have a minimum pipe stiffness of 46 psi (317 kPa) at five percent deflection and shall be capable of 60 percent vertical deflection in parallel plate loading without splitting or cracking. Fabric envelope materials for perforated pipe shall be stored in UV-resistant bags until just prior to installation.
2. Corrugated PE Pipe with Smooth Interior. The pipe shall be according to AASHTO M 294 (nominal size - 12 to 60 in.). The pipe shall be Type S or D.

All perforated polyethylene (PE) tubing shall be wrapped or covered with a filter fabric envelope as specified in Section 705-2.13.

All perforated underdrains shall be perforated corrugated polyethylene (PE) pipe of the diameter shown in the plans, with sock conforming to the requirements of Heavy Duty AASHTO M 252 and pipe shall be referred to as C.P.P.U.P. Heavy Duty Tubing shall be used. The perforated underdrain shall be wrapped with a filter fabric envelope.

All non-perforated underdrain shall be ASTM D 3034 PVC pipe of the diameter shown in the plans without Filter fabric envelope.

705-2.13 FILTER FABRIC ENVELOPES FOR PERFORATED (PE) TUBING. The fabric envelope for encasing pipe underdrains may be either a knitted, woven, or nonwoven fabric.

A. Fabric Materials

1. **Knitted Fabric.** Knitted fabric envelope shall be an approved continuous one-piece knitted polyester material that fits over the pipe underdrain like a sleeve. It shall be knitted of continuous 150 denier polyester yarn and shall be free from any chemical treatment or coating that might significantly reduce porosity and permeability.
2. **Woven or Nonwoven Fabric.** The filaments for woven or nonwoven fabric shall be polypropylene, polyester, or polyethylene. The filaments must be dimensionally stable (i.e., filaments must maintain their relative position with respect to each other) and resistant to delamination. The filaments must be free from any chemical treatment or coating that might significantly reduce porosity and permeability. Nonwoven fabric shall be needle punched.
3. **Physical Properties.** The physical properties for both knitted and woven or nonwoven fabric shall be according to the following:

PHYSICAL PROPERTIES				
	Knitted ^{1/}		Woven or Nonwoven	
Min. Weight (oz/ sq yd)	3.5 applied 4.8 relaxed	ASTM D 3887 ASTM D 3887	3.5	ASTM D 3776
Min. Wet Grab Tensile Strength (lb)	--	--	100	ASTM D 4632 ^{2/}
Grab Elongation @ Break (%)	--	--	20 min.	ASTM D 4632 ^{2/}
Apparent Opening Size (AOS No.) ^{4/}	30 max.	ASTM D 4751 ^{3/}	30 max. nonwoven ^{3/} 50 max. woven ^{3/}	--
Static Puncture Strength (psi)	116 min.	ASTM D 6241 ^{3/}	--	--

PHYSICAL PROPERTIES (Metric)				
	Knitted ^{1/}		Woven or Nonwoven	
Min. Weight (g/sq m)	119 applied 163 relaxed	ASTM D 3887 ASTM D 3887	120	ASTM D 3776
Min. Wet Grab Tensile Strength (N)	--	--	450	ASTM D 4632 ^{2/}
Grab Elongation @ Break (%)	--	--	20 min.	ASTM D 4632 ^{2/}
Apparent Opening Size (AOS No.) ^{4/}	600 µm max.	ASTM D 4751 ^{3/}	600 µm max. nonwoven ^{3/} 300 µm max. woven ^{3/}	--
Static Puncture Strength (kPa)	890 min.	ASTM D 6241 ^{3/}	--	--

1/ Knitted fabric shall be Type A according to ASTM D 6707.

2/ For woven fabric, test results shall be referenced to orientation with warp or fill, whichever the case may be.

3/ Manufacturer's certification to meet test requirements.

4/ Fabric material must have an opening size equal to or smaller than this sieve size opening (i.e. #100 sieve is smaller than #30 sieve and would therefore be acceptable).

B. Handling and Storage. The knitted fabric envelope shall be applied to the pipe underdrain in the shop so as to maintain a uniform applied weight. Woven and nonwoven fabric or underdrains with knitted fabric envelope shall be delivered to the jobsite in such manner as to facilitate handling and incorporation into the work without damage. Fabric envelope materials shall be stored in UV-resistant bags until just prior to installation. In no case shall the fabric be stored or exposed to direct sunlight that might significantly diminish its strength or toughness. Torn or punctured fabric envelope shall not be used.

705-2.14 CONCRETE. Concrete for connections to drainage structures or other miscellaneous items shall conform to Item 610, Structural Portland Cement Concrete.

CONSTRUCTION METHODS

705-3.1 EQUIPMENT. All equipment necessary and required for the proper construction of pipe underdrains shall be on the project, in first-class working condition, and approved by the Resident Engineer before construction is permitted to start.

The Contractor shall provide hand tampers and pneumatic tampers to obtain the required compaction of the pipe bed and backfill, as specified.

705-3.2 EXCAVATION. The Contractor shall do all necessary excavation to the depth shown on the plans. The excavation shall be unclassified and shall be performed regardless of the material encountered.

When rock or noncushioning material is encountered in trench excavation, a cushion at least 4 inches thick shall be placed between the rock and the bottom of the pipe. The cushion shall consist of clean sand or equivalent granular material. The cost of furnishing and placing the cushion material shall be included in the bid price per linear foot of pipe. When rock is encountered, the bottom of the trench shall be excavated to a horizontal section as far as is practicable.

Excavated material not required or acceptable for backfill shall be disposed of by the Contractor as directed by the Resident Engineer. The excavation shall not be carried below the required depth; when this is done, the trench shall be backfilled at the Contractor's expense with material approved by the Resident Engineer and compacted to the density of the surrounding earth material, as determined by the compaction control tests in Division VII.

The depth of cut shown on the plans is from the surface grade to the invert of the pipeline. In case the depth of cut is changed from that shown on the plans, the change shall not exceed 6 inches without a revision in the contract unit price per linear foot of pipe. However, if the depth of cut is changed more than 6 inches, compensation or deduction of work involved, whether increased or decreased, shall be provided for in a change order or a supplemental agreement.

The minimum width of the trench at the top of the pipe, when placed, shall be a width which will permit the proper construction of joints and compaction of backfill around the pipe, but shall be at least equal to the outside diameter of the pipe plus 6 inches on each side of the pipe.

The bed for the pipe shall be so shaped that at least the lower quarter of the pipe shall be in continuous contact with the bottom of the trench. Spaces for the pipe bell shall be excavated accurately to size to clear the bell so that the barrel supports the entire weight of the pipe.

The Contractor shall do such trench bracing, sheathing, or shoring necessary to perform and protect the excavation as required for safety and conformance to governing laws. Unless otherwise provided, the bracing, sheathing, or shoring shall be removed by the Contractor after the completion of the backfill to at least 12 inches over the top of the pipe. The sheathing or shoring shall be pulled as the granular backfill is placed and compacted to avoid any unfilled spaces between the trench wall and the backfill material. The cost of bracing, sheathing, or shoring, and the removal of same, shall be included in the unit price bid per foot for the pipe.

705-3.3 LAYING AND INSTALLING PIPE. Corrugated polyethylene tubing underdrains shall be constructed as follows:

Trenches shall be excavated to the dimensions and grades required by the plans or as directed by the Engineer.

Prior to installing the pipe, a 4" minimum layer of porous backfill meeting the requirements of Section 705-2.5 shall be constructed in the bottom of the trench.

Perforated, corrugated polyethylene tubing with filter fabric sock shall be seated in the porous backfill and held firmly in place, while porous backfill meeting the requirements of Section 705-2.5 is placed to a height of 5 inches \pm 1 inch above the tubing. After the first lift is compacted to the satisfaction of the Engineer, the remainder of the backfill shall be placed and compacted.

Perforated, corrugated polyethylene tubing shall be laid true to grade and shall not be stretched more than 5% during installation.

The Contractor shall be required to establish control grade on the underdrain pipe to ensure the pipe is installed at the proper elevation. Contract grade elevations are to be provided to the resident engineer upon request.

705-3.4 RESERVED

705-3.5 RESERVED

705-3.6 BACKFILLING.

- A. Earth. All trenches and excavations shall be backfilled within a reasonable time after the pipes are installed, unless other protection of the pipe is directed. The backfill material shall be selected material from excavation or borrow; material which is placed within a nominal pipe diameter distance at the sides of the pipe and 1 foot over the top shall be material which can be readily compacted. It shall not contain stones retained on a 3-inch sieve, frozen lumps, chunks of highly plastic clay, or any other material which is objectionable to the Resident Engineer. The material shall be moistened or dried, of necessary to be compacted by the method in use. Backfill material shall be approved by the Resident Engineer. Special care shall be taken in placing the backfill. Great care shall be used to obtain thorough compaction under the haunches and along the sides to the top of the pipe.

The backfill shall be placed in loose layers not exceeding 6 inches in depth under and around the pipe, and not exceeding 8 inches over the pipe. Successive layers shall be added and thoroughly compacted by hand and pneumatic tampers, approved by the Resident Engineer, until the trench is completely filled and brought to the proper elevation. Backfilling shall be done in a manner to avoid injurious top or side pressures on the pipe.

In embankments and for other areas outside of pavements, the backfill shall be compacted to the density required for embankments in unpaved areas under Item 152. Under paved areas, the subgrade and any backfill shall be compacted to the density required for embankments for paved areas under Item 152.

- B. Granular Material. When granular backfill is required, its placement in the trench and about the pipe shall be as shown on the plans. Special care shall be taken in placing the backfill. The granular backfill shall not contain a damaging amount of foreign matter, nor shall earth from the sides of the trench or from the windrow be allowed to filter into the backfill. When required by the Resident Engineer, a template shall be used to properly place and keep separate the two sizes of backfill. The backfill shall be placed in loose layers not exceeding 6 inches in depth and compacted by hand and pneumatic tampers to the requirements as given for earth backfill. Backfilling shall be done in a manner to avoid injurious top or side pressure on the pipe. The granular backfill shall be made to the elevation of the trench, as shown on the plans.

When perforated pipe or cradle invert pipe is specified, granular backfill material shall be placed along the full length of the pipe. The position of the granular material shall be as shown on the plans.

When porous backfill is to be placed in paved or adjacent areas prior to the completion of grading or subgrade operations, the backfill material shall be placed immediately after laying the pipe. The

depth of this granular backfill shall be not less than 12 inches, measured from the top of the underdrain. During subsequent construction operations, this minimum backfill of 12 inches in depth shall not be disturbed until such time as the underdrains are to be completed. When the underdrains are to be completed, the unsuitable material shall be removed until the porous backfill is exposed. That part of the porous backfill which contains objectionable material shall be removed and replaced with suitable material. The cost of removing and replacing any such unsuitable material shall be borne by the Contractor.

Whenever a granular subbase blanket course is to be used under pavements which extend several feet beyond the edge of paving to the outside edge of the underdrain trench, the granular backfill material over the underdrains shall be placed in the trench up to an elevation of 2 inches above the bottom surface of the granular subbase blanket course. Immediately prior to the placing of the granular subbase blanket course, the Contractor shall blade this excess trench backfill from the top of the trench onto the adjacent subgrade where it can be incorporated into the granular subbase blanket course. Any unsuitable material which remains over the underdrain trench shall be removed and replaced. The subbase material shall be placed to provide clean contact between the subbase material and the underdrain granular backfill material for the full width of the underdrain trench.

Backfilling for perforated underdrains shall be as detailed in the plans.

705-3.7 CONNECTIONS. When the plans call for connections to existing or proposed pipe or structures, these connections shall be watertight and made so that a smooth uniform flow line will be obtained throughout the drainage system.

Connection of the pipe underdrain into the proposed drainage structures shown on the plans shall be sealed with structural portland cement concrete, as specified in Item 610.

705-3.8 CLEANING AND RESTORATION OF SITE. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the Resident Engineer. Except for paved areas of the airport, the Contractor shall restore all disturbed areas to their original condition.

After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

Performance of the work described in this section is not payable directly but shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for the underdrain.

705-3.9 HEADWALLS, END SECTIONS, INSPECTION HOLES, COLLECTION STRUCTURES AND CLEANOUTS FOR UNDERDRAINS. Headwalls, end sections, inspection holes, collection structures and cleanouts for underdrains shall be constructed in accordance with the applicable sections of Item 751 and Item 752.

METHOD OF MEASUREMENT

705-4.1 The footage of pipe to be paid for shall be the number of linear feet of pipe underdrains in place, completed, and approved to be measured along the centerline of the pipe from end or inside face of structure to the end or inside face of structure, whichever is applicable. The number of headwalls, end sections, inspection holes, collection structures and cleanouts for underdrains shall be measured by the unit. All fittings shall be included in the footage as typical pipe sections in the pipeline being measured.

BASIS OF PAYMENT

705-5.1 The contract unit price per linear foot for underdrains shall be full compensation for furnishing and installing all materials, excavation, and for all labor, equipment and tools necessary to complete this item of the size and type to the satisfaction of the Engineer. The filter fabric pipe envelope, and porous backfill shall be considered incidental to the underdrain and shall not be measured for payment purposes.

The contract unit price per each for headwalls, end sections, inspection holes, collection structures and cleanouts for underdrains shall be full compensation for furnishing and installing all materials, excavation, and for all labor, equipment and tools necessary to complete this item to the satisfaction of the Engineer

All farm field tiles encountered during the construction must be protected, replaced, or connected to the proposed storm sewers and culverts, as directed by the Engineer. Protection, replacement, and connection of farm field tiles will not be measured for payment, but shall be considered incidental to the associated underdrain.

Payment for underdrain removal and underdrain structure removal shall not be paid for separately, but shall be considered incidental to the project.

Downspout connections to the underdrain shall not be paid for separately, but shall be incidental to underdrain.

ITEM 751 MANHOLES, CATCH BASINS, INLETS AND INSPECTION HOLES

DESCRIPTION

751-1.1 This item shall consist of construction and/or adjustments of manholes, catch basins, inlets, and inspection holes, in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the Engineer.

MATERIALS

751-2.1 RESERVED

751-2.2 MORTAR. The mortar shall be composed of 1 part of Portland cement and 2 parts of mortar sand, by volume. The Portland cement shall conform to the requirements of ASTM C 150. The sand shall conform to the requirements of ASTM C 144. Hydrated lime may be added to the mixture of sand and cement in an amount not to exceed 15% of the weight of cement used. The hydrated lime shall meet the requirements of ASTM C 6. The water shall be clean and free of deleterious amounts of acids, alkalies, or organic material. If the water is of questionable quality, it shall be tested in accordance with AASHTO T 26.

751-2.3 CONCRETE. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of Item 610.

751-2.4 PRECAST CONCRETE PIPE MANHOLE RINGS. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C-478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches nor more than 48 inches.

751-2.5 RESERVED

751-2.6 FRAMES, COVERS, AND GRATES. The castings shall conform to one of the following requirements:

- A. Gray iron castings shall meet the requirements of ASTM A 48.
- B. Malleable iron castings shall meet the requirements of ASTM A 47.
- C. Steel castings shall meet the requirements of ASTM A 27.
- D. Structural steel for grates and frames shall conform to the requirements of ASTM A 148.
- E. Ductile iron castings shall conform to the requirements of ASTM A 536.

All castings or structural steel units shall conform to the type and dimensions shown on the plans and shall be designed to support the loadings specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A 123.

All frames having circular lids shall have the bearing surfaces of the lid and frame machined or ground so that there will be no variation from a circular, straight edge, of the dimensions corresponding to the lid bearing surface. The diameter of the lid shall be such as to fit the frame without wedging.

751-2.7 STEPS. The steps or ladder bars shall be gray or malleable cast iron, galvanized wrought iron, galvanized steel or approved equal. The steps shall be the size, length, shape, and material shown on the plans.

751-2.8 STEEL REINFORCEMENT. Concrete reinforcing shall consist of deformed bars of either structural, intermediate, or hard grade billet steel meeting ASTM A 706; or welded wire fabric meeting ASTM A 185.

CONSTRUCTION METHODS

751-3.1 UNCLASSIFIED EXCAVATION.

- A. The Contractor shall do all excavation for structures and structure footings to the lines and grades or elevations, shown on the plans, or as staked by the Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the Resident Engineer may order, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.
- B. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Resident Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall not be made until just before the concrete or reinforcing is to be placed.
- C. The Contractor shall do all bracing, sheathing, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.
- D. Unless otherwise provided, bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner which will not disturb or mar finished masonry. The cost of removal shall be included in the unit price bid for the structure.
- E. After each excavation is completed, the Contractor shall notify the Resident Engineer to that effect; and concrete or reinforcing steel shall be placed after the Resident Engineer has approved the depth of the excavation and the character of the foundation material.

751-3.2 RESERVED

751-3.3 CONCRETE STRUCTURES. Concrete structures shall be built on prepared foundations, conforming to the dimensions and form indicated on the plans. Foundation materials shall conform to Section 701-3.3 constructed to the dimensions and thicknesses shown in the plans. The construction shall conform to the requirements specified in Item 610. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the Resident Engineer before the concrete is poured.

All invert channels shall be constructed and shaped accurately so as to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped downward toward the outlet.

751-3.4 PRECAST CONCRETE PIPE STRUCTURES. Precast concrete pipe structures shall be constructed on prepared or previously placed slab foundations and shall conform to the dimensions and locations shown on the plans. The sources of any precast concrete structures must be on the IDOT "Certified Pre-Cast Concrete Producers" list. All precast concrete pipe sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily. The top of the upper precast concrete pipe member shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal steps which are embedded or built into the side walls shall be aligned and placed at vertical intervals of 12 inches. When a metal ladder replaces the steps, it shall be securely fastened into position.

751-3.5 RESERVED

751-3.6 INLET AND OUTLET PIPES. Inlet and outlet pipes shall extend through the walls of the structures for a sufficient distance beyond the outside surface to allow for connections but shall be cut off flush with the wall on the inside surface, unless otherwise directed. Mortar shall be placed around these pipes so as to form a tight, neat connection.

751-3.7 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES, AND FITTINGS. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the Resident Engineer, and shall be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place and position before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are to be placed upon previously constructed masonry, the bearing surface or masonry shall be brought true to line and grade and shall present an even bearing surface in order that the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed and approved by the Resident Engineer. All units shall set firm and secure.

After the frames or fittings have been set in final position and the concrete or mortar has been allowed to harden for 7 days, then the grates or covers shall be placed and fastened down.

751-3.8 INSTALLATION OF STEPS. The steps shall be installed as indicated on the plans or as directed by the Resident Engineer. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is poured. The steps shall not be disturbed or used until the concrete or mortar has hardened for at least 7 days. After this period has elapsed, the steps shall be cleaned and painted, unless they have been galvanized.

When steps are required with precast concrete pipe structures, they shall be cast into the sides of the pipe at the time the pipe sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 inches.

In lieu of steps, prefabricated ladders may be installed. In the case of concrete structures, the ladder shall be held in place by grouting the supports in drilled holes. In the case of metal structures, the ladder shall be secured by welding the top support and grouting the bottom support into drilled holes in the foundation or as directed.

751-3.9 BACKFILLING.

- A. Backfill material shall be an approved IDOT Division of Highways Gradation CA-6 conforming to the material requirements of Item 209.
- B. Backfilling shall not be placed against any structure until permission is given by the Resident Engineer. In the case of concrete, such permission shall not be given until the concrete has been in place 7 days, or until tests made by the laboratory under supervision of the Resident Engineer establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.
- C. Backfill shall not be measured for direct payment. Performance of this work shall be considered as a subsidiary obligation of the Contractor covered under the contract unit price for the structure involved.

751-3.10 CLEANING AND RESTORATION OF SITE. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the Resident Engineer. The Contractor shall restore all disturbed areas to their original condition.

After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

751-4.1 The number of manholes, catch basins, inlets, and inspection holes of each size and types and structure adjustments shall be counted and measured by the unit.

BASIS OF PAYMENT

751-5.1 The accepted number of manholes, catch basins, inlets, inspection holes and structure adjustments will be paid for at the contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of the materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the plans; and for all labor equipment, tools and incidentals necessary to complete the structure.

ITEM 752 CONCRETE CULVERTS, HEADWALLS, AND MISC. DRAINAGE STRUCTURES

DESCRIPTION

752-1.1 This item shall consist of either plain or reinforced concrete culverts, headwalls, and miscellaneous drainage structures, precast reinforced concrete end section, grating for the precast reinforced concrete end section, and special structures constructed in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the Resident Engineer.

MATERIALS

752-2.1 CONCRETE. Plain and reinforced concrete shall meet the requirements of Item 610.

CONSTRUCTION METHODS

752-3.1 UNCLASSIFIED EXCAVATION.

- A. Trenches and foundation pits for structures or structure footings shall be excavated to the lines and grades or elevations shown on the plans or as staked by the Resident Engineer. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximate only; and the Resident Engineer may order, in writing, changes in dimensions or elevations of footings necessary to secure a satisfactory foundation.
- B. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Resident Engineer. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to final grade shall not be made until just before the concrete or reinforcing steel is to be placed.
- C. The Contractor shall do all bracing, sheathing, or shoring necessary to perform and protect the excavation and the structure as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring shall be included in the unit price bid for the structure.
- D. Unless otherwise provided, bracing, sheathing, or shoring involved therewith shall be removed by the Contractor after the completion of the structure. Removal shall be effected in a manner which will not disturb or mar finished concrete. The cost of removal shall be included in the unit price bid for structure.
- E. After each excavation is completed, the Contractor shall notify the Resident Engineer to that effect, and concrete or reinforcing steel shall be placed after the Resident Engineer has approved the depth of the excavation and the character of the foundation material.

752-3.2 BACKFILLING.

- A. After a structure has been completed, backfilling with approved material shall be accomplished by applying the fill in horizontal layers not to exceed 8 inches in loose depth, and compacted to the density required in Item 152, and as determined by compaction control tests specified in Division VII.
- B. No backfilling shall be placed against any structure until permission is given by the Resident Engineer. In the case of concrete, such permission shall not be given until the concrete has been in place 7 days, or until tests made by the laboratory under the supervision of the Resident Engineer establish that the concrete has attained sufficient strength to provide a factor of safety against damage or strain in withstanding any pressure created by the backfill or the methods used in placing it.

- C. Fill placed around concrete culverts shall be deposited on both sides at the same time and to approximately the same elevation. Care shall be taken to prevent any wedging action against the structure, and all slopes bounding or within the areas to be backfilled shall be stepped or serrated to prevent wedge action.
- D. Backfill will not be measured for direct payment. Performance of this work under the contract is not payable directly but shall be considered as a subsidiary obligation of the Contractor, covered under the contract unit price for each type and size of structure.

752-3.3 WEEP HOLES. Weep holes shall be constructed when and as shown on the plans.

752-3.4 CLEANING AND RESTORATION OF SITE. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankment, shoulders, or as ordered by the Resident Engineer. The Contractor shall restore all disturbed areas to their original condition. After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

752-4.1 The number of concrete culverts, headwalls, and miscellaneous drainage structures of each size and type shall be counted and measured by the completed unit.

BASIS OF PAYMENT

752-5.1 The accepted number of concrete culverts, headwalls, and miscellaneous drainage structures of each size and type will be paid for at the contract unit price per each, complete and in place. This price shall be full compensation for furnishing all materials and for all preparation, excavation, backfilling and placing of materials; furnishing and installation of such specials and connections to pipes and other structures as may be required to complete the item as shown on the plans; and for all labor, equipment, tools and incidentals necessary to complete the structure.

ITEM 754 CONCRETE GUTTERS, DITCHES, AND FLUMES

DESCRIPTION

754-1.1 This item shall conform to the detail or IDOT standard shown in the plans and shall consist of Portland cement concrete curb and/or gutter and/or combination curb and gutter.

This item shall consist of removal of concrete curb and/or gutter and/or combination curb and gutter. All these items shall be constructed in accordance with these specifications at the specified locations in conformance with the details dimensions, lines, and grades as shown on the plans or as required by the Engineer.

MATERIALS

754-2.1 CONCRETE. Plain and reinforced concrete shall meet the requirements of Item 610.

754-2.2 JOINTS. Joint filler materials and premolded joint material shall conform to Item 610 or Item 605 unless otherwise specified.

754-2.3 GRANULAR BEDDING. A 4" granular bedding course shall be constructed and mechanically compacted under all proposed curbs and gutters. Granular Bedding shall be IDOT CA-6 in accordance with Item 208.

CONSTRUCTION METHODS

754-3.1 PREPARING SUBGRADE. Excavation shall be made to the required width and depth, and the subgrade upon which the item is to be built shall be compacted to a firm uniform grade. All soft and unsuitable material shall be removed and replaced with suitable approved material. When required, a layer of approved granular material, compacted to the thickness indicated on the plans, shall be placed to form a subbase. The underlying course shall be checked and accepted by the Resident Engineer before placing and spreading operations are started.

754-3.2 PLACING. The forms for and the mixing, placing, finishing, and curing of concrete shall conform to the requirements of Item 610 and shall be in accordance with the following requirements.

The concrete shall be tamped and spaded until it is consolidated and mortar entirely covers and forms the top surface. The surface of the concrete shall be floated smooth and the edges rounded to the radii shown on the plans. Before the concrete is given the final finishing, the surface shall be tested with a 10-foot straightedge, and any irregularities of more than 1/4 inch in 10 feet shall be eliminated.

The concrete shall be placed with dummy-grooved joints not to exceed 15 feet apart, except where shorter lengths are necessary for closures, but no section shall be less than 4 feet long.

Expansion joints of the type called for in the plans shall be constructed to replace a dummy groove at spacings of approximately 75 feet. When the gutter is placed next to concrete pavement, expansion joints in the gutter shall be located opposite expansion joints in the pavement. When a gutter abuts a pavement or other structure, an expansion joint shall be placed between the gutter and the other structure.

Forms shall not be removed within 24 hours after the concrete has been placed. Minor defects shall be repaired with mortar containing 1 part cement and 2 parts fine aggregate.

The operations of depositing, compacting, and finishing the item shall be conducted so as to build a satisfactory structure. If any section of concrete is found to be porous, other than minor defects which may be plastered, or is otherwise defective, it shall be removed and replaced by the Contractor without additional compensation.

754-3.3 BACKFILLING. After the concrete has set sufficiently, the spaces adjacent to the structure shall be refilled to the required elevation with material specified on the plans and compacted by

mechanical equipment to at least 90% density, as determined by compaction control test specified in Division VII.

754-3.4 CLEANING AND RESTORATION OF SITE. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as ordered by the Resident Engineer. The Contractor shall restore all disturbed areas to their original condition.

After all work is completed, the Contractor shall remove all tools and equipment, leaving the entire site free, clear and in good condition.

Performance of the work described in this section is not payable directly but shall be considered as a subsidiary obligation of the Contractor, covered under the contract until price for the structure.

754-3.5 REMOVALS. The existing curb and/or gutter and/or combination curb and gutter shall be sawcut at the limits of removal. If adjacent pavement or structures are to remain in place the Contractor shall provide saw cuts along the pavement or structures to remain. The curb and/or gutter and/or combination curb and gutter shall be completely removed and disposed of by the Contractor off of airport property.

METHOD OF MEASUREMENT

754-4.1 Concrete gutters, paved ditches, and flumes shall be measured by the number of linear feet of gutter, ditches, or flume measured along the centerline of each respective type of structure.

BASIS OF PAYMENT

754-5.1 Payment will be made at the contract unit price per linear foot for concrete curb and/or gutter and/or combination curb and gutter completed and accepted in accordance with the plans and specifications.

Payment will be made at the contract unit price per linear foot for removal of concrete curb and/or gutter and/or combination curb and gutter completed and accepted in accordance with the plans and specifications.

These prices shall be full compensation for furnishing all materials, and for all preparation, excavation, granular bedding and compaction and installation of these materials, and for all labor, equipment, tools and incidentals necessary to complete the item. Granular bedding for curb and gutters shall not be measured separately but shall be considered incidental to the proposed curb and gutter.

DIVISION V- TURFING

ITEM 901 SEEDING

DESCRIPTION

901-1.1 This item shall consist of seeding the areas shown on the plans or as directed by the Resident Engineer as well as seeding all areas disturbed by the Contractor's operations in accordance with these specifications.

Seeding shall immediately follow clearing operations and clearing and grubbing operations outside of the grading limits to minimize erosion.

MATERIALS

901-2.1 SEED. Seed shall be furnished separately or in mixtures in standard containers with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the Resident Engineer a certification by a registered seed technologist or university representative certifying that each lot of seed has been tested by a recognized laboratory for seed testing within 12 months of date of delivery. This certification statement shall include: name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished, and, in case of a mixture, the proportions of each kind of seed.

The seed mixtures shall be as follows:

Seeds	Lbs./Acre
Inferno Tall Fescue or Tarheel II Fescue	60
Annual Ryegrass	20
Audubon Red Fescue	30
Rescue 911 Hard Fescue	30
Endophytic Fescue Cultivar	60

In locations where poor soil conditions exist, the Resident Engineer may require that Perennial Ryegrass be substituted for the Annual Ryegrass.

Seed mixes may be planted April 1 through June 1 and August 1 through November 1, provided that the ground is not frozen or in any way detrimental to the seed.

901-2.2 LIME. Agricultural ground limestone shall contain particles ground sufficiently fine so that essentially all material pass a No. 4 sieve and is graded relatively uniform through the Nos. 8, 30, and 60 sieves. Approved sources of agricultural ground limestone shall be tested by the Department of Agriculture and rated with a source correction factor.

All agricultural lime sources must be listed on the Illinois Department of Agriculture's "Limestone Program Producer Information" booklet listed on the IDOT website.

Agricultural lime shall be applied at 2 ton per acre. The Contractor has the option to perform a soil test, at their expense, to determine if lime is not necessary, based upon the existing pH level of the soil. The pH level of the soil must be between 5.5 and 7.6 for the application of lime to be eliminated. The soil test results must be reviewed and approved by the Engineer before the application of lime can be waived.

901-2.3 FERTILIZER. Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate specified herein, and shall meet the specified requirements of the applicable State and Federal laws. They shall be furnished in standard containers with name,

weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

- A. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
- B. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
- C. A granular or pellet form suitable for application by blower equipment.

Fertilizer shall be incorporated to a minimum depth of 3 inches.

During project Design, the fertilizer mix was analyzed for suitability for on-site or plan specified topsoil sources. The contractor shall carefully check the plans and specifications to confirm the following mix was not changed. Unless modified elsewhere in the plans and specifications, the Contractor shall apply 270 lb of fertilizer nutrients per acre (hectare) at a 3:1:2 ratio as follows:

Nitrogen Fertilizer Nutrients	135 lb/acre
Phosphorus Fertilizer Nutrients	45 lb/acre
Potassium Fertilizer Nutrients	90 lb/acre

901-2.4 SOIL FOR REPAIRS. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the Resident Engineer before being placed.

CONSTRUCTION METHODS

901-3.1 ADVANCE PREPARATION AND CLEANUP. After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded shall be raked or otherwise cleared of stones larger than 2 inches in any diameter, sticks, stumps, and other debris which might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes has occurred after the completion of grading and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage. This may include filling gullies, smoothing irregularities, and repairing other incidental damage.

An area to be seeded shall be considered a satisfactory seedbed without additional treatment if it has recently been thoroughly loosened and worked to a depth of not less than 5 inches as a result of grading operations and, if immediately prior to seeding, the top 3 inches of soil is loose, friable, reasonably free from large clods, rocks, large roots, or other undesirable matter, and if shaped to the required grade.

However, when the area to be seeded is sparsely sodded, weedy, barren and unworked, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than 5 inches. Clods shall be broken and the top 3 inches of soil shall be worked into a satisfactory seedbed by disking, or by use of cultipackers, rollers, drags, harrows, or other appropriate means.

Soil moisture shall exist throughout the zone from one inch to at least five inches below the surface at the time of planting. The required moisture content of the soil may be estimated and judged closely by the hand squeeze test. The soil should readily form a tight cast when squeezed in the hand. The cast should break into two pieces without crumbling and without leaving excess water on the hand after casting.

In areas where slopes exceed 4:1, the slopes shall be ripped parallel to the contours prior to seeding operations.

901-3.2 DRY APPLICATION METHOD

- A. Liming. Lime, if required, shall be applied separately and prior to the application of any fertilizer or seed and only on seedbeds which have previously been prepared as described above. The lime shall then be worked into the top 3 inches of soil after which the seedbed shall again be properly graded and dressed to a smooth finish.
- B. Fertilizing. Following advance preparations and cleanup, and liming if required, fertilizer shall be uniformly spread at the rate which will provide not less than the minimum quantity stated in the special provisions.
- C. Seeding. Grass seed shall be sown at the rate specified on the plans or in the special provisions immediately after fertilizing, and the fertilizer and seed shall be raked within the depth range stated in the special provisions. When seeding is required at other than the seasons shown on the plans or in the special provisions, a cover crop shall be sown by the same methods required for grass seeding.
- D. Rolling. After the seed has been properly covered, the seedbed shall be immediately compacted by means of an approved lawnroller, weighing 40 to 65 pounds per foot of width for clay soil (or any soil having a tendency to pack), and weighing 150 to 200 pounds per foot of width for sandy or light soils.

901-3.3 WET APPLICATION METHOD

- A. General. The Contractor may elect to apply seed and fertilizer (and lime, if required) by spraying them on the previously prepared seedbed in the form of an aqueous mixture and by using the methods and equipment described herein. The rates of application shall be as specified in the special provisions.
- B. Spraying Equipment. The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than 50 gallons over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

The unit shall also be equipped with a pressure pump capable of delivering 100 gallons per minute at a pressure of 100 pounds per square inch. The pump shall be mounted in a line which will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipe lines shall be capable of providing clearance for 5/8 inch solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

The nozzle pipe shall be mounted on an elevated supporting stand in such a manner that it can be rotated through 360 degrees horizontally and included vertically from at least 20 degrees below to at least 60 degrees above the horizontal. There shall be a quick-acting, three-way control valve connecting the recirculating line to the nozzle pipe and mounted so that the nozzle operator can control and regulate the amount of flow of mixture delivered to the nozzle. At least three different types of nozzles shall be supplied so that mixtures may be properly sprayed over distance varying from 20 feet to 100 feet. One shall be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-range jet nozzle. For case of removal and cleaning, all nozzles shall be connected to the nozzle pipe by means of quick-release couplings.

In order to reach areas inaccessible to the regular equipment, an extension hose at least 50 feet in length shall be provided to which the nozzles may be connected.

- C. Mixtures. Lime, if required, shall be applied separately, in the quantity specified, prior to the fertilizing and seeding operations. Not more than 220 pounds of lime shall be added to and mixed together in the relative proportions specified, but not more than a total of 220 pounds of these combined solids shall be added to and mixed with each 100 gallons of water.

All water used shall be obtained from fresh water sources and shall be free from injurious chemicals and other toxic substances harmful to plant life. Brackish water shall not be used at any time. The Contractor shall identify to the Resident Engineer all sources of water at least 2 weeks prior to use. The Resident Engineer may take samples of the water at the source or from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor shall not use any water from any source which is disapproved by the Resident Engineer following such tests.

All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures shall be used within 2 hours from the time they were mixed or they shall be wasted and disposed of at locations acceptable to the Resident Engineer.

- D. Spraying. Lime, if required, shall be sprayed only upon previously prepared seedbeds. After the applied lime mixture has dried, the lime shall be worked into the top 3 inches, after which the seedbed shall again be properly graded and dressed to a smooth finish.

Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which the lime, if required, shall already have been worked in. The mixtures shall be applied by means of a high-pressure spray which shall always be directed upward into the air so that the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in such a manner as might produce erosion or runoff.

Particular care shall be exercised to insure that the application is made uniformly and at the prescribed rate and to guard against misses and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area. Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or pans over the area at intervals and observing the quantity of material deposited thereon.

On surfaces which are to be mulched as indicated by the plans or designated by the Resident Engineer, seed and fertilizer applied by the spray method need not be raked into the soil or rolled. However, on surfaces on which mulch is not to be used, the raking and rolling operations will be required after the soil has dried.

901-3.4 MAINTENANCE OF SEEDED AREAS. The Contractor shall protect seeded areas against traffic or other use by warning signs or barricades, as approved by the Resident Engineer. Surfaces gullied or otherwise damaged following seeding shall be repaired by regrading and reseeding as directed. The Contractor shall mow, water as directed, and otherwise maintain seeded areas in a satisfactory condition until final inspection and acceptance of the work.

The Contractor shall be required to establish a good stand of grass of uniform color and density to the satisfaction of the Engineer and Owner. The turf shall not contain ruts, gullies or undulations. If, at the time of final inspection, it is not possible to determine if a good stand of grass has been established, payment for the unaccepted portions of the areas seeded out of season will be withheld until such time as these requirements have been met.

METHOD OF MEASUREMENT

901-4.1 The quantity of seeding, as measured on the ground surface in acres, shall be payable after being seeded, limed and fertilized as specified. Acceptance of the pay item occurs after grass has been established per 901-3.4.

When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans, the Contractor and the Engineer may agree in writing per 70-01 to use the plan quantities as the final pay quantities.

Only those areas disturbed to complete the work shown in the plans shall be seeded unless directed otherwise by the Engineer. All other areas requiring repair due to the Contractor's operations shall be seeded with the cost to be borne by the Contractor.

The quantity of water utilized for seed bed preparation, maintenance of the seeded areas and water used as a carrier for seed in hydraulic seeding operations shall be considered incidental to seeding and will not be measured for payment.

BASIS OF PAYMENT

901-5.1 The quantity, determined as provided above, will be paid for at the contract unit price per acre, or fraction thereof, for the pay item listed below, which price and payment shall be full compensation for furnishing and placing all material and for all labor, equipment, tools, and incidentals necessary to complete the work prescribed in this item.

ITEM 904 SODDING

DESCRIPTION

904-1.1 This item shall consist of furnishing, hauling, and placing approved live sod on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the Resident Engineer.

MATERIALS

904-2.1 SOD. Sod furnished by the Contractor shall have a good cover of living or growing grass. This shall be interpreted to include grass that is seasonally dormant during the cold or dry seasons and capable of renewing growth after the dormant period. All sod shall be obtained from areas where the soil is reasonably fertile and contains a high percentage of loamy topsoil. Sod shall be cut or stripped from living, thickly matted turf relatively free of weeds or other undesirable foreign plants, large stones, roots, or other materials which might be detrimental to the development of the sod or to future maintenance. At least 70% of the plants in the cut sod shall be composed of the species stated in the special provisions, and any vegetation more than 6 inches in height shall be mowed to a height of 3 inches or less before sod is lifted. Sod, including the soil containing the roots and the plant growth showing above, shall be cut uniformly to a thickness not less than that stated in the special provisions.

904-2.2 LIME. Lime, if specified, shall conform to the requirements of 901-2.2.

904-2.3 FERTILIZER. Fertilizer, if specified, shall conform to the requirements of 901-2.3.

904-2.4 WATER. The water shall be sufficiently free from oil, acid, alkali, salt, or other harmful materials that would inhibit the growth of grass. It shall be subject to the approval of the Resident Engineer prior to use.

904-2.5 SOIL FOR REPAIRS. The soil for fill and topsoiling of areas to be repaired shall conform to the requirements of 901-2.4.

CONSTRUCTION METHODS

904-3.1 GENERAL. Areas to be solid, strip, or spot sodded shall be shown on the plans. Areas requiring special ground surface preparation such as tilling and those areas in a satisfactory condition which are to remain undisturbed shall also be shown on the plans.

Suitable equipment necessary for proper preparation of the ground surface and for the handling and placing of all required materials shall be on hand, in good condition, and shall be approved by the Resident Engineer before the various operations are started. The Contractor shall demonstrate to the Resident Engineer before starting the various operations that the application of required materials will be made at the specified rates.

904-3.2 PREPARING THE GROUND SURFACE. After grading of areas has been completed and before applying fertilizer and limestone, areas to be sodded shall be raked or otherwise cleared of stones larger than 2 inches in any diameter, sticks, stumps, and other debris which might interfere with sodding, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes occurs after grading of areas and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage. This may include filling gullies, smoothing irregularities, and repairing other incidental damage.

904-3.3 APPLYING FERTILIZER AND GROUND LIMESTONE. Following ground surface preparation, fertilizer shall be uniformly spread at a rate which will provide not less than the minimum quantity of each fertilizer ingredient, as stated in the special provisions. If use of ground limestone is required, it shall then be spread at a rate which will provide not less than the minimum quantity stated in the special provisions. These materials shall be incorporated into the soil to a depth of not less than 2 inches by disking, raking, or other methods acceptable to the Resident Engineer. Any stones larger than 2 inches in any diameter, large clods, roots, and other litter brought to the surface by this operation shall be removed.

904-3.4 OBTAINING AND DELIVERING SOD. After inspection and approval of the source of sod by the Resident Engineer, the sod shall be cut with approved sod cutters to such a thickness that after it has been transported and placed on the prepared bed, but before it has been compacted, it shall have a uniform thickness of not less than 2 inches. Sod sections or strips shall be cut in uniform widths, not less than 10 inches, and in lengths of not less than 18 inches, but of such length as may be readily lifted without breaking, tearing, or loss of soil. Where strips are required, the sod must be rolled without damage with the grass folded inside. The Contractor may be required to mow high grass before cutting sod.

The sod shall be transplanted within 24 hours from the time it is stripped, unless circumstances beyond the Contractor's control make storing necessary. In such cases, sod shall be stacked, kept moist, and protected from exposure to the air and sun and shall be kept from freezing. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. Where the soil is too dry, permission to cut sod may be granted only after it has been watered sufficiently to moisten the soil to the depth the sod is to be cut.

904-3.5 LAYING SOD. Sodding shall be performed only during the seasons when satisfactory results can be expected. Frozen sod shall not be used and sod shall not be placed upon frozen soil. Sod may be transplanted during periods of drought with the approval of the Resident Engineer, provided the sod bed is watered to moisten the soil to a depth of at least 4 inches immediately prior to laying the sod.

The sod shall be moist and shall be placed on a moist earth bed. Pitch forks shall not be used to handle sod, and dumping from vehicles shall not be permitted. The sod shall be carefully placed by hand, edge to edge and with staggered joints, in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward. The sod shall immediately be pressed firmly into contact with the sod bed by tamping or rolling with approved equipment to provide a true and even surface, and insure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Where the sod may be displaced during sodding operations, the workmen when replacing it shall work from ladders or treaded planks to prevent further displacement. Screened soil of good quality shall be used to fill all cracks between sods. The quantity of the fill soil shall not cause smothering of the grass. Where the grades are such that the flow of water will be from paved surfaces across sodded areas, the surface of the soil in the sod after compaction shall be set approximately 1 inch below the pavement edge. Where the flow will be over the sodded areas and onto the paved surfaces around manholes and inlets, the surface of the soil in the sod after compaction shall be placed flush with pavement edges.

On slopes steeper than 1 vertical to 2 1/2 horizontal and in V-shaped or flat-bottom ditches or gutters, the sod shall be pegged with wooden pegs not less than 12 inches in length and have a cross-sectional area of not less than 3/4 square inch. The pegs shall be driven flush with the surface of the sod.

904-3.6 WATERING. Adequate water and watering equipment must be on hand before sodding begins, and sod shall be kept moist until it has become established and its continued growth assured. In all cases, watering shall be done in a manner which will avoid erosion from the application of excessive quantities and will avoid damage to the finished surface.

904-3.7 ESTABLISHING TURF.

- A. General. The Contractor shall provide general care for the sodded areas as soon as the sod has been laid and shall continue until final inspection and acceptance of the work.
- B. Protection. All sodded areas shall be protected against traffic or other use by warning signs or barricades approved by the Resident Engineer.
- C. Mowing. The Contractor shall mow the sodded areas with approved mowing equipment, depending upon climatic and growth conditions and the needs for mowing specific areas. In the event that weeds or other undesirable vegetation are permitted to grow to such an extent that, either cut or uncut, they threaten to smother the sodded species, they shall be mowed and the clippings raked and removed from the area.

904-3.8 REPAIRING. When the surface has become gullied or otherwise damaged during the period covered by this contract, the affected areas shall be repaired to re-establish the grade and the condition of the soil, as directed by the Resident Engineer, and shall then be resodded as specified in 904-3.5.

METHOD OF MEASUREMENT

904-4.1 This item shall be measured on the basis of the area in square yards of the surface covered with sod and accepted.

When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans and the Contractor and the Resident Engineer have agreed in writing by the use of form AER-981 that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the Plans have been altered or when disagreement exists between the Contractor and the Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured as herein specified.

Only those areas designated in the plans shall be sodded, unless directed otherwise by the Engineer. All other areas requiring repair due to the Contractor's operations shall be sodded with the cost to be borne by the Contractor.

The quantity of water utilized for sod bed preparation and maintenance of the sodded areas shall be considered incidental to sodding and will not be measured for payment.

Areas of sodding not showing a uniform stand of grass in density and color shall not be approved for payment. Such areas shall be resodded to the Owner's satisfaction at the Contractor's cost.

BASIS OF PAYMENT

904-5.1 This item will be paid for on the basis of the contract unit price per square yard for sodding, which price shall be full compensation for all labor, equipment, material, staking, and incidentals necessary to satisfactorily complete the items as specified.

ITEM 905 TOPSOILING

DESCRIPTION

905-1.1 This item shall consist of preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, and placing and spreading the topsoil on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the Resident Engineer.

Topsoil shall be stripped from cut areas and below proposed pavements and stockpiled outside of the grading limits. Topsoil shall be utilized in shoulders adjacent to the proposed pavements. In addition, the surface of all disturbed areas shall be covered with a layer of topsoil, as needed, to facilitate drainage and the growth of turf.

No separate payment shall be made for stockpiling or excavation from the stockpile. Costs associated with stockpiling and/or excavation from the stockpile shall be considered incidental to Item 152.

MATERIALS

905-2.1 TOPSOIL. Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stones (2 inches or more in diameter), clay lumps or similar objects. Brush and other vegetation which will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sods and herbaceous growth such as grass and weeds are not to be removed but shall be thoroughly broken up and intermixed with the soil during handling operations. The topsoil or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 pH to 7.6 pH, when tested in accordance with the methods of testing of the Association of Official Agricultural Chemists in effect on the date of invitation of bids. The organic content shall be not less than 3% nor more than 20% as determined by the wet-combustion method (chromic acid reduction). There shall be not less than 20% nor more than 80% of the material passing the 200 mesh sieve as determined by the wash test in accordance with ASTM C 117.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications. For contractor sourced off-site topsoil, any amendments needed are at contractor expense. For on-site topsoil or plan specified offsite sources, it is assumed the needed amendments were determined in the design phase and included in the quantities for the project plans.

905-2.2 INSPECTION AND TESTS. For contractor sourced topsoil, the Resident Engineer shall be notified of the source of topsoil to be furnished by the Contractor 21 days prior to use. The topsoil shall be inspected by the Contractor and the Resident Engineer to determine if the selected soil meets the requirements specified and to determine the depth to which stripping will be permitted. At this time, the Contractor will be required to take representative soil samples from several locations within the area under consideration and to the proposed stripping depths, for testing purposes as specified in 905-2.1.

For on-site or plan specified offsite topsoil sources, the topsoil stripping depth will be shown on the plans or as directed by the Resident Engineer.

CONSTRUCTION METHODS

905-3.1 GENERAL. Areas to be topsoiled shall be shown on the plans. If topsoil is available on the site, the location of the stockpiles or areas to be stripped of topsoil and the stripping depths shall be shown on the plans.

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the Resident Engineer before the various operations are started.

905-3.2 PREPARING THE GROUND SURFACE. Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the Resident Engineer, to a minimum depth of 2 inches to facilitate bonding of the topsoil

to the covered subgrade soil. The surface of the area to be topsoiled shall be cleared of all stones larger than 2 inches in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

Grades on the area to be topsoiled, which have been established by others as shown on the plans, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and properly compacted condition to prevent, insofar as practical, the formation of low places or pockets where water will stand.

905-3.3 OBTAINING TOPSOIL. Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the Resident Engineer. Heavy sod or other cover, which cannot be incorporated into the topsoil by disking or other means shall be removed.

When suitable topsoil is available on the site, the Contractor shall remove this material from the designated areas and to the depth as directed by the Resident Engineer. The topsoil shall be spread on areas already tilled and smooth-graded, or stockpiled in areas approved by the Resident Engineer. Unless otherwise specified, any topsoil stockpiled by the Contractor shall be rehandled and placed without additional compensation. Any topsoil that has been stockpiled on the site by others, and is required for topsoiling purposes, shall be removed and placed by the Contractor. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding.

When suitable topsoil is secured off the airport site, the Contractor shall locate and obtain the supply, subject to the approval of the Resident Engineer. The Contractor shall notify the Resident Engineer sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor shall remove the topsoil from approved areas and to the depth as directed. The topsoil shall be hauled to the site of the work and placed for spreading, or spread as required. Any topsoil hauled to the site of the work and stockpiled shall be rehandled and placed without additional compensation.

905-3.4 PLACING TOPSOIL. The topsoil shall be evenly spread on the prepared areas to a uniform depth of 2 inches after compaction, unless otherwise shown on the plans or stated in the special provisions. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turfing operations can proceed with a minimum of soil preparation or tilling.

After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (2 inches or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. After spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the Resident Engineer. The compacted topsoil surface shall conform to the required lines, grades, and cross sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

Rutted or damaged areas due to construction and other areas graded as a part of this contract shall have topsoil spread as required to facilitate drainage and turfing.

METHOD OF MEASUREMENT

905-4.1 Topsoil obtained on the site shall be measured by the number of cubic yards of topsoil measured in its final compacted position. Topsoil shall be measured by volume in cubic yards computed by the method of average end areas using 4 inch depth.

905-4.2 Topsoil obtained off the site shall be measured by the number of cubic yards of topsoil measured in its final compacted position. Topsoil shall be measured by volume in cubic yards computed by the method of average end areas using 4 inch depth.

BASIS OF PAYMENT

905-5.1 No individual payment for topsoil material shall be made. Payment for topsoil will be made at the contract unit price per cubic yard for Item AR152410 - Unclassified Excavation or at the contract unit price per square yard for Item AR152480 - Shoulder Adjustment.

ITEM 908 MULCHING

DESCRIPTION

908-1.1 This item shall consist of furnishing, transporting, placing, and securing mulch on surfaces indicated on the plans or designated by the Resident Engineer.

Mulch shall be provided on all seeded areas.

MATERIALS

908-2.1 MULCH MATERIAL. Material used for mulching shall be (A) hay or (B) straw, except as noted otherwise. Hydraulic mulch shall be used on slopes exceeding 3:1 and shall be of the type shown on the plans or as specified in the Special Provisions.

Low grade, musty, spoiled, partially rotted hay, straw, or other materials unfit for animal consumption will be acceptable. Mulch materials, which contain matured seed of species which would volunteer and be detrimental to the proposed overseeding, or to surrounding farm land, will not be acceptable. Straw or other mulch material which is fresh and/or excessively brittle, or which is in such an advanced stage of decomposition as to smother or retard the planted grass, will not be acceptable

- A. Hay. Hay shall be native hay, Sudan grass hay, broomsedge hay, legume hay, or similar hay or grass clippings.
- B. Straw. Straw shall be the threshed plant residue of oats, wheat, barley, rye, or rice from which grain has been removed.
- C. Hay Mulch Containing Seed. Hay mulch shall be mature hay containing viable seed of native grasses or other desirable species stated in the special provisions or as approved by the Resident Engineer. The hay shall be cut and handled so as to preserve the maximum quantity of viable seed. Hay mulch which cannot be hauled and spread immediately after cutting shall be placed in weather-resistant stacks or baled and stored in a dry location until used.
- D. Hydraulic Mulch The mulch component shall be comprised of a minimum of 70 percent biodegradable material such as wood cellulose, paper fibers, straw or cotton and shall contain no growth or germination inhibiting factors. The remainder of the components shall consist of the manufacturer's choice of tackifiers and/or strengthening fibers needed to meet the performance specifications. Tackifiers shall be non-toxic and LC 50 test results shall be provided along with the manufacturer's certification. Hydraulic mulch shall disperse evenly and rapidly and remain in slurry when agitated with water. When uniformly applied, the slurry shall form an absorbent cover allowing percolation of water to the underlying surface. Hydraulic mulch shall be packaged in UV and moisture resistant factory labeled packages or bags with the net quantity of the packaged material plainly shown on each package. The biodegradable material shall be relatively free of glossy papers and shall not be water soluble. The hydraulic mulches shall be according to the following.

Light-Duty Hydraulic Mulch	
Property ^{1/}	Value
Functional Longevity ^{2/}	3 Months
Minimum Application Rates	2000 lb/acre
Typical Maximum Slope Gradient (V:H)	≤ 1:3
Maximum Uninterrupted Slope Length	50 ft
Maximum C Factor	0.15
Minimum Vegetation Establishment ^{5/}	200%

Heavy-Duty Hydraulic Mulch	
Property ^{1/}	Value
Functional Longevity ^{2/}	12 Months
Minimum Application Rates	3000 lb/acre
Typical Maximum Slope Gradient (V:H)	≤ 1:2
Maximum Uninterrupted Slope Length	100 ft
Maximum C Factor ^{3/,4/}	0.02
Minimum Vegetation Establishment ^{5/}	400%

- 1/ This table sets minimum requirements only. Refer to manufacturer recommendations for application rates, instructions, gradients, maximum continuous slope lengths and other site specific recommendations.
- 2/ Manufacturer's estimated time period, based upon field observations, that a material can be anticipated to provide erosion control as influenced by its composition and site-specific conditions.
- 3/ "C" Factor calculated as ratio of soil loss from HECF protected slope (tested at specified or greater gradient, h:v) to ratio of soil loss from unprotected (control) plot based on large-scale testing.
- 4/ Large-scale test methods shall be according to ASTM D 6459.
- 5/ Minimum vegetation establishment shall be calculated according to ASTM D 7322.

The manufacturer shall furnish a certification with each shipment of hydraulic mulch stating the number of packages or bags furnished and that the material complies with these requirements.

908-2.2 RESERVED

CONSTRUCTION METHODS

908-3.1 MULCHING. Before spreading mulch, all large clods, stumps, stones, brush, roots, and other foreign material shall be removed from the area to be mulched. The spreading of the mulch may be by hand methods, blower, or other mechanical methods, provided a uniform covering is obtained.

Mulch material shall be furnished, hauled, and evenly applied on the area shown on the plans or designated by the Resident Engineer. Straw or hay mulch and hydraulic mulch on slopes flatter than 3:1 shall be applied within 24 hours of the time seeding has been performed. Straw or hay shall be spread over the surface to a uniform thickness at the rate of 2 to 3 tons per acre to provide a loose depth of not less than 1 1/2 inches nor more than 3 inches. The application method shall consist of hand or machine application of hay or straw mulch. The mulch shall be loose enough to permit air to circulate but compact enough to reduce erosion. If baled mulch material is used, care shall be taken that the material is in a loosened condition and contains no lumps or knots of compacted material. Other organic material shall be spread at the rate directed by the Resident Engineer. Mulch may be blown on the slopes and the use of cutters in the equipment for this purpose will be permitted to the extent that at least 95% of the mulch in place on the slope shall be 6 inches or more in length. When mulches applied by the blowing method are cut, the loose depth in place shall be not less than 1 inch nor more than 2 inches.

On slopes equal to or steeper than 3:1, or when called for in the plans or Special Provisions, hydraulic mulch of the type specified shall be applied uniformly at the rate specified. On slopes equal to or steeper than 3:1, hydraulic mulch shall be applied the same day as seeded or planted.

When Light-Duty Hydraulic Mulch is specified, the method shall consist of the machine application of a light-duty hydraulic mulch. When Heavy-Duty Hydraulic Mulch is specified, the method shall consist of the machine application of a heavy-duty hydraulic mulch and the mulch shall be applied using a mechanically agitated hydraulic mulching machine. Seeding shall be conducted as a separate operation and shall not be added to the hydraulic mulch slurry. Hydraulic mulch shall not be applied when the ambient temperature is at or below freezing. To achieve full and even coverage, the hydraulic mulch shall be applied from two opposing directions. Mixing and application rates shall be according to the manufacturer's recommendations and meet the minimum application rates specified.

Following all mulching operation, every precaution shall be taken to prohibit foot or vehicular traffic, or the movement of equipment over the mulched area. At any location where mulching has been displaced by any Contractor's equipment or personnel, the seeding or other work damaged as a result

of that displacement shall immediately be replaced and the mulch covering replaced, at the Contractor's expense, in a manner satisfactory to the Resident Engineer.

It shall be the Contractor's responsibility to make certain that the rate of mulch application is maintained constant throughout the seeding operations.

908-3.2 SECURING MULCH. Hay or straw mulch shall be held in place by light disking, a very thin covering of topsoil, small brush, pins, stakes, wire mesh, or other adhesive material approved by the Resident Engineer.

The hay or straw shall be applied in accordance with all of the above requirements except a mulch stabilizer shall be used to anchor mulch into the soil by means of full blades or disks. These blades or disks shall be without camber, be approximately 20 inches in diameter. The disks shall be notched and shall be spaced at approximately 3 inch intervals and shall be equipped with scrapers. The stabilizer shall weigh approximately 1,000 pounds and shall have a working width not to exceed 72 inches and shall be equipped with a ballast compartment, so that when directed, weight can be increased. The Contractor shall notify the Resident Engineer of his/her proposed method of securement for his/her approval prior to performing the work.

908-3.3 CARE AND REPAIR.

- A. The Contractor shall care for the mulched areas until final acceptance of the project. Such care shall consist of providing protection against traffic or other use by placing warning signs, as approved by the Resident Engineer, and erecting any barricades that may be shown on the plans before or immediately after mulching has been completed on the designated areas.
- B. The Contractor shall be required to repair or replace any mulching that is defective or becomes damaged until the project is finally accepted. When, in the judgment of the Resident Engineer, such defects or damages are the result of poor workmanship or failure to meet the requirements of the specifications, the cost of the necessary repairs or replacement shall be borne by the Contractor. However, once the Contractor has completed the mulching of any area in accordance with the provisions of the specifications and to the satisfaction of the Resident Engineer, no additional work at his/her expense will be required, but subsequent repairs and replacements deemed necessary by the Resident Engineer shall be made by the Contractor and will be paid for as additional or extra work.

METHOD OF MEASUREMENT

908-4.1 Mulching shall be measured in acres on the basis of the actual surface area acceptably mulched.

Only those areas measured for seeding shall be mulched unless otherwise directed by the Engineer. All other areas requiring repair due to the Contractor's operations shall be mulched with the cost to be borne by the Contractor.

When the project is constructed essentially to the lines, grades, or dimensions shown on the Plans and the Contractor and the Resident Engineer have agreed in writing by the use of form AER-981 that the plan quantities are accurate, no further measurement will be required and payment will be made for the quantities shown in the contract for the various items involved except that if errors are discovered after work has been started, appropriate adjustments will be made.

When the Plans have been altered or when disagreement exists between the Contractor and the Engineer as to the accuracy of the plan quantities, either party shall, before any work is started which would affect the measurement, have the right to request in writing and thereby cause the quantities involved to be measured as herein specified.

BASIS OF PAYMENT

908-5.1 Payment will be made at the contract unit price per acre for mulching. This price shall be full compensation for furnishing all materials and for placing and anchoring the materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

DIVISION VI - LIGHTING INSTALLATION

ITEM 101 AIRPORT ROTATING BEACONS

ITEM 101580 REFURBISH 36" BEACON

DESCRIPTION

101-1.1 This item shall consist of airport rotating beacons furnished and installed in accordance with this specification at the location and shall conform to the design and dimensions shown in the plans. This work shall include the mounting, leveling, wiring, painting, servicing, and testing of the beacon and all materials and incidentals necessary to place the beacons in operating condition as a completed unit to the satisfaction of the Engineer. This item shall include a mounting platform if specified in the plans.

This item of work shall consist of furnishing and installing a rotating beacon at the location shown in the plans, refurbishing of an existing airport rotating beacon, or relocating the existing beacon as shown in the plans. All necessary electrical connections and work required to install the proposed or relocated rotating beacon to function properly will be considered part of this work item and no additional compensation will be permitted. This includes all vault work and installation of obstruction lighting required. Two FAA approved L-810 obstruction lights shall be mounted on the proposed beacon with a photocell and all necessary electrical components to make it complete and operational to the satisfaction of the Engineer.

This item shall consist of the refurbishment of an existing airport rotating beacon in accordance with this Special Provision. This work shall include the mounting, leveling, wiring, painting, servicing, and testing of the beacon and all materials and incidentals necessary to place the beacon in operating condition as a completed unit to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

101-2.1 GENERAL.

- A. Airport lighting equipment and materials covered by these specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D. C. 20590, and shall be listed in Advisory Circular 150/5345-53, Approved Airport Lighting Equipment (latest revision).
- B. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

101-2.2 BEACON. The airport rotating beacon shall conform to FAA Advisory Circular 150/5345-12 (latest revision), Specification for L-801 Airport and Heliport Beacon.

The proposed beacon shall be of the type and size shown in the plans.

101-2.3 PANEL BOARDS AND BREAKERS. Panel boards and breakers shall conform with the applicable sections of Item 109 of these specifications.

101-2.4 WEATHERPROOF CABINETS. The weatherproof cabinets shall conform to National Electrical Manufacturers Association standards and shall be constructed of steel not less than No. 16 USS gauge.

101-2.5 WIRE. Wire in conduit rated up to 5,000 volts shall conform to Advisory Circular 150/5345-7 (latest revision), Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal.

Wire shall be provided in accordance with Item 108-2.2.

101-2.6 CONDUIT. Rigid steel conduit and fittings shall conform to the requirements of Underwriters Laboratories 6, 514, and 1242.

101-2.7 PAINT.

- A. Priming paint for ungalvanized metal surfaces shall be a high solids alkyd primer conforming to Society for Protective Coatings Specification SSPC-Paint 25, Primer, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments).
- B. Priming paint for galvanized metal surfaces shall be zinc dust-zinc oxide primer paint conforming to MIL-DTL-24441/19B. If necessary, add not more than 1/2 pint of turpentine to each gallon.
- C. Orange paint for the body and the finish coats on metal and wood surfaces shall consist of a ready-mixed non-fading paint. The color shall be in accordance with Federal Standard 595, Aviation Gloss Orange Number 12197.
- D. White paint for body and finish coats on metal and wood surfaces shall be ready-mixed paint conforming to the Master Painter's Institute, Reference #9, Exterior Alkyd, Gloss, VOC Range E2.
- E. Priming paint for wood surfaces shall be mixed on the job by thinning the above specified orange or white paint with 1/2 pint of raw linseed oil to each gallon.

101-2.8 For Refurbishing Beacon. The Contractor shall remove the existing beacon from the tower and perform the following items of work in accordance with current FAA requirements and specifications:

- A. Completely dismantle the beacon, including glass and lenses.
- B. Sandblast the frame and assemblies.
- C. Replace the bearings and seals in the spindle.
- D. Replace the wiring with #14 Teflon or silicon high-temperature insulated wire.
- E. Install new terminal strips.
- F. Remove existing plug fuse holder and replace with a double cartridge type fuse holder. Fuse light and motor separately with fuse rated for 200,000 RMS interrupting capacity at 240 VAC.
- G. The motor shall be removed. Conversion to a belt drive unit shall be provided. A new motor shall be provided and shall be UL Listed, ¼ hp at 115 VAC, 60 Hz, 1.10 service factor, with maximum amperage not to exceed 2.4 amps. The gear reducer shall provide the beacon RPM specified and have a minimum full torque of 200 inch pounds.
- H. The beacon main drive shaft shall be completely dismantled and cleaned. New bearings and races shall be provided on the main drive shaft. All bearings shall be filled with grease at the time of re-assembly.
- I. Grease fittings shall be provided on the edge of the mounting plate that holds the beacon head support ring and in the side of the bearing support shaft casing to provide grease for both the top and bottom bearings.
- J. All removed glass shall be cleaned and resealed back in its original place on the beacon. Provide new cork or rubber cushions for each glass element. The sealing material shall have a guaranteed pliable life of at least 20 years.
- K. The existing 1000 watt incandescent lamp system shall be replaced with an FAA approved high output, pulse-start metal halide lamp system delivering 44,000 lumens of output, and carrying a

two-year warranty. Provide an FAA approved color filter to correct for the type of light emitted by the metal halide lamp.

- L. Lighting assembly shall be converted to a stationary, non-rotating type. The light socket shall be mounted on a minimum ½" galvanized or plated pipe securely fastened to proper support members inside the beacon base. Support shall be centered in the beacon head assembly.
- M. Lamp holder assembly shall be properly aligned, centered and leveled so that the lamp is in proper focus. Lamp holder shall be adjustable both vertically and horizontally, and calibrated with permanent degree markings. The beam angle shall be set at 3 degrees.
- N. The refurbished beacon shall be fitted with two L-810 obstruction lights mounted on top of the beacon, or remotely mounted on the platform. These obstruction lights shall be operated from a photocontrol integral to the beacon power pack that operates the beacon lamp, and which automatically de-energizes the obstruction lights when the beacon lamp reaches 60-70% brightness.
- O. Provide all new fastening hardware including but not limited to, stainless steel bolts, lock washers, and nuts. Plated fasteners will not be allowed.
- P. Repaint beacon – International orange.
- Q. After the beacon is reassembled, it shall be test-operated for at least two hours. Any irregularities shall be corrected. The Resident Engineer and the Airport Management shall witness this test.
- R. The following vendors may furnish equipment and materials complying with this specification:
 - 1. Hali-Brite, Inc., PO Box 11, Crosby, MN 56441 – PH 218-546-7473.
 - 2. ECS, PO Box 1997, Greenwood, MS 38935 – PH 662-453-0588
 - 3. Crouse Hinds Aviation Lighting, 1200 Kennedy Road, Windsor, CT. 06095 – PH 203-683-4370.

After the beacon is refurbished, the Contractor shall replace the beacon back on top of the tower and connect it to the proposed wiring.

The Contractor shall obtain refurbished beacon from one of the acceptable vendors mentioned above to perform such work. If this option is chosen, the Contractor shall perform crating and shipping as required by the refurbishing vendor, and shall pay all shipping and refurbishing costs. The Contractor shall retain full responsibility for the satisfactory completion of this item. Any damage to the beacon caused by the Contractor or his/her agents while removing, refurbishing, or replacing the beacon, or incurred in transit from or to the airport, will be repaired at the Contractor's expense to the satisfaction of the Owner and the Engineer.

CONSTRUCTION METHODS

101-3.1 PLACING THE BEACON. The beacon shall be mounted on a beacon tower, platform, or building roof as shown in the plans.

101-3.2 HOISTING AND MOUNTING. The beacon shall be hoisted to the mounting platform by using suitable slings and hoisting tackle. Before fastening the beacon to the mounting platform, the mounting holes shall be checked for correct spacing. Beacon base or mounting legs shall not be strained or forced out of position to fit incorrect spacing of mounting holes. The beacon base shall be raised first, set in position, and bolted in place. The drum shall then be raised and assembled to the base.

101-3.3 LEVELING. After the beacon has been mounted in place, it shall be accurately leveled. The leveling shall be checked in the presence of the Resident Engineer and shall be to his/her satisfaction.

101-3.4 SERVICING. Before placing the beacon in operation, the Contractor shall check the manufacturer's manual for proper servicing requirements, follow the manufacturer's servicing requirements for each size beacon and shall accomplish the following:

- A. Clean and polish all glassware, both inside and outside, using a type of cleaner which will not scratch the lens, and clean the interior of the beacon.
- B. Clean interior of beacon base and check for alignment of parts.
- C. Clean and polish slip rings. Apply a very small amount of petroleum jelly to the slip rings, operate about 1/2 hour, then wipe the surplus off the rings. Remove the brushes and lubricate the chamber of brush holders.
- D. Grease gears of rotating mechanism where gears are accessible. Check to see if gears mesh properly, and turn the motor shaft by hand to ascertain if action of gear train is free. Check and adjust the clutch tension. The clutch should be not quite tight enough to stall the motor when the lamp-rotating element is held fast. Fill grease fittings with grease conforming to the manufacturer's or Engineer's recommendations.
- E. Set brushes for free motion on slip rings, and adjust springs to 1 or 2 pounds pressure to provide firm contact.
- F. Secure lamps properly in the sockets.

101-3.5 BEAM ADJUSTMENT. After the beacon has been mounted and leveled, the elevation of the beams shall be adjusted. The final beam adjustments shall be made at night so that results can be readily observed. The beams shall be adjusted to the elevation directed by the Engineer or as shown in the plans, except that, in no case shall the elevation of the beams be less than 2 degrees above the horizontal.

101-3.6 BEACON MOUNTING PLATFORM. Where the beacon is to be mounted at a location other than the beacon tower and where a special mounting platform is required, the construction of this mounting platform and any necessary lightning protection equipment shall be in accordance with the details shown in the plans.

When the proposed beacon will be mounted to the top of the beacon tower, it shall be done in accordance with the manufacturer's recommendations. The Contractor will make any necessary modifications to the mounting assembly in order to bolt the proposed beacon to the beacon tower.

101-3.7 WIRING. The Contractor shall furnish all necessary labor and materials and shall make complete above ground electrical connections in accordance with the wiring diagram furnished with the project plans.

If underground cable for the power feed from the transformer vault to the beacon site and duct for this cable installation under paved areas is required, the cable, ground rods, and duct shall be installed in accordance with and paid for by linear foot measurement as described in Item 108, Installation of Underground Cable for Airports, and Item 110, Installation of Airport Underground Electrical Duct.

Unless otherwise specified, the Contractor shall connect the tell-tale relay mechanism in the beacon to energize the tower obstruction light circuit when failure of the beacon service (Primary) lamp occurs.

If lightning protection is specified in the plans or proposal as a part of this item, it shall be in accordance with 103-2.3, 103-2.4, 103-2.5, 103-2.6, and 103-3.4 in Item 103, Installation of Airport Beacon Towers.

For beacon replacement, all cables associated with the existing rotating beacon that are in conflict with the installation of the proposed beacon shall be removed by the Contractor and disposed of off airport property. Existing underground cables that do not conflict shall be abandoned in place.

101-3.8 PANEL AND CABINET. Unless otherwise specified, the Contractor shall furnish and install at the top of the beacon tower or mounting platform a circuit-breaker panel consisting of four 15-ampere breakers mounted in a weather-proof cabinet to provide separate protection for the circuits to the beacon lamps, motor, obstruction lights, and other equipment. The cabinet shall be located on the side of the beacon platform, as directed by the Engineer.

For refurbishing beacons, the Contractor shall remove one existing platform circuit breaker panel and furnish and install a proposed weatherproof panel at the base of the beacon tower, consisting of four 15-ampere breakers mounted in a weather-proof cabinet to provide separate protection for the circuits to the beacon lamps, motor, obstruction lights, and other equipment. The panel shall be located as shown on the Plans.

At the platform, provide a weatherproof safety switch mounted in place of the existing panel.

101-3.9 CONDUIT. All exposed wiring shall be run in not less than 3/4 inch galvanized rigid steel conduit. No conduit shall be installed on top of a beacon platform floor. All conduit shall be installed to provide for drainage. If mounted on a steel beacon tower, the conduit shall be fastened to the tower members with "wraplock" straps, clamps, or approved fasteners, spaced approximately 5 feet apart. The conduit shall be fastened to wooden structures with galvanized pipe straps and with galvanized wood screws not less than No. 8 or less than 1-1/4 inches long. There shall be at least two fastenings for each 10-foot length.

For refurbished beacons, all exposed wiring shall be run in not less than 1/2 inch liquid-tight metallic flexible conduit. Such conduit shall be UL Listed for grounding, with a copper strip factory-embedded in the metallic coil. Fittings shall be waterproof, and compatible with this type of conduit.

101-3.10 BOOSTER TRANSFORMER. If shown in the plans or specified in job specifications, a booster transformer to compensate for voltage drop to the beacon shall be installed in a suitable weatherproof housing under or on the tower platform or at the base of the tower. The installation shall be as indicated in the plans and described in the proposal. If the booster transformer is required for installation in the transformer vault, it shall be installed in accordance with and paid for as described in Item 109, Installation of Airport Transformer Vault and Vault Equipment.

101-3.11 PHOTOELECTRIC CONTROL. If shown in the plans or specified in job specifications, the Contractor shall furnish and install an automatic control switch at the location indicated in the plans. The switch shall be a photoelectric type. It shall be a standard commercially available unit suitable for aviation service. It shall be installed, connected, and adjusted in accordance with the manufacturer's instructions.

101-3.12 OBSTRUCTION LIGHTS. Unless otherwise specified, the Contractor shall install on the top of the beacon tower or mounting platform two L-810 obstruction lights on opposite corners, or optionally on top of the rotating beacon. If mounted on the platform, these lights shall be mounted on conduit extensions to a height of not less than 4 inches above the top of the beacon. If integral to the beacon, they shall be connected in series into the tell-tale photocontrol circuit with the necessary relay and wiring connections.

101-3.13 PAINTING. If construction of a wooden mounting platform is stipulated in the proposal as part of this item, all wooden parts of the platform shall be given one priming coat of white or aviation-orange paint after fabrication but before erection and one body and one finish coat of aviation-orange paint after erection. Steel mounting platforms shall be given one priming coat of corrosion inhibiting primer before erection and one body and one finish coat of aviation-orange paint after erection. All equipment installed under this contract and exposed to the weather shall be given one body and one finish coat of aviation-orange or white paint as required. This shall include beacon (except glass surfaces), beacon base, breaker cabinet, all conduit, and transformer cases. It shall not include air terminals or obstruction light globes.

The paint shall be applied uniformly in the proper consistency by skilled painters. The finished paint shall be free from sags, holidays, and smears. Each coat of paint shall be given ample time to dry and harden before the next coat of paint is applied. A minimum of 3 days shall be allowed for drying on wood surfaces, and a minimum of 4 days shall be allowed for drying on metal surfaces. Painting shall not be done in cold, damp, foggy, dusty, or frosty atmospheres, or when air temperature is below 40° F (4° C), nor started when the weather forecast indicates such conditions for the day.

All surfaces shall be cleaned before painting. The surfaces shall be dry and free from scale, grease, rust, dust, and dirt when paint is applied. All knots in wood surfaces shall be covered with shellac immediately before applying the priming coat of paint. Nail holes and permissible imperfections shall be filled with putty. The ready-mixed paint shall be thinned for the priming and body coats in

accordance with the manufacturer's recommendations. In the absence of such recommendations, the following shall apply:

A. Body Coats - Add 1/2 pint of turpentine to each gallon of ready-mixed paint for body coats.

B. Finish Coats - The ready-mixed paint shall be used as it comes from the container for finish coats.

For refurbishing beacons, painting as described in this section shall be required only for damage or marring of new metallic surfaces.

101-3.14 TESTING. The installation shall be fully tested in operation as a completed unit prior to acceptance. These tests shall include operation of the lamp-changer operation and taking megger and voltage readings. The insulation resistance to ground of the beacon supply circuit shall be not less than 50 megohms when measured ungrounded. Testing equipment shall be furnished by the Contractor. Tests shall be conducted in the presence of the Resident Engineer and shall be to his/her satisfaction.

METHOD OF MEASUREMENT

101-4.1 The quantity to be paid for under this item shall be the number of beacons installed as completed units in place, accepted, and ready for operation.

The beacon refurbishment shall be paid for on a lump sum basis for a completed unit in place, accepted, and ready for operation.

BASIS OF PAYMENT

101-5.1 Payment shall be made at the contract per each price for a completed and accepted installation. This price shall be full compensation for furnishing all materials and for preparation, removals, obstruction lights and beacon wiring, conduit, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item including the removal of the existing beacon where shown in the plans.

For refurbished beacon, payment will be made at the contract unit lump sum price for the completed airport rotating beacon refurbishment, and appurtenances specified herein or shown on the Plans. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

ITEM 103 INSTALLATION OF AIRPORT BEACON TOWERS

DESCRIPTION

103-1.1 This item shall consist of furnishing and installing an airport beacon tower of the type specified or shown in the plans, furnished and installed in accordance with this specification at the location and shall conform to the design and dimensions shown in the plans. This work shall include the clearing of the site, erection of the tower, installation of lightning protection, painting, and all incidentals necessary to place it in operating condition as a completed unit to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

103-2.1 GENERAL. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

103-2.2 TOWER. The Steel Tower shall be 51' in height and shall conform to the details and requirements shown on the plans, as well as FAA Advisory Circular 150/5340-30.

Foundations and installation shall be per manufacturer's recommendations. The Contractor shall furnish and install conduit, cable, disconnect switch and any necessary items to make a complete and operational system.

103-2.3 LIGHTNING PROTECTION. Lightning protection shall comply with NFPA-780, Standard for the Installation of Lightning Protection Systems. All materials shall comply with Class II requirements regardless of tower height. Ground rods and underground cables shall be installed in accordance with and paid for as described in Item L-108, Underground Power Cable for Airports.

The lightning rod shall consist of a galvanized steel, copper, or copper-clad rod with the upper end drawn to a point and of sufficient length to extend from the point of fastening to not less than 6 inches above the top of the beacon.

103-2.4 PAINT.

- A. Priming paint for galvanized steel towers shall be zinc, dust-zinc oxide primer paint conforming to MIL-DTL-24441/19B. If necessary, add not more than 1/2 pint of turpentine to each gallon.
- B. Priming paint for ungalvanized steel towers shall be a high solids alkyd primer conforming to the Master Painter's Institute, Reference #9, Exterior Alkyd, Gloss, VOC Range E2.
- C. Orange paint for the body and finished coats on metal and wood surfaces shall consist of a ready-mixed nonfading paint meeting the requirements of Master Painter's Institute, Reference #9, Alkyd, Exterior, Gloss, (MPI Gloss Level 6) and Reference #94, Alkyd, Exterior, Semi-gloss, (MPI Gloss Level 5). The color shall be in accordance with Federal Standard 595, Aviation Gloss Orange Number 12197.
- D. White paint for steel tower shall be ready-mixed paint conforming to Commercial Item Description A-A-3067.

103-2.5 DOWN CONDUCTOR. The down conductor cable for lightning protection shall consist of No. 8 AWG or larger bare stranded copper wire.

103-2.6 GROUND ROD. The ground rod shall be of the diameter and length specified in the plans. It shall be copper or copper clad.

103-2.7 GROUND CLAMP. Ground clamp shall be similar and equal to the Type GR as manufactured by the Burndy Engineering Company.

CONSTRUCTION METHODS

103-3.1 CLEARING AND GRADING. The site on which the beacon tower is to be erected shall be cleared and leveled. All trees and brush shall be removed from the area within a distance of 25 feet from the tower or as called for in the job plans. Stumps shall be removed to a depth of 18 inches below finished grade and the excavation filled with earth and tamped. If a transformer vault or other structure is included as part of the installation, the area shall be cleared to a distance of 25 feet from these structures. The ground near the tower shall be leveled to permit the operation of mowing machines. The leveling shall extend at least 2 feet outside the tower legs or base. All debris removed from the tower site shall be disposed of by the Contractor to the satisfaction of the Resident Engineer and in accordance with Federal, state, or local regulations.

103-3.2 EXCAVATION AND FILL. Excavation for the tower footings shall be carried to a minimum of 4 inches below the footing depth. The excess excavation below the footing depth shall then be backfilled with gravel or crushed stone and compacted to the required level. The footing plates shall be installed, and a thickness of not less than 18 inches of the same gravel or crushed stone shall be placed immediately above the footing plates in layers of not over 6 inches. Each layer above the footing plates shall be thoroughly tamped in place. The remainder of the backfill may be of excavated earth placed in layers not to exceed 6 inches. Each layer shall be thoroughly compacted by tamping.

Where solid rock is encountered, which prevents the carrying of the foundation legs to the required depth but which is of sufficient strength to use holddown bolts, the tower anchor posts shall be cut off at the required length and the holddown bolts shall be installed as indicated in the plans with the approval of the Engineer. Each tower leg shall be anchored to the rock by means of two 7/8-inch diameter by 3-foot long expansion or split bolts and shall be grouted with neat Portland cement into holes drilled into the natural rock. Except as required for rock foundations, the footing members shall not be cut off or shortened. If excavated material is of such character that it will not readily compact when backfilled, the Resident Engineer may order the excavation backfilled with concrete or other suitable material.

The concrete footing for tubular beacon towers shall be installed in accordance with the manufacturer's recommendations. Portions of the footing in the topsoil layer shall not be included in the footing height.

103-3.3 ERECTION. Detail erection drawings furnished by the manufacturer shall be strictly followed during construction. All towers shall be erected in sections from the ground up unless otherwise specified. In final assembly, all bolts and fastenings shall be installed, and the structure shall be plumb, true, square, and level. Nuts shall be taken up to a firm bearing after which the bolts shall, if necessary, be cut to proper length to protrude three full threads. Approved locknuts shall be placed on each bolt over the regular nut. Ladder bolts shall be inserted with the head to the outer face of the tower. Diagonal, leg, and handrail bolts shall be installed with nuts on the outer face of the tower, unless otherwise specified. Bent parts shall be straightened before erection without damage to the protective coating. Surfaces abraded or bared of protective coating shall be painted with the proper priming paint as specified in these specifications.

The Contractor shall install the ladder on the side of the tower adjacent to the driveway or most accessible approach to the tower. Tubular beacon towers shall be erected in accordance with the manufacturer's recommendations. The safety cable shall be located on the side of the tower adjacent to the driveway or most accessible approach to the tower.

103-3.4 LIGHTNING PROTECTION. The Contractor shall furnish and install a lightning rod, down conductor, and at least one ground plate or rod for each beacon tower. The lightning rod shall be installed at the top of the tower with the tip of the rod extending not less than 6 inches above the top of the beacon.

Down-conductor cables shall be securely fastened to the surface of the tower leg at 5-foot intervals with suitable bronze fasteners having bronze or noncorrosive metal bolts. Sharp turns or bends in the down conductor will not be permitted.

All connections of cable to cable, cable to lightning rods, and cable to ground plates or rods shall be made with approved type solderless connectors or noncorrosive metal and shall be of substantial construction.

The down-conductor cable shall be securely attached to ground rods or plates placed at least 2 feet away from the tower foundations.

The ground rod shall be driven into the ground so that the top is at least 6 inches below grade. The down-conductor shall be firmly attached to the ground plate or rod by means of a ground connector or clamp. Plates shall be embedded in the area of permanent moisture.

The complete lightning protection installation shall be accomplished to the satisfaction of the Resident Engineer. The resistance to ground of any part of the lightning protection system shall not exceed 25 ohms.

103-3.5 PAINTING. The Contractor shall furnish all materials and labor for painting the beacon tower. The color scheme for the steel tower shall be as shown in the plans.

A. Parts to be Painted. Tower parts (except those parts to be exposed to earth) shall not be treated or primed before erection. All tower parts placed below ground level or within 12 inches above ground level shall be given two coats of approved paint.

The paint shall be applied uniformly in the proper consistency by skilled painters. The finished paint shall be free from sags, holidays, and smears. Division lines between colors shall be sharply defined. Each coat of paint shall be given ample time to dry and harden before the next coat is applied. A minimum of 4 days shall be allowed for drying on metal surfaces. Painting shall not be done in cold, damp, foggy, dusty, or frosty atmospheres, or when air temperature is below 40° F., nor started when the weather forecast indicates such conditions for the day (24 hour period).

All surfaces shall be cleaned before painting. The surfaces shall be dry and free from scale, grease, rust, dust, and dirt when paint is applied.

The number of coats of paint applied shall be in accordance with the following instructions:

B. Steel Towers, Galvanized. One priming coat of zinc dust-zinc oxide primer after erection and one body and one finish of white or orange paint (as required by the color scheme) applied after erection.

C. Steel Towers, Not Galvanized. One priming coat of corrosion-inhibiting primer and one body and one finish coat of white or orange paint (as required by the color scheme) applied after erection.

The above specified orange and white ready-mixed paints shall be thinned for the body coats in accordance with the manufacturer's recommendations. In the absence of such recommendations, the following shall apply:

D. Body Coats. Add not more than 1/2 pint of turpentine to each gallon of ready-mixed paint for body coats.

E. Finish Coats. The ready-mixed paint shall be used as it comes from the container for finish coats.

METHOD OF MEASUREMENT

103-4.1 The quantity to be paid for under this item shall be the number of airport beacon towers installed as completed units in place, accepted, and ready for operation.

BASIS OF PAYMENT

103-5.1 Payment will be made at the contract unit price for each completed and accepted job. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

ITEM 106 APRON LIGHTING

DESCRIPTION

106-1.1. The work under this item shall include the furnishing and installation of apron floodlights, light pole, light pole foundation, internal fusing, anchor bolts, fixture brackets, ballasts, and lamps. Installation shall include aiming of the luminaries to obtain the light levels specified herein and testing of light fixtures with portable power supply and the installation of light pole foundations of the depth shown on plans and specified herein.

106-1.2. Light pole locations are indicated on the plans and no deviation from these locations shall be permitted without the written approval of the Engineer.

A scaled computer analysis showing expected light levels on the apron shall be provided with the luminaries shop drawings. The input sheet shall also be provided and shall show all luminaries locations, mounting heights, aiming directions and tilts. Tilts in excess of 20 degrees shall not be allowed. A computer disk with photometrics in I.E.S. format shall also be submitted.

106-1.3. The shafts of the light pole foundations shall be cased to overcome unsuitable soil conditions and permit removal of water. The work shall be performed in a manner that will confine disturbance of surrounding materials to a minimum. The light pole foundations shall receive full lateral support from the surrounding materials.

Applicable standards include the current edition of the following:

- ACI 336.1 - Construction of End Bearing Drilled Piers.
- ASTM A 252 - Welded and Seamless Steel Pipe Piles.

The installer of the light pole foundations shall not have less than five (5) years of documented experience in similar installations.

Light pole foundation construction shall conform to the requirements of all codes, regulations, ordinances or laws as may apply thereto. The Contractor is also required to be familiar with and to comply with all OSHA, EPA, and any other federal, state or local requirements which pertain to this work. All tests, materials or additional work called for by said requirements shall be provided at no extra expense to the Airport. **All poles supplied shall be certified to be vibration-free at all wind loads.**

106-1.4 All steel used in the construction of this item shall be of 100 percent domestic origin.

EQUIPMENT AND MATERIALS

106-2.1 LIGHT FIXTURES.

APRON FLOODLIGHT. The apron floodlight fixture housing shall be formed from heavy gauge aluminum and shall be internally welded. All external hardware shall be stainless steel. The housing dimensions shall be as shown on the plans and the unit shall be U.L. listed for wet locations.

The lens frame shall be extruded, metered clear anodized aluminum and shall be welded into one piece and permanently fastened to the housing with a full length hinge.

The flat, thermal and shock resistant glass lens shall be sealed to the lens frame and secured with form corner keys.

The lens shall be silicone sealed in the extruded "U" channel lens frame. The lens frame shall be gasketed to the housing internal reinforcement ring with silicone impregnated Dacron type gasketing.

The luminaries shall have a type F reflector system. The reflector shall have a sharp cutoff at 70 degrees with maximum candlepower at 65 degrees. The multiple faceted, segmented reflector system

shall be constructed of electro-brightened, anodized and sealed aluminum. Each reflector system shall be outfitted with porcelain base lamp holders and insulated lamp supports.

The reflector system shall also be fully enclosed. All photometric data shall be certified by an independent testing facility.

The fixture shall be mounted on the pole using the "K-swivel" knuckle for mounting on a pole with a 2.375" O.D. tenon. The swivel knuckle's cast aluminum adjustable knuckle shall be serrated for positive locking in position. The knuckle shall be provided with a fully enclosed integral junction box.

The fixture shall be pretreated, primed, baked, covered with a high solid polyester finish and baked again. Contractor shall verify finish color before ordering. The double baked finish shall meet or exceed all AAMA requirements for 1,000 hour salt spray exposure.

Luminaries shall be suitable for use with 1000W high pressure sodium lamps. Luminaries shall operate at 240VAC.

It shall be the responsibility of the Contractor to aim the proposed luminaries as directed by the Engineer.

All lamps shall be 1,000W high pressure sodium. One spare lamp shall be provided. Lamps shall be installed by Contractor just prior to testing of the system to reduce the possibility of breakage. Broken lamps shall be replaced and will not be paid for.

Units shall have ballasts operating on 240V, 1 phase, 60 Hz and be capable of starting the lamps indicated herein down to a temperature of -20°F. Ballasts shall be of high power factor autotransformer type. They shall be an integral but easily replaceable part of the luminaries.

It shall be the responsibility of the Contractor and his/her lighting supplier to provide any shielding and/or aiming of luminaries required to prevent glare from direct or reflected light in the pilot's field of vision.

106-2.2 LIGHT POLES.

APRON LIGHT POLE. The proposed round tapered poles shall be of the type and height shown in the plans and shall be of one or two section design, unless otherwise shown in the plans. Each section shall be one-piece construction with a full length longitudinal weld and shall be cylindrical in cross-section having a uniform taper of 0.14 inches of diameter change per foot of length.

The anchor base shall be fabricated from a structural quality hot rolled carbon steel plate that meets or exceeds a minimum yield strength of 36,000 psi. The anchor base shall telescope the pole shaft and shall be circumferentially welded at top and bottom.

Anchor bolts shall also be supplied by the pole manufacturer. Anchor bolts shall be fabricated from a commercial quality hot rolled carbon steel bar that meets or exceeds a minimum yield strength of 50,000 psi. Four properly sized anchor bolts, each furnished with two regular hex nuts and washers shall be furnished and shipped with the poles. Anchor bolts shall have the threaded end galvanized a minimum of 8 inches.

The pole shall also have a 5" x 8" handhole and opening for receptacle located 18" above the base. Pole color shall be as shown in the plans. Poles shall come complete with mounting plates for mounting of proposed fixture brackets.

The Contractor shall verify finish color and size before ordering the proposed poles and shall submit shop drawings on all parts of the poles including the poles, brackets, tenons, handholes, mounting methods, colors, finish procedures and written warranties.

Brackets for light poles shall be as detailed on the plans. Brackets, poles and fixtures shall be matched for a perfect fit. Bracket shall have mounting plate attached that matches mounting plate on proposed poles. Bracket stubs for installation of fixtures shall be suitable for slipfitter furnished with floodlight fixture and shall come as a complete unit with any adapters which also may be required. Each bracket shall be capable of supporting two (2) fixtures and one (1) obstruction light.

106-2.3 LIGHTNING ARRESTERS. Each pole shall be furnished with a 240V or 480V, respectively, lightning arrester. Lightning arrester shall have 3,200V impulse sparkover and shall have a minimum of 10,000A discharge current. Lightning arresters shall be installed in the light pole handholes.

106-2.4 LIGHT POLE FOUNDATIONS. Apron light pole foundations shall be as shown in the plans. Reinforcing steel shall be installed as detailed on plans.

Anchor bolts shall be supplied by the pole manufacturer and shall be installed according to his/her recommendations. Anchor bolts shall be "L" shaped and shall be minimum 1" diameter, 36" long with 7" "L" unless otherwise recommended by the pole manufacturer.

Foundations shall conform to the applicable sections of Item 610.

Light pole foundations shall extend 30" above finished grade.

Breakaway couplings and skirt shall be provided for each base mounted pole.

106-2.5 INTERNAL WIRINGS. All fusing shall be accessible through the pole handhole for the light poles. Contractor shall provide the waterproof splices, breakaway fuse holders, fuses and other miscellaneous items necessary for a complete installation. The breakaway fuse holders and fuses shall be manufactured by Bussman or equal. All splicing of wiring from main power wiring to #10 wiring within pole shall be done at concrete handhole at each pole. All fuses and lightning arrestors shall be within the light pole handhole.

106-2.6 GROUND RODS. All light poles shall be furnished with a ground rod as detailed in the plans. The proposed ground rods shall be ¾" diameter, 10' long copper clad. The top of the rod shall be buried min. 12" below finished grade. All the connections to the ground rod shall be buried min. 12" below finished grade. All the connections to the ground rods shall be one shot exothermic welding as manufactured by Cadweld or equal.

CONSTRUCTION METHODS

106-3.1 POLES AND LUMINARIES. Poles and luminaires shall be assembled and wired on the ground, then lifted and bolted in place plumb. The pole shall be considered plumb when the center of the top is directly over the center of the base. Plumb is to be measured with a transit by the Contractor and checked by the Resident Engineer.

Wiring run from luminaire to pole base shall have a strain relief clamp provided at the entry to the luminaire to prevent the wires from pulling loose from their terminals at the luminaire.

Internal wiring of poles and luminaires including fuses and waterproof splices shall be incidental to this item.

Poles and luminaires shall be set on their foundations such that the luminaires aim in the direction indicated on the plans.

All proposed poles shall be grounded to ground rods. Contractor shall use one shot exothermic weld by Cadweld or equal.

106-3.2 LIGHT POLE FOUNDATIONS. The Contractor shall be responsible for the necessary concreting and formwork to install the foundations as detailed on the plans.

The Contractor is referred to Item 610, which covers the proper installation of the concrete.

Foundations shall extend as shown on the plans below finished grade or pavement. Foundations shall extend thirty inches (30") above finished grade.

Anchor bolts shall be set according to the bolt circle requirements of the poles supplied. They shall be so arranged that when the pole and luminaire are erected, the luminaire will be properly aimed.

106-3.2 POWER AND CONTROL. The location of power and control materials and work to be performed shall be as indicated in the plans. Electrical cable is specified in Item 108. The Contractor shall furnish and install identifying tags on all wires at the point where they connect to the breaker indicating which lights the wires serve. The Contractor shall stencil an identifying label on the control panel enclosure.

106-3.3 RESTORATION. All areas disturbed by the light fixture installation and storing of dirt and other work shall be restored to its original condition. The restoration shall include any necessary topsoiling, fertilizing, seeding or sodding and shall be performed in accordance with the Standard Turfing Specifications. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

METHOD OF MEASUREMENT

106-4.1. The quantity of light poles to be paid for under this item shall be the number of units furnished and installed ready for operation. Each unit shall consist of the fixtures, brackets, fuses, internal wiring, ground rods, light pole foundations and any miscellaneous items and fittings required to make the unit operational.

Each unit shall consist of the ballast, housing, and any other items required for successful operations.

BASIS OF PAYMENT

106-5.1. Payment will be made at the contract unit price for each light pole complete with fixtures, electrical wiring, ground rods and foundation and any other accessories completed by the Contractor and accepted by the Engineer. These prices shall consist of full compensation for furnishing and material, backfilling and compacting trenches, and for all labor, equipment, tools, and incidentals necessary to complete this item.

ITEM 107 INSTALLATION OF AIRPORT 8-FOOT AND 12-FOOT WIND CONES

DESCRIPTION

107-1.1 This item shall consist of an airport wind cone furnished and installed in accordance with this specification at the location and in accordance with the dimensions, design, and details shown in the plans.

The work shall include the furnishing and installation of a support for mounting the wind cone, the specified wire, and a concrete foundation. The item shall also include all cable connections, conduit and conduit fittings, the furnishing and installation of all lamps, ground rod and ground connection, the testing of the installation, and all incidentals necessary to place the wind cone in operation as a completed unit to the satisfaction of the Resident Engineer.

EQUIPMENT AND MATERIALS

107-2.1 GENERAL.

- A. Airport lighting equipment and materials covered by these specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D. C. 20590, and shall be certified and listed in FAA Advisory Circular 150/5345-53 (latest revision), Approved Airport Lighting Equipment.
- B. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Resident Engineer.
- C. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

107-2.2 WIND CONES. The 8-foot and 12-foot wind cones and assemblies shall conform to the requirements of AC 150/5345-27, Specification for Wind Cone Assemblies.

The illuminated windcone must present a constant brightness to the pilot. Where the series lighting circuit is used as a power source to the windcone, a power adapter that converts constant current to constant voltage must be installed in accordance with the manufacturer recommendations and as specified in the special provisions or as shown in the plans. The output voltage must remain constant regardless of the input current.

107-2.3 WIRE. Wire in conduit rated up to 5,000 volts shall conform to FAA Advisory Circular 150/5345-7 (latest revision), Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal.

107-2.4 CONDUIT. Rigid steel conduit and fittings shall conform to the requirements of Underwriters Laboratories Standard 6, 514, and 1242.

107-2.5 RESERVED

107-2.6 CONCRETE. The concrete for foundations shall be proportioned, placed, and cured in accordance with Item 610, Structural Portland Cement Concrete.

107-2.6 PAINT.

- A. Priming paint for ungalvanized metal surfaces, and the mixing thereof, shall be a high solids alkyd primer conforming to Society for Protective Coatings Specification SSPC-Paint 25, Primer, Raw Linseed Oil and Alkyd Primer, (Without Lead and Chromate Pigments).

- B. Priming paint for galvanized metal surfaces shall be zinc dust-zinc oxide primer paint conforming to MIL-DTL-24441/19B. If necessary, add not more than 1/2 pint of turpentine to each gallon.
- C. Orange paint for the body and the finish coats on metal and wood surfaces shall consist of a ready-mixed nonfading paint meeting the requirements of Master Painter's Institute, Reference #9, Alkyd, Exterior, Gloss, (MPI Gloss Level 6) and Reference #94, Alkyd, Exterior, Semi-gloss, (MPI Gloss Level 5). The color shall be in accordance with Federal Standards 595, Aviation Gloss Orange Number 12197.
- D. White paint for body and finish coats on metal and wood surfaces shall be ready-mixed paint conforming to the Master Painter's Institute, Reference #9, Exterior Alkyd, Gloss, VOC Range E2..
- E. Priming paint for wood surfaces shall be mixed on the job by thinning the above specified aviation-orange or white paint by adding 1/2 pint of raw linseed oil to each gallon.

CONSTRUCTION METHODS

107-3.1 INSTALLATION. The hinged support or hinged pole shall be installed on a concrete foundation as shown in the plans.

107-3.2 COUNTERWEIGHT. The Contractor shall furnish and install a counterweight on the hinged support for the 12-foot wind cone. The counterweight may consist of lead weights which may be furnished with the "A" frame assembly or it may consist of concrete poured around the bottom of the hinged support. Where concrete is used, the counter-weight shall be approximately 12 inches wide by 24 inches deep and should weigh approximately 500 pounds. The counterweight should be 25 to 50 pounds less than the weight needed to balance the assembly. The counterbalancing should operate to the satisfaction of the Resident Engineer.

107-3.3 ELECTRICAL CONNECTION. The Contractor shall furnish all labor and materials and shall make complete electrical connections in accordance with the wiring diagram furnished with the project plans. The electrical installation shall conform to the requirements of the latest edition of National Fire Protection Association, NFPA-70, National Electric Code.

If underground cable from the transformer vault to the wind cone site and duct for this cable installation under paved areas is required, the cable and duct shall be installed in accordance with and paid for by linear foot measurement as described in Item 108, Installation of Underground Cables for Airports, and Item 110, Installation of Airport Underground Electrical Duct.

107-3.4 BOOSTER TRANSFORMER. If shown in plans or specified in job specifications, a booster transformer to compensate for voltage drop to the lamps shall be installed in a suitable weatherproof housing. The booster transformer shall be installed as indicated in the plans and described in the proposal. If the booster transformer is required for installation in the transformer vault, it shall be installed in accordance with and paid for as described in Item 109, Installation of Airport Transformer Vault and Vault Equipment.

107-3.5 GROUND CONNECTION AND GROUND ROD. The Contractor shall furnish and install a ground rod, grounding cable, and ground clamps for grounding the "A" frame of the 12-foot assembly or pipe support of the 8-foot support near the base. The ground rod shall be of the diameter and length specified in the plans and shall be copper or copper clad. The ground rod shall be driven into the ground adjacent to the concrete foundation so that the top is at least 6 inches below grade. The grounding cable shall consist of No. 4 AWG bare stranded copper wire or larger and shall be firmly attached to the ground rod by means of a ground connector or clamp. The other end of the grounding cable shall be securely attached to a leg of the "A" frame or to the base of the pipe support with noncorrosive metal and shall be of substantial construction. The resistance to ground shall not exceed 25 ohms.

107-3.6 PAINTING. Three coats of paint shall be applied (one prime, one body, and one finish) to all exposed material installed under this item except the fabric cone, obstruction light globe, and lamp reflectors. The wind cone assembly, if painted on receipt, shall be given one finish coat of paint in lieu of the three coats specified above. The paint shall meet the requirements of Master Painter's Institute, Reference #9, Alkyd, Exterior, Gloss, (MPI Gloss Level 6) and Reference #94, Alkyd, Exterior, Semi-

gloss, (MPI Gloss Level 5). The color shall be in accordance with Federal Standard 595, Aviation Gloss Orange Number 12197.

107-3.7 LAMPS. The Contractor shall furnish and install four 200-watt, 115-volt general lighting service lamps in the reflectors for the 12-foot cone or four 150-watt, 115-volt lamps for the 8-foot cone. A clear 100-watt, 107-watt, or 116-watt, 115-volt traffic signal lamp with a medium screw base, or a 100-watt, A-21 bulb, 115-volt, medium prefocus base lamp shall be furnished and installed in the obstruction light as required.

107-3.8 CHAIN AND PADLOCK. The Contractor shall furnish and install a suitable operating chain for lowering and raising the hinged top section. The chain shall be attached to the pole support in a manner to prevent the light fixture assembly from striking the ground in the lowered position.

A padlock shall also be furnished by the Contractor on the 8-foot wind cone for securing the hinged top section to the fixed lower section. Keys for the padlock shall be delivered to the Resident Engineer.

METHOD OF MEASUREMENT

107-4.1 The quantity to be paid for under this item shall be the number of wind cones installed as completed units in place, accepted, and ready for operation.

BASIS OF PAYMENT

107-5.1 Payment will be made at the contract unit price for each completed and accepted job. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

ITEM 108 INSTALLATION OF UNDERGROUND CABLE FOR AIRPORTS

DESCRIPTION

108-1.1 This item shall consist of underground cable furnished and installed in accordance with this specification at the locations and in accordance with the design, dimensions, and details shown in the plans. This item shall include the excavation and backfill of the trench, the installation of cable and counterpoise wire in trench, duct or conduit, splicing, cable marking, and testing of the installation, and all incidentals necessary to place the cable in operating condition as a completed unit to the satisfaction of the Engineer. This item shall not include the installation of the duct or conduit or installation or furnishing of any cable for FAA facilities.

Installation of direct buried cable and cable in unit duct and conduit as shown on the plans. The Contractor has the option to either trench or plow the proposed cable in unit-duct into place. All direct buried cable not in unit duct will be trenched into place.

All installations shall be done at the locations shown on the plans and in accordance with these specifications. In areas where there is a congestion of buried cable, the Contractor will be required to trench the proposed cable into place. When crossing existing circuits, the Contractor will be required to hand dig the trenches for the proposed cable.

The hand digging and trenching or plowing of this cable will be considered incidental to the contract unit price of the proposed cable and no additional compensation will be allowed.

The Contractor shall label all airfield lighting cables in ducts, manholes and the vault as directed by the Resident Engineer. All costs of labeling shall be considered incidental to the contract unit price for the associated item.

EQUIPMENT AND MATERIALS

108-2.1 GENERAL.

- A. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be approved under the Airport Lighting Equipment Certification Program described in Advisory Circular (AC) 150/5345-53, current version.
- B. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification, when requested by the Engineer.
- C. Except as specified otherwise, all new equipment shall be provided by the Contractor and shall be tested for specification conformance as part of the Aviation Lighting Equipment Certification Program. Currently, these tests are performed by ETL Testing Laboratories. Certification of conformance as tested by ETL Testing Laboratories shall be provided by the manufacturer for all items submitted for approval. Equipment that has not been tested by ETL Testing Laboratories but is listed in Advisory Circular 150/5345-53 (latest edition) may be submitted for approval, provided that the manufacturer provides certification that the submitted equipment continues to meet FAA standards on which approval was originally made and that FAA standards for the equipment have not changed since the release of 150/5345-53 (latest Edition).
- D. FAA/ETL approval of airport lighting equipment only means that the test data satisfied the applicable specification requirements. This does not insure that the approved equipment will satisfactorily operate when connected either power and/or control, to other approved airport lighting equipment or "off the shelf" equipment not requiring FAA approval.
- E. The Contractor shall ascertain that all lighting system components furnished by him (including FAA approved equipment) are compatible in all respects with each other and the remainder of the new/existing system. Any non-compatible components furnished by the Contractor shall be replaced by him at no additional cost to the airport sponsor with a similar unit, approved by the

Engineer (different model or different manufacturer) that is compatible with the remainder of the airport lighting system.

108-2.2 CABLE. Underground cable shall conform to the requirements of AC 150/5345-7, Specification for L-824 Underground Electrical Cables for Airport Lighting Circuits. The following types are covered in Specification L-824:

- Type C -- Single and multiple conductor cable with 600 volt or 5,000 volt, cross-linked polyethylene insulation. Multiple conductor cables will have a jacket applied overall.

All series circuit cable shall be L-824, 1/C, No. 8, 5000 V, Type C in unit-duct of the size shown on the plans.

Low voltage power cable shall be L-824, 1/C, 600V, Type C in unit duct of the size shown on the plans.

Proposed cable and unit duct shall be factory assembled and delivered to the site on reels.

All cable for airport lighting service shall be stranded via: 600-volt--7-strand; 5,000-volt--19 strand. For power cable, conductor size shall not be smaller than No. 8 AWG. Control cable, conductor size shall not be less than No. 12 AWG. These limits on conductor sizes shall not apply to leads furnished by manufacturers of transformers and fixtures.

If telephone control cable is specified, copper shielded, polyethylene insulated and jacketed, No. 19 AWG telephone cable conforming to the United States Department of Agriculture, Rural Electrification Administration (REA) Bulletin 345-14, REA Specification for Fully Color-Coded, Polyethylene Insulated, Double Polyethylene-Jacketed Telephone Cables for Direct Burial, shall be used.

Where counterpoise conductors are to be installed and where soil conditions would adversely affect bare copper wire, thermoplastic wire conforming to Federal Specification J-C-30, Type TW, 600-volt, may be used.

Cable type, size, number of conductors, strand and service voltage shall be specified in the plans and/or proposal.

108-2.3 BARE COPPER WIRE (COUNTERPOISE OR GROUND) AND GROUND RODS. Wire for counterpoise or ground--installations for airfield lighting systems shall be No. 6 AWG solid for counterpoise and or No. 6 AWG stranded for ground wire conforming to ASTM B 3 and ASTM B 8, and shall be bare copper wire conforming to the requirements of ASTM D 33.

108-2.4 CABLE CONNECTIONS. In-line connections of underground primary cables shall be of the type called for in the plans or in the proposal, and shall be one of the types listed below. When the plans or the proposal permit a choice of connection, the Contractor shall indicate in the bid the type of connection he proposes to furnish. Only L-823 connectors shall be used for all L-824 cable airfield lighting circuit connections.

The Contractor will use a cable stripper/penciler whenever cable connections are made. All breaks in the unit duct will be sealed by shrink kits.

- A. The Cast Splice. A cast splice, employing a plastic mold and using epoxy resin equal to that manufactured by Minnesota Mining and Manufacturing Company, "Scotchcast" Kit No. 82-A, or as manufactured by Hysol Corporation, "Hyseal Epoxy Splice" Kit No. E1135, for potting the splice is approved. This means of splicing is the only type approved for telephone control cable.
- B. The Field-attached Plug-in Splice. Shall conform to Specification for L-823 Plug and Receptacle, Cable Connectors, employing connector kits, is approved for field attachment to single conductor cable.
- C. The Factory-molded Plug-in Splice. Specification for L-823 Connectors, Factory-Molded to Individual Conductors, are approved.

- D. The Taped or Heat-Shrunked Splice. Taped splices employing field-applied rubber, or synthetic rubber tape covered with plastic tape is acceptable. The rubber tape should meet the requirements of ASTM D 4388 and the plastic tape should comply with Mil Spec. MIL-I-24391 or Fed. Spec. A-A-55809. Heat shrinkable tubing shall be heavy-wall, self-sealing tubing rated for the voltage of the wire being spliced and suitable for direct-buried installations. The tubing shall be factory coated with a thermoplastic adhesive-sealant that will adhere to the insulation of the wire being spliced forming a moisture- and dirt-proof seal. Additionally, heat shrinkable tubing for multi-conductor cables, shielded cables, and armored cables shall be factory kits designed for the application. Heat shrinkable tubing and tubing kits shall be manufactured by Tyco Electronics/ Raychem Corporation, Energy Division, or approved equivalent.
- E. In all the above cases, connections of cable conductors shall be made using crimp connectors utilizing a crimping tool designed to make a complete crimp before the tool can be removed. All L-823/L-824 splices and terminations shall be made in accordance with the manufacturer's recommendations and listings.
- F. All connections of counterpoise, grounding conductors and ground rods shall be made by the exothermic process or approved equivalent, except the base can ground clamp connector shall be used for attachment to the base can. All exothermic connections shall be made in accordance with the manufacturer's recommendations and listings.

108-2.5 RESERVED

108-2.6 CONCRETE. Concrete for cable markers shall conform to Specification Item 610, "Structural Portland Cement Concrete."

108-2.7 RESERVED

108-2.8 CABLE IDENTIFICATION TAGS. Cable identification tags shall be made from a non-corrosive material with the circuit identification stamped or etched onto the tag. The tags shall be of the type as detailed on the plans.

108-2.7 HEAT SHRINK TUBING. Heat shrink tubing for FAA Type L-823 plug and receptacle cable connections shall be Raychem APL 1300/400-16, Sigmaform Corp. Series APL-823A or equivalent. Complete kit shall be used and shall be capable of being stripped off easily for re-entry.

Heat shrink tubing for 5KV, L-824 Airfield in-line splices shall be Raychem HVS-501 or equivalent.

Heat shrink tubing for 600V, general power distribution in-line splice shall be Raychem WCSM or equivalent.

Heat shrink tubing for cables other than as specified above shall be as required by Engineer.

108-2.8 CABLE PLOWING EQUIPMENT. At the Contractor's option the cable in unit-duct may be installed in trench or using cable plowing equipment.

The cable plowing equipment shall be of the vibratory type. It shall vibrate at a rate of at least 1200 cycles per minute. The vibrating unit shall not be rigidly mounted on the tractor. It shall be connected to the tractor for towing, in such a manner that the tractor will not dampen the vibrations.

The plow blade shall be of sufficient length to facilitate installation of unit-duct at the specified depth. The shoe throat shall be sized for the unit-duct size. Cable way and cable guides shall be smooth, free of obstructions and sharp edges and shall not cause bending of the unit-duct at shorter than 3-inch radius. It also shall not cause excessive cable strain which may damage cable insulation or stretch the conductor.

Where several conductors are installed in a single operation, the plow shall be equipped with separate feeds, one for each conductor, to provide the specified separation.

108-2.9 TAPE. Electrical tapes shall be Scotch Electrical Tapes – number Scotch 88 (1-1/2" wide) and Scotch 130C linerless rubber splicing tape (2" wide), as manufactured by the Minnesota Mining and Manufacturing Company, or approved equivalent.

108-2.10 RESERVED

108-2.11 RESERVED

108-2.12 LINE MARKING TAPE. The line marking tape shall be approximately 5 mils thick constructed of aluminum foil encased in an impervious mylar plastic coating. The minimum tensile strength determined in accordance with ASTM D 882 is 1600 per square inch. The tape shall contain sufficient metal mass to provide detectability at depths up to 3 feet with a radio type metal locator. Tape shall be acid, alkali and corrosion resistant. Color shall be "RED" corresponding to the standard color for electric lines.

The tape shall be "Type III Super Tuff" detectable underground utility line marking tape as manufactured by LINEGUARD, Inc. of Wheaton, Illinois or an approved equal.

108-2.13 UNIT DUCT. Where indicated on the Plans, unit-duct shall be as described under this item. The duct shall comply with NEMA Standards Publication No. TC7-1990, Part 4, ASTM D 3485, and ASTM D 1248, with additions, options, and exceptions as detailed herein. The duct shall be annealed during the extrusion process. The duct shall be manufactured from black, virgin, high density polyethylene resin designated as Type III, Grade P34, Class C, Category 5 material in accordance with ASTM D 1248.

Standard sizes of smooth wall polyethylene duct shall conform to the dimensional requirements indicated on the plans.

Dimensional measurements shall be performed on samples removed from each complete length of finished duct. The manufacturer shall have the capability to manufacture a composite wire/cable-in-duct system, wherein the wire and cables are placed in the polyethylene duct without sticking during the extrusion process. The open ends of each length of reeled flexible duct shall be sealed by plastic caps to prevent the entrance of dirt and water. The duct shall have a durable identification which shows the manufacturer's name and/or trademark, all at intervals not to exceed ten (10) feet.

The manufacturer shall furnish copies of certified test reports on duct.

CONSTRUCTION METHODS

108-3.1 GENERAL. The Contractor shall install the specified cable at the approximate locations indicated in the airport lighting layout plans. The Resident Engineer shall indicate specific locations.

Cable connections between fixtures will be permitted only at the fixture locations for connecting the underground cable to the individual fixtures. The Contractor shall be responsible for providing cable in continuous lengths for home runs or other long cable runs without connections, unless otherwise authorized in writing by the Engineer or shown in the plans.

Cable shall be continuous between lights. Any repairs necessary after backfilling shall be done at the Contractor's expense and shall consist of replacing the entire length of damaged cable between lights. All cable shall be in unit-duct unless shown as otherwise in the plans

All lighting circuits are considered critical. It is, therefore, imperative that the Contractor carefully review the plans showing electrical layout.

If the Contractor desires to lay cable on a line other than that shown on the plans, he shall obtain the approval of the Engineer before doing so, and any additional cable required to do so will not be paid for unless being completely necessary to make a more proper connection or more convenient location.

The Contractor may be allowed to provide a single unit-duct with 2-each 1/C #8 5KV cable for the lighting series circuit homerun.

The location of existing cables are taken from available record maps and it will be necessary for the Contractor to make field investigations to determine the exact locations of underground cable and conduits at critical points. Any existing cables cut as a result of the Contractor's operations shall be repaired in accordance with paragraphs 108-2.4 and 108-3.5, cost to be borne by the Contractor.

108-3.2 INSTALLATION IN DUCT OR CONDUIT. This item includes the installation of the cable in duct or conduit as described below. The maximum number and voltage ratings of cables installed in each single duct or conduit, and the current-carrying capacity of each cable shall be in accordance with the latest National Electric Code, or the code of the local agency having jurisdiction.

The Contractor shall make no connections or joints of any kind in cables installed in conduits or ducts.

The duct or conduit shall be installed as a separate item in accordance with Item 110, Installation of Airport Underground Electrical Duct. The Contractor shall make sure that the duct is open, continuous, and clear of debris before installing cable. The cable shall be installed in a manner to prevent harmful stretching of the conductor, injury to the insulation, or damage to the outer protective covering. The ends of all cables shall be sealed with moisture-seal tape before pulling into the conduit and it shall be left sealed until connections are made. Where more than one cable is to be installed in a duct under the same contract, all cable shall be pulled in the duct at the same time. The pulling of a cable through ducts or conduits may be accomplished by handwinch or power winch with the use of cable grips or pulling eyes. Pulling tensions should be governed by recommended standard practices for straight pulls or bends. A lubricant recommended for the type of cable being installed shall be used where pulling lubricant is required. Duct or conduit markers temporarily removed for excavations shall be replaced as required.

The cable in unit-duct shall be delivered to the jobsite pre-assembled on reels.

108-3.3 TRENCHING. Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for cables may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Road patrols or graders shall not be used to excavate the trench with their blades. The bottom surface of trenches shall be essentially smooth and free from coarse aggregate. Unless otherwise specified, cable trenches shall be excavated to a minimum depth of 24 inches below finished grade, except as follows:

- A. When off the airport or crossing under a roadway or driveway, the minimum depth shall be 36 inches unless otherwise specified.
- B. Minimum cable depth when crossing under a railroad track, shall be 42 inches unless otherwise specified.

The Contractor shall excavate all cable trenches to a width not less than 6 inches. The trench shall be widened where more than two cables are to be installed parallel in the same trench. Unless otherwise specified in the plans, all cables in the same location and running in the same general direction shall be installed in the same trench.

When rock excavation is encountered, the rock shall be removed to a depth of at least 3 inches below the required cable depth and it shall be replaced with bedding material of earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch sieve. The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All excavation shall be unclassified.

All cable in unit-duct may be installed using the plowing-in method or direct burial in trench, (Refer to Item 108-3.9) except at critical locations where required to protect existing cables or to facilitate construction. Cable plowing shall be done at a minimum depth of 18" below finished grade.

Trenching shall be at no additional cost to the Contract.

- C. Except for installation of cable (or cables) in unit-duct, the Contractor shall not use a cable plow for installing cable. Mechanical cable-laying equipment may be used in conjunction with a trenching

machine if specified on project plans and specifications; and it should provide for physical inspection of cable prior to backfilling. Sharp bends or kinks in the cable shall not be permitted.

Cables shall be unreeled in place alongside or in the trench and shall be carefully placed along the bottom of the trench. The cable shall not be unreeled and pulled into the trench from one end.

Where two or more cables are laid parallel in the same trench, they shall be placed laterally a minimum distance of 3 inches apart, and the trench shall be widened sufficiently to accomplish this.

Cables crossing over each other shall have a minimum of 3-inch vertical displacement with the topmost cable depth at or below the minimum required depth below finished grade.

Not less than 1 foot of cable slack shall be left on each side of all connections, isolation transformers, light units, and at all other points where cable is connected to field equipment. The slack cable shall be placed in the trench in a series of S curves. Additional slack cable shall be left in runway light bases, handholes, manholes, etc., where it is required to bring the cable above ground level to make connections. The amount of slack cable shall be stipulated by the Resident Engineer, or as shown in the plans and specifications.

At locations, such as in an existing duct or wireway, or near an existing light location, where existing cable to be replaced might obstruct or interfere with efficient operation of the electrical systems, it shall be removed and disposed of by the Contractor. The cost of removing and disposing of this existing cable shall be considered as incidental to the contract unit price per linear foot for underground cable installed in trench or duct, and no additional compensation will be allowed.

- D. After the cable has been installed, the trench shall be filled 3 inches in depth, loose measurement, and shall be either earth or sand containing no mineral aggregate particles that would be retained on a 1/4-inch sieve. This layer shall not be compacted. The second layer shall be 5 inches deep, loose measurement, and shall contain no particles that would be retained on a 1-inch sieve. The remainder of the backfill shall be excavated or imported mineral and shall not contain stone or aggregate larger than 4 inches maximum diameter. The third and subsequent layers of the backfill shall not exceed 8 inches in maximum depth, loose measurement.

The second, and subsequent layers shall be thoroughly tamped and compacted to at least the density of the adjacent undisturbed soil, and to the satisfaction of the Resident Engineer. If necessary to obtain the desired compaction, the backfill material shall be moistened or aerated as required.

Trenches shall not be excessively wet and shall not contain pools of water during backfilling operations. The trench shall be completely backfilled and tamped level with the adjacent surface, except when sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement. Any excess excavated material shall be removed and disposed of in accordance with instructions issued by the Resident Engineer.

Line marking tape shall be installed during the backfill process at a minimum depth of 4" and a maximum depth of 8". Installation methods shall be to the satisfaction of the Engineer.

- E. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the trenching, storing of dirt, cable laying, pad construction, and other work shall be restored to its original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging or mulching. All such work shall be performed in accordance with the FAA Standard Turfing Specifications. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

108-3.4 CABLE MARKERS. The location of runway light circuits shall be marked by a concrete slab marker, 2 feet square and 4 inches thick, extending approximately 1 inch above the surface. Each cable run from the line of runway lights to the equipment vault shall also be marked at approximately every 200 feet along the cable run, with an additional marker at each change of direction of cable run. All other cable buried directly in the earth shall be marked in the same manner. The Contractor shall not install slab markers where cable lies in straight lines between obstruction light poles which are

spaced 300 feet apart, or less. Cable markers shall be installed immediately above the cable. The Contractor shall impress the word "CABLE" and directional arrows on each cable marking slab. The letters shall be approximately 4 inches high and 3 inches wide, with width of stroke 1/2 inch and 1/4 inch deep.

The location of each underground cable connection, except at lighting units or insulating transformers, shall be marked by a concrete marker slab placed above the connection. The Contractor shall impress the work "SPLICE" on each slab. The Contractor also shall impress additional circuit identification symbols on each slab if so desired by the Resident Engineer.

108-3.5 SPLICING. Connections of the type shown in the plans shall be made by experienced personnel regularly engaged in this type of work and shall be made as follows:

- A. Cast Splices. These shall be made by using crimp connectors for joining conductors. Molds shall be assembled, and the compound shall be mixed and poured in accordance with manufacturer's instructions and to the satisfaction of the Resident Engineer.
- B. Field-attached Plug-in Splices. These shall be assembled in accordance with manufacturer's instructions. These splices shall be made by plugging directly into mating connectors. In all cases the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1 1/2 inches on each side of the joint.
- C. Factory-molded Plug-in Splices. These shall be made by plugging directly into mating connectors. In all cases, the joint where the connectors come together shall be wrapped with at least one layer of rubber or synthetic rubber tape and one layer of plastic tape, one-half lapped, extending at least 1 1/2 inches on each side of the joint.
- D. Taped or Heat-Shrunked Splices. A taped splice shall be made in the following manner:

Bring the cables to their final position and cut so that the conductors will butt. Remove insulation and jacket allowing for bare conductor of proper length to fit compression sleeve connector with 1/4 inch (6 mm) of bare conductor on each side of the connector. Prior to splicing, the two ends of the cable insulation shall be penciled using a tool designed specifically for this purpose and for cable size and type. Do not use emery paper on splicing operation since it contains metallic particles. The copper conductors shall be thoroughly cleaned. Join the conductors by inserting them equidistant into the compression connection sleeve. Crimp conductors firmly in place with crimping tool that requires a complete crimp before tool can be removed. Test the crimped connection by pulling on the cable. Scrape the insulation to assure that the entire surface over which the tape will be applied (plus 3 inches (75 mm) on each end) is clean. After scraping wipe the entire area with a clean lint-free cloth. Do not use solvents.

Apply high-voltage rubber tape one-half lapped over bare conductor. This tape should be tensioned as recommended by the manufacturer. Voids in the connector area may be eliminated by highly elongating the tape, stretching it just short of its breaking point. Throughout the rest of the splice less tension should be used. Always attempt to exactly half-lap to produce a uniform buildup. Continue buildup to 1-1/2 times cable diameter over the body of the splice with ends tapered a distance of approximately 1 inch (25 mm) over the original jacket. Cover rubber tape with two layers of vinyl pressure-sensitive tape one-half lapped. Do not use glyptol or lacquer over vinyl tape as they react as solvents to the tape. No further cable covering or splice boxes are required.

Heat shrinkable tubing shall be installed following manufacturer's instructions. Direct flame heating shall not be permitted unless recommended by the manufacturer. Cable surfaces within the limits of the heat-shrink application shall be clean and free of contaminants prior to application.

Splices will be allowed in new circuits only at fixtures, handholes and splice cans as detailed on plans. No direct burial of splices will be allowed.

108-3.6 BARE COUNTERPOISE WIRE INSTALLATION FOR LIGHTNING PROTECTION AND GROUNDING. If shown on the plans or included in the job specifications, bare counterpoise copper

wire shall be installed for lightning protection of the underground cables. Counterpoise wire shall be installed in the same trench for the entire length of buried cable, conduits and duct banks that are installed to contain airfield cables. Where the cable or duct/conduit trench runs parallel to the edge of pavement, the counterpoise shall be installed in a separate trench located half the distance between the pavement edge and the cable or duct/conduit trench. In trenches not parallel to pavement edges, counterpoise wire shall be installed continuously a minimum of 4 inches above the cable, conduit or duct bank, or as shown on the plans if greater. Additionally, counterpoise wire shall be installed at least 8 inches below the top of subgrade in paved areas or 10 inches below finished grade in un-paved areas. This dimension may be less than 4 inches where conduit is to be embedded in existing pavement. Counterpoise wire shall not be installed in conduit.

The counterpoise wire shall be routed around to each light fixture base, mounting stake, or junction/access structures. The counterpoise wire shall also be exothermically welded to-ground rods installed as shown on the plans but not more than 500feet apart around the entire circuit.

The counterpoise system shall be continuous and terminate at the transformer vault or at the power source. It shall be securely attached to the vault or equipment external ground ring or other made electrode grounding system. The connections shall be made as shown on-the plans and in the specifications.

If shown on the plans or in the specifications, a separate equipment (safety) ground system shall be provided in addition to the counterpoise wire using one of the following methods:

- A. A ground rod installed at and securely attached to each light fixture base, mounting stake if painted, and to all metal surfaces at junction/access structures.
- B. Install an insulated equipment ground conductor internal to the conduit system and securely attached it to each light fixture base and to all metal surfaces at junction/access structures. This equipment ground conductor shall also be exothermically welded to ground rods installed not more than 500 feet (150 m) apart around the circuit.
- C. Counterpoise Installation Above Multiple Conduits and Duct Banks. Counterpoise wires shall be installed above multiple conduits/duct banks for airfield lighting cables, with the intent being to provide a complete cone of protection over the airfield lighting cables. When multiple conduits and/or duct banks for airfield cable are installed in the same trench, the number and location of counterpoise wires above the conduits shall be adequate to provide a complete cone of protection measured $22\frac{1}{2}$ degrees each side of vertical.

Where duct banks pass under pavement to be constructed in the project, the counterpoise shall be placed above the duct bank. Reference details on the construction plans.

- D. Counterpoise Installation at Existing Duct Banks. When airfield lighting cables are indicated on the plans to be routed through existing duct banks, the new counterpoise wiring shall be terminated at ground rods at each end of the existing duct bank where the cables being protected enter and exit the duct bank. The new counterpoise conductor shall be bonded to the existing counterpoise system.

108-3.7 EXOTHERMIC BONDING. Bonding of counterpoise wire shall be by the exothermic welding process. Only personnel experienced in and regularly engaged in this type of work shall make these connections.

Contractor shall demonstrate to the satisfaction of the Engineer, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations shall comply with the manufacturer's recommendations and the following:

- All slag shall be removed from welds.
- For welds at light fixture base cans, all galvanized coated surface areas and "melt" areas, both inside and outside of base cans, damaged by exothermic bond process shall be restored by coating with a liquid cold-galvanizing compound conforming to U.S. Navy galvanized repair

coating meeting Mil. Spec. MIL-P-21035. Surfaces to be coated shall be prepared and compound applied in accordance with manufacturer's recommendations.

- All buried copper and weld material at weld connections shall be thoroughly coated 6 mil of 3M "Scotchkote," or approved equivalent, or coated with coal tar bitumastic material to prevent surface exposure to corrosive soil or moisture."

108-3.8 TESTING. The Contractor shall furnish all necessary equipment and appliances for testing the underground cable circuits after installation. The Contractor shall test and demonstrate to the satisfaction of the Engineer the following:

- A. That all lighting power and control circuits are continuous and free from short circuits.
- B. That all circuits are free from unspecified grounds.
- C. That the insulation resistance to ground of all nongrounded series circuits is not less than 50 megohms.
- D. That the insulation resistance to ground of all nongrounded conductors of multiple circuits is not less than 50 megohms.
- E. That all circuits are properly connected in accordance with applicable wiring diagrams.
- F. That all circuits are operable. Tests shall be conducted that include operating each control not less than 10 times and the continuous operation of each lighting and power circuit for not less than 1/2 hour.

All testing shall be documented and the results should be provided to the Resident Engineer.

All testing shall be performed in the presence of the Resident Engineer. All cables found to be defective due to installation methods shall be replaced by the Contractor at his/her expense.

All existing circuits to which additions or deletions are to be made shall be meggered BEFORE any work is performed. Megger readings taken after completion of the work shall be, as a minimum, equal to the previous reading. Should the reading be deficient, the Contractor shall locate within his/her work area, the source of the deficiency and correct it at his/her expense.

The remaining existing field circuits within the working limits of this contract which are not scheduled to be added or deleted from shall also be meggered BEFORE any work is performed in the presence of the Resident Engineer. Any subsequent damage to these existing circuits shall be immediately repaired at no cost to the contract such that megger readings taken after completion of the repair shall be, as a minimum, equal to the reading taken before the work began.

The new cable, after installation and after connection of all series circuit isolation transformers, but before connection to power source (constant current regulators, power transformers, disconnect switches, etc.) and/or connections to load other than isolation transformers (PAPI, etc.), shall be tested in the following manner:

- G. The conductor resistance shall be measured by an ohmmeter and shall be within $\pm 20\%$ of the calculated value for the size and length of the conductor.
- H. Each test shall last for a minimum of one minute after instrument readings have been stabilized. The minimum acceptable insulation resistance value shall be 50 megohms.
- I. When unacceptable readings are obtained, the Contractor shall locate the fault(s) and correct them.
- J. The test equipment and power to operate it shall be furnished and operated by the Contractor at no additional cost. The equipment shall be approved by the Engineer before testing is commenced. All tests shall be witnessed by the Engineer.

108-3.9 PLOWING-IN OF CABLE IN UNIT-DUCT.

NOTICE: Plowing-in of unit-duct does not relieve the Contractor of responsibility for repairing damage to existing cables cut as a result of the Contractor's operations, as described in Paragraph 108-3.1. Extreme care must be taken to locate all existing circuits in the working limits of the plowing operations before commencing the operation. The Contractor shall have the option of trenching-in cables as described in section 108-3.3 in lieu of plowing-in any sections so noted on the plans - at no additional cost or time to the contract.

If the Contractor elects to plow the cable in unit-duct into place, his/her plowing operation must conform to the following requirements:

The forward moving speed of the plow shall be between 15 and 40 feet per minute. The plow shall be wide enough to freely allow the unit-duct to pass through it but not exceed the overall width of two inches.

The unit-duct shall be inserted into the plow in a manner that will not cause the unit-duct to bind, pull or break. The unit-duct shall be installed so that it is possible to withdraw a cable and pull in a new one. Sweeping long radius bends shall be used. Any run with a kink or short radius bend will be rejected. The holes for the transformer bases or at locations of cable termination shall be dug before the plowing operation is commenced. A method approved by the Engineer shall be used to prevent the walls of the holes from collapsing due to tractor and plow wheels.

The unit-duct may be unreeled along the proposed cable route before plowing or the unit-duct reels may be mounted on the tractor. In the latter case unreeling of the unit-duct shall not cause excessive tension on the cable.

After the tractor and the plow are positioned at the beginning of the run, sufficient unit-duct slack shall be pulled through the throats. Then the plow shall be lowered into the hole and the unit-duct shall be hand held for the start of plowing.

At each equipment hole the plow shall be stopped (movement and vibration), raised and the required amount of slack shall be hand pulled. Care shall be taken during the operation that the unit-duct, at the entrance into the equipment hole, shall not be pulled from the specified depth. Plowing shall be continued by lowering the plow, starting it and holding the unit-duct by hand until it is firmly held by the ground.

The plow shall not be backed onto the unit-duct.

When an underground obstruction is encountered, the plow shall be lifted out of the ground. The obstruction shall be removed by hand digging. An opening shall be hand dug around the unit-duct down to the depth of the unit-duct and large enough to lower the plow. Then the plow shall be lowered into the opening. While this is being done the unit-duct shall be pulled back into the throat by hand to prevent kinks or sharp bends. In no case shall the unit-duct be bent sharper than 3 inch radius, or be subjected to excessive tension.

After installation of unit-duct by plowing, the disturbed earth at the surface shall be leveled and, if necessary, compacted by a device approved by the Engineer.

Ends of cable shall be taped immediately after cutting to prevent moisture from entering the cable. Where the cable is not expected to be connected for at least 72 hours, the tape shall also be varnished.

To identify routing of the unit-duct, immediately after plowing, stakes shall be installed every 500 feet along straight runs and at each curve. Later these stakes shall be replaced by regular concrete cable markers.

Before cable plowing is commenced, equipment to be used shall be inspected by the Engineer and approved. Before approving, the Engineer may require demonstration of the equipment at the installation site and location selected by the Engineer and by using actual unit-duct. The test run shall consist of at least one starting hole, one intermediate hole (equipment location) and one terminating hole and shall be 100 feet long as minimum. The test cable shall not be reused. The cost for the test run shall be included into the item for underground cable.

Plow operators shall be experienced and qualified by schooling and/or by sufficient on-the-job training under an experienced operator. Proof of such qualification shall be required from the Contractor.

108-3.10 LOCATING OF EXISTING CABLES. Contractor shall locate and mark all existing cables within ten (10) feet of proposed excavating, plowing/trenching area. Any cables found interfering with proposed excavation or cable plowing/trenching shall be hand dug and exposed. Any damaged cables shall be immediately repaired to the satisfaction of the Engineer at the Contractor's expense. The Resident Engineer and Owner shall be notified immediately if any cables are damaged.

It should be noted that all FAA control and communications cables shall be located by the FAA. All utility cables shall be located by the utility. The contact person shall be JULIE (Joint Utility Locating Information for Excavators).

Payment for locating and marking underground cable will not be paid for separately but shall be considered incidental to the plowing/trenching of unit-duct.

108-3.11 TERMINATIONS AND CONNECTIONS. Unit-duct shall be terminated on the inside of light bases and shall be sealed in a manner which will prevent dirt or water from entering the duct.

All L-823 connections at light fixtures shall be taped with one layer of rubber tape and one layer of plastic one-half, lapped, extending at least 1-1/2" each side of the joint. Heat shrinkable tubing with interior adhesive shall be applied at all cable connections in conformance with the plans. The heat shrinkable tubing will be as manufactured by 3M, Scotch, or equal and applied as recommended by the manufacturer.

In line connections for existing cables cut during construction shall be repaired with the cast splice kit. The Contractor shall have a minimum of two (2) splice kits on the jobsite at all times for emergency repairs. Splice markers shall be installed over each splice in cables not to be abandoned. Cast splice kits shall be as specified in Paragraph A. of Item 108-2.4.

No splices will be allowed in the new cable. Cable shall be continuous from light to light. Any repairs necessary after backfilling the trenches shall be done at the Contractor's expense and shall consist of replacing the entire length of damaged cable between fixtures.

METHOD OF MEASUREMENT

108-4.1 The footage of cable and cable in unit-duct to be paid for shall be the number of linear feet installed by the plowing-in method (for cable in unit duct only), in common trench, or installed in existing or proposed duct banks, measured in place, completed, ready for operation, and accepted as satisfactory. No additional measurement will be made for multiple conductors in a common unit-duct. No extra quantity will be allotted for any vertical distances or the required cable slack, as stated under Item 108-3.3.

No measurement for payment will be made for the plowing in, trenching, or installing in existing or proposed duct banks for cable or cable in unit duct. The cost of plowing-in or installation in trenches or duct banks, and all connections and splices shall be included in the unit price bid for the measured cable or cable in unit duct in place.

The costs associated with the above cables which are not measured for payment, including cable slack, shall be considered incidental to the unit prices for the light unit they are associated with.

108-4.2 The footage of cable or counterpoise wire installed to be paid for shall be the number of linear feet of cable or counterpoise wire installed in trenches, duct or conduit, measured in place, completed, ready for operation, and accepted as satisfactory. Separate measurement shall be made for each cable or counterpoise wire installed.

The footage of line marking tape installed shall be considered incidental to the work and shall not be measured separately.

BASIS OF PAYMENT

108-5.1

The cable and cable in unit duct measured under Item 108-4.1 shall be paid for under this item.

- A. These prices shall be full compensation for furnishing all materials and for all preparation and installation of these materials, plowing, backfilling and compacting trenches, all connections, line marking tape and installation, and for all labor, equipment, tools, and incidentals necessary to complete these items.
- B. The line marking tape installed shall be considered incidental to the work and shall not be paid for separately.

ITEM 109 INSTALLATION OF AIRPORT TRANSFORMER VAULT AND VAULT EQUIPMENT

DESCRIPTION

109-1.1 This work shall include all conduits and wireway required for cabling used in connection of new or relocated equipment at the locations and to the dimensions shown on the plans or approved by the Engineer.

Work shall include any painting of equipment and conduit, the marking and labeling of equipment and the labeling or tagging of wires, testing of the installation, and the furnishing of all incidentals necessary to place it in operating condition as a completed unit to the satisfaction of the Engineer.

This item shall also consist of furnishing and installing vault equipment and miscellaneous power and control wiring as required for operation, complete and ready to operate.

EQUIPMENT AND MATERIALS

109-2.1 GENERAL.

- A. Airport lighting equipment and materials covered by FAA specifications shall have prior approval of the Federal Aviation Administration, Airport Service, Washington, D.C. 20591, and shall be certified and listed in the latest Advisory Circular 150/5345-53, Approved Airport Lighting Equipment.

FAA approval of airport lighting equipment and subsequent inclusion in Advisory Circular 150/5345-53, "Approved Airport Equipment," only means that the test data satisfied the applicable specification requirements. This does not insure that the approved equipment will satisfactorily operate when interconnected to other approved airport lighting equipment or "off the shelf" equipment not requiring FAA approval in a power and/or control configuration.

The Contractor shall ascertain that all lighting system components furnished by him/her (including FAA approved equipment) are compatible in all respects with each other and the remainder of the new and/or existing systems. Any incompatible components furnished by the Contractor shall be replaced by him/her at no additional cost to the Airport Sponsor with a similar unit, approved by the Engineer (different model or different manufacturer) that is compatible with the remainder of the airport lighting system.

Equipment and materials shall be as specified in the Contract Special Provisions and as shown on the plans.

All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

- B. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.

VAULT AND PREFABRICATED METAL HOUSING

109-2.2 CONCRETE. The concrete for the vault shall be proportioned, placed, and cured in accordance with Item 610, Structural Portland Cement Concrete, using 3/4-inch maximum size coarse aggregate.

109-2.3 REINFORCING STEEL. Reinforcing steel bars shall be intermediate or structural grade deformed-type bars and shall meet the requirements of ASTM A 706 and shall be of 100 percent domestic origin.

109-2.4 BRICK. Brick shall conform to ASTM C-62, Grade SW.

109-2.5 RIGID STEEL CONDUIT. Rigid steel conduit and fittings shall be in accordance with Underwriters Laboratories Standard 6 and 514.

109-2.6 LIGHTING. Vault or metal-housing light fixtures shall be of a vaporproof type.

109-2.7 OUTLETS. Convenience outlets shall be heavy-duty duplex units designed for industrial service.

109-2.8 SWITCHES. Vault or metal-housing light switches shall be single-pole switches.

109-2.9 PAINT.

- A. Priming paint for ungalvanized metal surfaces, and the mixing thereof, shall be a high solids alkyd primer conforming to Society for Protective Coatings Specifications SSPC-Paint 25, Primer, Raw Linseed Oil and Alkyd Primer, (Without Lead and Chromate Pigments).
- B. White paint for body and finish coats on metal and wood surfaces shall be ready-mixed paint conforming to the Master Painter's Institute, Reference #9, Exterior Alkyd, Gloss, VOC Range E2.
- C. Priming paint for wood surfaces shall be mixed on the job by thinning the above specified white paint by adding 1/2 pint of raw linseed oil to each gallon.
- D. Paint for the floor, ceiling, and inside walls shall be in accordance with Fed. Spec. TT-E-487. Walls and ceiling shall be light gray and the floor shall be medium gray.
- E. The roof coating shall be hot asphalt material in accordance with ASTM D 2823.

109-2.10 HIGH-VOLTAGE BUS. High-voltage bus shall be standard weight 3/8-inch IPS copper tubing or it may be insulated copper cable of the size and voltage rating specified.

109-2.11 BUS CONNECTORS. Connectors shall be similar to Burndy Type NT (or equal) for copper tubing. Connectors for insulated bus cable shall be of the proper size and type for the service intended.

109-2.12 BUS SUPPORTS. Bus supports shall be similar to Westinghouse No. 527892 (or equal), insulated for 7,500 volts, single clamp type for 2-bolt flat mounting.

109-2.13 GROUND BUS. Ground bus shall be 1/8 X 3/4 inch minimum copper bus bar.

109-2.14 SQUARE DUCT. Duct shall be square similar to that manufactured by the Square D Company (or equal), or the Trumbull Electric Manufacturing Company (or equal). The entire front of the duct on each section shall consist of hinged or removable cover for ready access to the interior. The cross sections of the duct shall be not less than 4 x 4 inches except where otherwise shown in the plans.

109-2.15 GROUND RODS. Ground rods shall be copper or copper-clad of the length and diameter specified in the plans.

109-2.16 POTHEADS. Potheads shall be similar to G&W Type N, Shape C (or equal), unless otherwise specified. Potheads shall be furnished with plain insulator bushings and conduit couplings. Potheads shall have a rating not less than the circuit voltage.

109-2.17 PREFABRICATED METAL HOUSING. The prefabricated metal housing shall be a McGraw-Edison transclosure housing or equal. It shall include any electrical apparatus such as mounting rails, channels, metal bus clamps, insulators, bushings, clips and other applicable packages as may be required. The size and type of transclosure shall be as specified in the special provisions. Also included in this item shall be a concrete pad in accordance with the details shown on the construction plans.

109-2.18 FAA-APPROVED EQUIPMENT. Certain items for airport lighting equipment installed in vaults or translosures are covered by individual FAA equipment specifications. The specifications are listed below:

Advisory Circular 150/5345-3 (latest revision), Specification for L-821 Panels for Remote Control of Airport Lighting.

Advisory Circular 150/5345-5 (latest revision), Circuit Selector Switch.

Advisory Circular 150/5345-7 (latest revision), Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits.

Advisory Circular 150/5345-10 (latest revision), Specification for L-828 Constant Current Regulators.

Advisory Circular 150/5345-13 (latest revision), Specification for L-841 Auxiliary Relay Cabinet Assembly for Pilot Control of Airport Lighting Circuits.

109-2.19 OTHER ELECTRICAL EQUIPMENT. Constant-current regulators, distribution transformers, oil switches, cutouts, relays, terminal blocks, transfer relays, circuit breakers, and all other regularly used commercial items of electrical equipment not covered by FAA equipment specifications shall conform to the applicable rulings and standards of the Institute of Electrical and Electronic Engineers or the National Electrical Manufacturers Association. When specified, test reports from a testing laboratory indicating that the equipment meets the specifications shall be supplied. In all cases, equipment shall be new and a first-grade product. This equipment shall be supplied in the quantities required for the specific project and shall incorporate the electrical and mechanical characteristics specified in the proposal and plans.

109-2.20 WIRE. Wire in conduit rated up to 5,000 volts shall conform to Advisory Circular 150/5345-7 (latest revision), Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal.

A. Control Circuits. Wire shall be not less than No. 12 AWG and shall be insulated for 600 volts. If telephone control cable is specified, No. 19 AWG telephone cable conforming to ICEA S-85-625-1996 specifications shall be used.

B. Power Circuits.

1. 600 volts maximum--Wire shall be No. 6 AWG or larger and shall be insulated for at least 600 volts.
2. 3,000 volts maximum--Wire shall be No. 6 AWG or larger and shall be insulated for at least 3,000 volts.
3. Over 3,000 volts--Wire shall be No. 6 AWG or larger and shall be insulated for at least the circuit voltage.

109-2.21 FLOOR DRAINS. The floor drains shall be similar to type Z-798-A (or equal), as manufactured by the Z. A. Zurn Manufacturing Company.

CONSTRUCTION METHODS

CONSTRUCTION OF VAULT AND PREFABRICATED METAL HOUSING

109-3.1 GENERAL. The Contractor shall construct the transformer vault or prefabricated metal housing at the location indicated in the plans. Vault construction shall be reinforced concrete, concrete masonry, or brick wall as specified. The metal housing shall be prefabricated equipment enclosure to be supplied in the size specified. The mounting pad or floor details, installation methods, and equipment placement are shown in the plans.

The Contractor shall clear, grade, and seed the area around the vault or metal housing for a minimum distance of 10 feet on all sides. The slope shall be not less than 1/2 inch per foot away from the vault or metal housing in all directions.

109-3.2 FOUNDATION AND WALLS.

- A. Reinforced Concrete Construction. The Contractor shall construct the foundation and walls in accordance with the details shown in the plans. Unless otherwise specified, internal ties shall be of the mechanical type so that when the forms are removed the ends of the ties shall be at least 1-inch beneath the concrete surface; the holes shall be plugged and finished to prevent discoloration. Reinforcing steel shall be placed, as shown in the drawings, and secured in position to prevent displacement during the concrete placement.

The external surfaces of the concrete shall be thoroughly worked during the placing operation to force all coarse aggregate from the surface. Thoroughly work the mortar against the forms to produce a smooth finish free from air pockets and honeycomb.

The surface film of all pointed surfaces shall be removed before setting occurs. As soon as the pointing has set sufficiently, the entire surface inside and outside of the vault shall be thoroughly wet with water and rubbed with a No. 16 carborundum stone, or equal quality abrasive, bringing the surface to a paste. All form marks and projections shall be removed. The surface produced shall be smooth and dense without pits or irregularities. The materials which have been ground into a paste during the rubbing process shall be spread or brushed uniformly over the entire surface (except the interior surfaces that are to be painted shall have all paste removed by washing before painting) and permitted to reset. Final exterior finish shall be obtained by rubbing with No. 30 carborundum stone, or an equal quality abrasive. The surface shall be rubbed until the entire surface is smooth and uniform in color.

- B. Brick and Concrete Construction. When this type of construction is specified, the foundation shall be concrete conforming to the details shown in the plans. The outer edge of the foundation at the floor level shall be beveled 1 1/2 inches at 45°. Brick walls shall be 8 inches thick, laid in running bond with every sixth course a header course. Brick shall be laid in cement mortar (1 part masonry cement and 3 parts sand) with full mortar bed and shoved joints. All joints shall be completely filled with mortar, and facing brick shall be back-parged with mortar as work progresses. All joints shall be 3/8-inch thick, exterior joints tooled concave, and interior joints struck flush. Both interior and exterior brick surfaces shall be cleaned and nail holes, cracks and other defects filled with mortar. When specified, a nonfading mineral pigment mortar coloring shall be added to the mortar. Steel reinforcing bars, 3/8-inch in diameter and 12 inches long, shall be set vertically in the center of the brick wall on not more than 2-foot centers to project 2 1/2 inches into the concrete roof slab. Lintels for supporting the brickwork over doors, windows, and louvers shall consist of two 4 X 3 X 3/8 inch steel angles. Lintels shall be painted with one coat of red lead before installation, and all exposed parts shall be painted similar to doors and window sash after installation.

Window sills may be concrete poured in place or precast concrete as indicated in the plans. All exposed surfaces shall have a rubbed finish as specified under reinforced concrete construction. After completion, all interior and exterior faces of walls shall be scrubbed with a solution of muriatic acid and water in the proportions of not less than 1 part acid to 10 parts of water. All traces of efflorescence, loose mortar, and mortar stain shall be removed, and the walls washed down with clear water.

- C. Concrete Masonry Construction. When this type of construction is specified, the foundation shall be concrete conforming to the details shown in the plans. The concrete masonry units shall be standard sizes and shapes and shall conform to ASTM C 90 and shall include the closures, jambs, and other shapes required by the construction as shown in the plans. Standard construction practice shall be followed for this type of work including mortar, joints, reinforcing steel for extensions into roof slab, etc. Plaster for interior walls, if specified, shall be Portland cement plaster.

109-3.3 ROOF. The roof shall be reinforced concrete as shown in the plans. Reinforcing steel shall be placed as shown in the drawing and secured in position to prevent displacement during the pouring

of the concrete. The concrete shall be poured monolithically and shall be free of honeycombs and voids. The surface shall have a steel-trowled finish and shall be sloped as shown in the drawing. The underside of the roof slab shall be finished in the same manner as specified for walls.

One brush or mop coat of hot asphalt roof coating shall be applied to the top surface of the roof slab. The asphalt material shall be heated to within the range specified by the manufacturer and immediately applied to the roof. The finished coat shall be continuous over the roof surface and free from holidays and blisters. Smears and dribbles of asphalt on the roof edges and building walls shall be removed.

109-3.4 FLOOR. The floor shall be reinforced concrete as shown in the drawings. When present, all sod, roots, refuse, and other perishable material shall be removed from the area under the floor to a depth of 8 inches, unless a greater depth is specified in the invitation for bids. This area shall be backfilled with materials consisting of sand, cinders, gravel, or stone. Fill shall be placed in layers not to exceed 4 inches and shall be thoroughly compacted by tamping or rolling. A layer of building paper shall be placed over the fill prior to placing concrete. The floor surfaces shall have a steel-trowled finish. The floor shall be level unless a drain is specified, in which case the floor shall be pitched 1/4 inch per foot downward toward the drain. A 1/4 inch asphalt felt expansion joint shall be placed between floor and foundation walls. The floor shall be poured monolithically and shall be free of honeycombs and voids.

109-3.5 FLOOR DRAIN. If shown in the plans, a floor drain and dry well shall be installed in the center of the floor of the equipment room. The dry well shall be excavated 4 X 4 feet square and to a depth of 4 feet below the finished floor elevation and shall be backfilled to the elevation of the underside of the floor with gravel - which shall all pass a 2-inch mesh sieve and shall all be retained on a 1/4 inch mesh sieve. The gravel backfill shall be placed in 6 inch maximum layers, and the entire surface of each layer shall be tamped either with a mechanical tamper or with a hand tamper weighing not less than 25 pounds and having a face area of not more than 36 square inches nor less than 16 square inches. The drain inlet shall be set flush in the concrete floor. The drain shall have a clear opening of not less than 8 inches in diameter.

109-3.6 CONDUITS IN FLOOR AND FOUNDATION. Conduits shall be installed in the floor and through the foundation walls in accordance with the details shown in the plans. All underground conduit shall be painted with a bituminous compound. Conduit shall be installed with a coupling or metal conduit adapter flush with the top of the floor. All incoming conduit shall be closed with a pipe plug to prevent the entrance of foreign material during construction. Space conduit entrances shall be left closed.

109-3.7 DOORS. Doors shall be metal-clad fireproof Class A doors conforming to requirements of the National Electric Code and local electrical codes.

109-3.8 PAINTING. The floor, ceiling, and inside walls of concrete construction shall first be given a hardening treatment, after which the Contractor shall apply two coats of paint as specified below, except that interior face brick walls need not be painted. The hardening treatment shall consist of applying two coats of either a commercial floor hardener or a solution made by dissolving 2 pounds of magnesium fluosilicate or zinc sulphate crystals in 1 gallon of water. Each coat shall be allowed to dry at least 48 hours before the next application. After the second treating coat has dried, the surfaces shall be brushed clean of all crystals and thoroughly washed with clear water. Paint for walls and ceiling shall be a light gray color approved by the Project Engineer. The floor paint shall be a medium gray color approved by the Project Engineer. Before painting, the surfaces shall be dry and clean. The first coat shall be thinned by adding 2/3-quart of spar varnish and 1/3-quart of turpentine to each gallon of paint. The second coat shall be applied without thinning. All doors, lintels, and windows shall be cleaned to remove any rust or foreign material and shall be given one body and one finish coat of white paint. Bare metal surfaces shall be given a prime coat of red lead prior to the body and finish coats.

109-3.9 LIGHTS AND SWITCHES. The Contractor shall furnish and install a minimum of two duplex convenience outlets in the vault room. Where a control room is specified, at least two duplex outlets shall be installed.

INSTALLATION OF EQUIPMENT IN VAULT OR PREFABRICATED METAL HOUSING

109-3.10 GENERAL. The Contractor shall furnish, install, and connect all equipment, equipment accessories, conduit, cables, wires, buses, grounds, and support necessary to insure a complete and

operable electrical distribution center for the airport lighting system as specified herein and shown in the plans. When specified, an emergency power supply and transfer switch shall be provided and installed.

The equipment installation and mounting shall comply with the requirements of the National Electrical Code and local code agency having jurisdiction.

109-3.11 POWER SUPPLY EQUIPMENT. Transformers, regulators, booster transformers, and other power supply equipment items shall be furnished and installed at the location shown in the plans or as directed by the Resident Engineer. The power supply equipment shall be set on steel "H" sections, "I" beams, channels, or concrete blocks to provide a minimum space of 1-1/2 inches between the equipment and the floor. The equipment shall be placed so as not to obstruct the oil-sampling plugs of the oil-filled units; and nameplates shall, so far as possible, not be obscured.

If specified in the plans and specifications, equipment for an alternate power source or an emergency power generator shall be furnished and installed. The alternate power supply installation shall include all equipment, accessories, an automatic changeover switch, and all necessary wiring and connections. The emergency power generator set shall be the size and type specified.

109-3.12 SWITCHGEAR AND PANELS. Oil switches, fused cutouts, relays, transfer switches, panels, panel boards, and other similar items shall be furnished and installed at the location shown in the plans or as directed by the Resident Engineer. Wall or ceiling-mounted items shall be attached to the wall or ceiling with galvanized bolts of not less than 3/8-inch diameter engaging metal expansion shields or anchors in masonry or concrete vaults.

109-3.13 DUCT AND CONDUIT. The Contractor shall furnish and install square-type exposed metallic ducts with hinged covers for the control circuits in the vault. These shall be mounted along the walls behind all floor-mounted equipment and immediately below all wall-mounted equipment. The hinged covers shall be placed to open from the front side with the hinges at the front bottom.

Wall brackets for square ducts shall be installed at all joints 2 feet or more apart with intermediate brackets as specified. Conduit shall be used between square ducts and equipment or between different items of equipment when the equipment is designed for conduit connection. When the equipment is not designed for conduit connection, conductors shall enter the square-type control duct through insulating bushings in the duct or on the conduit risers.

The Contractor shall supply and install conduit and duct at the dimensions and nominal diameters shown in the plans.

109-3.14 CABLE ENTRANCE AND HIGH-VOLTAGE BUS SYSTEM. Incoming underground cable from field circuits and supply circuits will be installed outside the walls of the transformer vault as a separate item under Item 108. The Contractor installing the vault equipment shall bring the cables from the trench or duct through the entrance conduits into the vault and make the necessary electrical connections. For the incoming and outgoing high-voltage load circuits, the Contractor shall furnish and install rigid metallic conduit risers, surmounted by potheads, from floor level to the level as shown in the plans.

The incoming high-voltage power supply service to the vault shall enter below the floor of the vault and shall rise from the floor level in a rigid metallic conduit riser, surmounted by a pothead, as described above. Using insulated high-voltage cable, the incoming power service shall be connected from the pothead to the oil-fused cutouts or to the specified disconnecting switch or equipment. From the oil-fused cutouts or disconnecting device, the insulated service conductors shall be connected to the overhead voltage bus system of the vault. The high-voltage bus system shall utilize the materials specified and shall be mounted and installed in accordance with the requirements of the National Electrical Code or the local code agency having jurisdiction.

109-3.15 WIRING AND CONNECTIONS. The Contractor shall make all necessary electrical connections in the vault in accordance with the wiring diagrams furnished and as directed by the Resident Engineer. In wiring to the terminal blocks, the Contractor shall leave sufficient extra length on each control lead to make future changes in connections at the terminal block. This shall be accomplished by running each control lead the longest way around the box to the proper terminal. Leads shall be neatly laced in place.

The Contractor shall remove the existing wiring and appurtenant equipment as shown in the plans in preparation for installation of the new or relocated electrical wireways and equipment. This shall include the reinstallation and/or repair of any lighting circuits which require temporary disconnection as a result of the work.

All wiring shall be in compliance with all local and state codes and the "National Electrical Code," latest edition.

109-3.16 MARKING AND LABELING. All equipment, control wires, terminal blocks, etc., shall be tagged, marked, or labeled as specified below:

- A. Wire Identification. The Contractor shall furnish and install self-sticking wire labels or identifying tags on all control wires at the point where they connect to the control equipment or to the terminal blocks. Wire labels, if used, shall be of the self-sticking preprinted type and of the manufacturer's recommended size for the wire involved. Identification markings designated in the plans shall be followed. Tags, if used, shall be of fiber not less than 3/4 inch in diameter and not less than 1/32 inch thick. Identification markings designated in the plans shall be stamped on tags by means of small tool dies. Each tag shall be securely tied to the proper wire by a nonmetallic cord.
- B. Labels. The Contractor shall stencil identifying labels on the cases of regulators, breakers, and distribution and control relay cases with white oil paint as designated by the Resident Engineer. The letters and numerals shall be not less than 1 inch in height and shall be of proportionate width. The Contractor shall also mark the correct circuit designations in accordance with the wiring diagram on the terminal marking strips which are a part of each terminal block.

109-3.17 EXISTING EQUIPMENT RELOCATIONS AND REMOVALS. The Contractor shall relocate the existing equipment as detailed in the plans. Contractor shall be held responsible for any damage to the existing equipment caused by this relocation and shall repair such damage immediately to the satisfaction of the Engineer at no cost to the contract.

109-3.18 TESTING. The installation shall be tested in operation as a completed unit prior to acceptance. Tests shall include resistance, voltage and current readings, as required by the Project Engineer. Testing equipment shall be furnished by the Contractor. Tests shall be conducted as directed by the Project Engineer and shall be to his/her satisfaction. The Contractor shall be responsible for all equipment and conduit in place which will be connected to the new equipment and any equipment or materials found to be defective or damaged shall be replaced by the Contractor at his/her own expense.

METHOD OF MEASUREMENT

109-4.1 The quantity of vaults to be paid for under this item shall consist of the number of vaults constructed in place and accepted as a complete unit.

109-4.2 The quantity of prefabricated metal housings to be paid for under this item shall consist of the number of housings constructed in place and accepted as a complete unit.

109-4.3 The quantity of vault equipment to be paid for under this item shall consist of all equipment installed, connected, and accepted as a complete unit ready for operation.

BASIS OF PAYMENT

109-5.1 Payment will be made at the contract lump sum price for each completed and accepted vault equipment installation. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

ITEM 110 INSTALLATION OF AIRPORT UNDERGROUND ELECTRICAL DUCT

DESCRIPTION

110-1.1 This item shall consist of underground electrical ducts installed in accordance with this specification at the locations and in accordance with the dimensions, designs, and details shown in the plans. This item shall include: the installation of all underground electrical ducts or underground conduits, trenching, backfilling, removal, and restoration of any paved areas; manholes, concrete encasement, mandreling installation of steel drag wires and duct markers, capping, and the testing of the installation as a completed duct system ready for installation of cables, to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

110-2.1 GENERAL. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when so requested by the Engineer.

110-2.2 STEEL CONDUIT. Steel conduits shall be galvanized rigid steel (GRS). Rigid steel conduit and fittings shall conform to the requirements of Underwriters Laboratories Standard 6, 514B, and 1242.

110-2.3 PLASTIC CONDUIT. The conduit, fittings, and accessories shall be manufactured from polyvinyl chloride complying with ASTM D 1784 and with all applicable requirements of NEMA Publication No. TC2, UL Standard 651 for EPC-40-PVC and shall be one of the following, as specified in the contract:

- A. Type I – suitable for underground use either directly in the earth or encased in concrete.
- B. Type II – suitable for either above ground or underground use.

Fittings and accessories for the electrical plastic conduit shall comply with all applicable requirements of NEMA Publication No. TC3.

The solvent cement used to join the conduit and fittings shall be according to ASTM D 2564.

110-2.4 SPLIT CONDUIT. Split conduit shall be pre-manufactured for the intended purpose and shall be made of steel or plastic.

110-2.5 CONDUIT SPACERS. Conduit spacers shall be prefabricated interlocking units manufactured for the intended purpose. They shall be of double wall construction made of high grade, high density polyethylene complete with interlocking cap and base pads, They shall be designed to accept No. 4 reinforcing bars installed vertically.

110-2.6 CONCRETE. Concrete shall conform to Item 610, Structural Portland Cement Concrete, using 1-inch maximum size coarse aggregate.

110-2.7 RESERVED

110-2.8 RESERVED

CONSTRUCTION METHODS

110-3.1 GENERAL. The Contractor shall install underground ducts at the approximate locations indicated in the construction plans. The Resident Engineer shall indicate specific locations as the work progresses, if required to differ from the plans. Ducts shall be of the size, material, and type indicated in the plans or specifications. Where no size is indicated in the plans or specifications, the ducts shall be not less than 2 inches inside diameter or comply with the National Electrical Code based on cable to be installed, whichever is larger. All duct lines shall be laid so as to grade toward handholes, manholes and duct ends for drainage. Grades shall be at least 3 inches per 100 feet. On runs where it is not

practicable to maintain the grade all one way, the duct lines shall be graded from the center in both directions toward manholes, handholes, or duct ends. Pockets or traps where moisture may accumulate shall be avoided.

The Contractor shall mandrel each duct. An iron-shod mandrel, not more than 1/4-inch smaller than the bore of the duct shall be pushed through each duct by means of jointed conduit rods. The mandrel shall have a leather or rubber gasket slightly larger than the duct hole.

All ducts installed shall be provided with a No. 10 gauge galvanized iron or steel drag wire for pulling the permanent wiring. Sufficient length shall be left in manholes or handholes to bend the drag wire back to prevent it from slipping back into the duct. Where spare ducts are installed, as indicated on the plans, the open ends shall be plugged with removable tapered plugs, designed by the duct manufacturers, or with hardwood plugs conforming accurately to the shape of the duct and having the larger end of the plug at least 1/4-inch greater in diameter than the duct.

All ducts shall be securely fastened in place during construction and progress of the work and shall be plugged to prevent seepage of grout, water, or dirt. Any duct section having a defective joint shall not be installed.

All ducts, except steel conduit, installed under runways, taxiways, aprons, and other paved areas shall be encased in a concrete envelope.

Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

Trenches for ducts may be excavated manually or with mechanical trenching equipment. Walls of trenches shall be essentially vertical so that a minimum of shoulder surface is disturbed. Blades of road patrols or graders shall not be used to excavate the trench. The Contractor shall ascertain the type of soil or rock to be excavated before bidding. All excavation shall be considered unclassified.

110-3.2 DUCTS ENCASED IN CONCRETE. Unless otherwise shown in the plans, concrete-encased ducts shall be installed so that the top of the concrete envelope is not less than 18 inches below the finished subgrade where installed under runways, taxiways, aprons, or other paved areas, and not less than 18 inches below finished grade where installed in unpaved areas. Ducts under paved areas shall extend at least 3 feet beyond the edges of the pavement or 3 feet beyond any underdrains which may be installed alongside the paved area. Trenches for concrete encased ducts shall be opened the complete length before concrete is laid so that if any obstructions are encountered, proper provisions can be made to avoid them. All ducts for concrete encasements shall be placed on a layer of concrete not less than 3 inches thick prior to its initial set. Where two or more ducts are encased in concrete, the Contractor shall space them not less than 3 inches apart (measured from outside wall to outside wall) using spacers applicable to the type of duct. As the duct laying progresses, concrete not less than 3 inches thick shall be placed around the sides and top of the duct bank. End bells or couplings shall be installed flush with the concrete encasement where required.

When specified, the Contractor shall reinforce the bottom side and top of encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy, where ducts cross under roadways, or where otherwise shown on the plans. Under such conditions, the complete duct structure shall be supported on reinforced concrete footings, piers, or piles located at approximately 5-foot intervals.

110-3.3 DUCTS WITHOUT CONCRETE ENCASEMENT. Trenches for single-duct lines shall be not less than 6 inches nor more than 12 inches wide, and the trench for 2 or more ducts installed at the same level shall be proportionately wider. Trench bottoms for ducts without concrete encasement shall be made to conform accurately to grade so as to provide uniform support for the duct along its entire length.

A layer of fine earth material, at least 4 inches thick (loose measurement) shall be placed in the bottom of the trench as bedding for the duct. The bedding shall consist of soft dirt, sand or other fine fill, and it shall contain no particles that would be retained on a 1/4-inch sieve. The bedding material shall be tamped until firm.

Unless otherwise shown in the plans, ducts for direct burial shall be installed so that the tops of all ducts are at least 18 inches below the finished grade.

When two or more ducts are installed in the same trench without concrete encasement, they shall be spaced not less than 4 inches apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches apart in a vertical direction.

Trenches shall be opened the complete length before duct is installed so that if any obstructions are encountered, proper provisions can be made to avoid them.

110-3.4 DUCT MARKERS. The location of all ducts shall be marked by an in-pavement duct marker approved by the Engineer. The markers shall be located above all ducts or duct banks, except where ducts terminate in a handhole, manhole, or building.

110-3.5 BACKFILLING. After concrete-encased ducts have been properly installed and the concrete has had time to set, the trench shall be backfilled in at least two layers with excavated material not larger than 4 inches in diameter and thoroughly tamped and compacted to at least the density of the surrounding undisturbed soil. If necessary to obtain the desired compaction, the backfill material shall be moistened or aerated as required.

Trenches shall not be excessively wet and shall not contain pools of water during backfilling operations.

The trench shall be completely backfilled and tamped level with the adjacent surface: except that, when sod is to be placed over the trench, the backfilling shall be stopped at a depth equal to the thickness of the sod to be used, with proper allowance for settlement.

Any excess excavated material shall be removed and disposed of in accordance with instructions issued by the Resident Engineer.

110-3.6 BACKFILLING. For ducts without concrete encasement, 8 inches of sand, soft earth, or other fine fill (loose measurement) shall be placed around the ducts and carefully tamped around and over them with hand tampers. The remaining trench may be filled with regular run of excavated material and thoroughly tamped as specified above.

All backfill and associated materials shall be considered incidental.

110-3.7 RESTORATION. Where sod has been removed, it shall be replaced as soon as possible after the backfilling is completed. All areas disturbed by the trenching, storing of dirt, cable laying, pad construction and other work shall be restored to its original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, sprigging, or mulching. All such work shall be performed in accordance with the Standard Turfing Specifications. The Contractor shall be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

METHOD OF MEASUREMENT

110-4.1 The quantity of concrete encased duct to be paid for shall be the number of linear feet installed, measured in place, completed and accepted. No separate measurements will be made for individual ducts in a multi-way duct system.

110-4.2. The quantity of galvanized rigid steel conduit to be paid for shall be the number of linear feet installed, measured in place, completed and accepted.

BASIS OF PAYMENT

110-5.1 Payment will be made at the contract unit price for each type and size of single-way or multi-way duct bank completed and accepted. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

Topsoiling, seeding, and mulching of the duct trench shall not be paid for separately but shall be considered incidental to the associated duct.

ITEM 119 AIRPORT OBSTRUCTION LIGHTS

DESCRIPTION

119-1.1 This item shall consist of furnishing and installing obstruction lights in accordance with these specifications. Included in this item shall be the furnishing and installing of wood poles, steel or iron pipes, or other supports as required in the plans or specifications.

This item shall also include all wire and cable connections, the furnishing and installing of all necessary conduits and fittings, insulators, pole steps, pole cross arms, and the painting of poles and pipes. In addition, it includes the furnishing and installing of all lamps and, if required, the furnishing and installing of insulating transformers, the servicing and testing of the installation and all incidentals necessary to place the lights in operation as completed units to the satisfaction of the Engineer.

EQUIPMENT AND MATERIALS

119-2.1 GENERAL.

- A. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) specifications shall be certified and listed under Advisory Circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program, latest edition.
- B. All other equipment and materials covered by other reference specifications shall be subject to acceptance through manufacturer's certification of compliance with the applicable specification when requested by the Engineer.
- C. Manufacturer's certifications shall not relieve the Contractor of the Contractor's responsibility to provide materials in accordance with these specifications and acceptable to the Engineer. Materials supplied and/or installed that do not materially comply with these specifications shall be removed, when directed by the Engineer and replaced with materials, which do comply with these specifications, at the sole cost of the Contractor.
- D. All materials and equipment used to construct this item shall be submitted to the Engineer for approval prior to ordering the equipment. Submittals consisting of marked catalog sheets or shop drawings shall be provided. Submittal data shall be presented in a clear, precise and thorough manner. Original catalog sheets are preferred. Photocopies are acceptable provided they are as good a quality as the original. Clearly and boldly mark each copy to identify pertinent products or models applicable to this project. Indicate all optional equipment and delete non-pertinent data. Submittals for components of electrical equipment and systems shall identify the equipment for which they apply on each submittal sheet. Markings shall be boldly and clearly made with arrows or circles (highlighting is not acceptable). Contractor is solely responsible for delays in project accruing directly or indirectly from late submissions or resubmissions of submittals.
- E. The data submitted shall be sufficient, in the opinion of the Engineer, to determine compliance with the plans and specifications. [The Contractor's submittals shall be neatly bound in a properly sized 3-ring binder, tabbed by specification section.] The Engineer reserves the right to reject any and all equipment, materials or procedures, which, in the Engineer's opinion, does not meet the system design and the standards and codes, specified herein.
- F. All equipment and materials furnished and installed under this section shall be guaranteed against defects in materials and workmanship for a period of at least twelve (12) months from final acceptance by the Owner. The defective materials and/or equipment shall be repaired or replaced, at the Owner's discretion, with no additional cost to the Owner.

119-2.2 OBSTRUCTION LIGHTS. The obstruction lights shall conform to the requirements of AC 150/5345-43, Specification for Obstruction Lighting Equipment, latest edition.

119-2.3 ISOLATION TRANSFORMERS. Where required for series circuits, the isolation transformers shall conform to the requirements of AC 150/5345-47, Isolation Transformers for Airport Lighting Systems, latest edition.

119-2.4 TRANSFORMER HOUSING. Transformer housings, if specified, shall conform to AC 150/5345-42, Specification for Airport Light Base and Transformer Housings, Junction Boxes, and Accessories, latest edition.

119-2.5 CONDUIT. Steel conduit and fittings shall be in accordance with Underwriters Laboratories Standard 6, 514, and 1242.

119-2.6 PLASTIC CONDUIT (for use below grade only). Plastic conduit and fittings shall conform to the requirements of Fed. Spec. W--C-1094 and Underwriters Laboratories Standards UL-651 and shall be one of the following, as shown on the plans:

A. Type I—Schedule 40 PVC suitable for underground use either direct-buried or encased in concrete.

B. Type II—Schedule 40 PVC suitable for either above ground or underground use.

119-2.7 WIRES. Wires in conduit rated up to 5,000 volts shall conform to AC 150/5345 7, Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits, for rubber insulated neoprene covered wire, or Fed. Spec. J-C-30, Type RHW, for rubber insulated fibrous covered wire. For ratings up to 600 volts, thermoplastic wire conforming to Fed. Spec. J-C-30, Types TW, THW, and THWN-2, shall be used. The wires shall be of the type, size, number of conductors, and voltage shown in the plans or in the proposal. Overhead line wire from pole to pole, where specified, shall conform to ANSI/ICEA S-70-547-1992.

119-2.8 MISCELLANEOUS. Paint, poles, pole steps, insulators, and all other miscellaneous materials necessary for the completion of this item shall be new and first-grade commercial products. These products shall be as specified in the plans or specifications.

CONSTRUCTION METHODS

119-3.1 PLACING THE OBSTRUCTION LIGHTS. The Contractor shall furnish and install single-or double-obstruction lights as specified in the proposal and shown in the plans. The obstruction lights shall be mounted on poles, buildings, or towers approximately at the location shown in the plans. The exact location shall be as directed by the Engineer.

119-3.2 INSTALLATION ON POLES. Where obstruction lights are to be mounted on poles, each obstruction light shall be installed with its hub at least as high as the top of the pole. All wiring shall be run in not less than 1-inch galvanized rigid steel conduit. If specified, pole steps shall be furnished and installed, the lowest step being 5 feet above ground level. Steps shall be installed alternately on diametrically opposite sides of the pole to give a rise of 18 inches for each step. Conduit shall be fastened to the pole with galvanized steel pipe straps and shall be secured by galvanized lag screws. Poles shall be painted as shown in the plans and specifications.

When obstruction lights are installed on existing telephone or power poles, a large fiber insulating sleeve of adequate diameter and not less than 4-feet long, shall be installed to extend 6 inches above the conductors on the upper cross arm. In addition, the sleeve shall be at least 18 inches below the conductors on the lower crossarm. The details of this installation shall be in accordance with the plans.

119-3.3 INSTALLATION ON BEACON TOWER. Where obstruction lights are installed on a beacon tower, two obstruction lights shall be mounted on top of the beacon tower using 1-inch conduit. The conduit shall screw directly into the obstruction light fixtures and shall support them at a height of not less than 4 inches above the top of the rotating beacon. If obstruction lights are specified at lower levels, the Contractor shall install not less than 1-inch galvanized rigid steel conduit with standard conduit fittings for mounting the fixtures. The fixtures shall be mounted in an upright position in all cases. The conduit shall be fastened to the tower members with "wraplock" straps, clamps, or approved fasteners spaced approximately 5 feet apart. Three coats of aviation-orange paint shall be applied (one prime, one body, and one finish coat) to all exposed material installed.

119-3.4 INSTALLATION ON BUILDINGS, TOWERS, SMOKESTACKS, ETC. Where obstruction lights are to be installed on buildings or similar structures, the installation shall be made in accordance with details shown in the plans. The hub of the obstruction light shall be not less than 1 foot above the highest point of the obstruction except in the case of smokestacks where the uppermost units shall be mounted not less than 5 feet , nor more than 10 feet (3 m) below the top of the stack. Conduit supporting the obstruction light units shall be fastened to wooden structures with galvanized steel pipe straps and shall be secured by 1-½ inch No. 10 galvanized wood screws. Conduit shall be fastened to masonry structures by the use of expansion shields, screw anchors, or toggle bolts using No. 10, or larger, galvanized wood or machine screws. Conduit fastened to structural steel shall have the straps held with not less than No. 10 roundhead machine screws in drilled and tapped holes. Fastenings shall be approximately 5 feet apart. Three coats of aviation-orange paint shall be applied (one prime, one body, and one finish coat) to all exposed material installed.

119-3.5 SERIES ISOLATION TRANSFORMERS. The L-810 series obstruction light does not include a film cutout; therefore, an isolation transformer is required with each series lamp. Double series units of this type require two series insulating transformers. The transformer shall be housed in a base or buried directly in the earth in accordance with the details shown in the plans.

119-3.6 WIRING. The Contractor shall furnish all necessary labor and materials and shall make complete electrical connections from the underground cable or other source of power in accordance with the wiring diagram furnished with the project plans. If underground cable is required for the power feed and if duct is required under paved areas, the cable and duct shall be installed in accordance with and paid for as described in Item 108, Underground Power Cable for Airports, and Item 110, Airport Underground Electrical Duct Banks and Conduit.

119-3.7 LAMPS. The Contractor shall furnish and install in each unit one or two lamps, as required, conforming to the manufacturer's requirements.

119-3.8 TESTS. The installation shall be fully tested by continuous operation for not less than 1/2 hour as a completed unit prior to acceptance. These tests shall include the functioning of each control not less than 10 times.

METHOD OF MEASUREMENT

119-4.1 The quantity of lights to be paid for under this item shall be the number of single- or double-type obstruction lights installed and accepted as completed units, in place, ready for operation.

BASIS OF PAYMENT

119-5.1 Payment will be made at the contract unit price for each completed obstruction light installed, in place by the Contractor, and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

ITEM 125 INSTALLATION OF AIRPORT LIGHTING SYSTEMS

DESCRIPTION

125-1.1 This item shall consist of airport lighting systems furnished and installed in accordance with this specification, the referenced specification, and the latest revision of the applicable FAA Advisory Circulars. The systems shall be installed at the location and in accordance with the dimensions, design, and details shown in the plans. This item shall include the furnishing of all equipment, materials, services, and incidentals necessary to place the systems in operation as completed units to the satisfaction of the Engineer.

125-1.2 Additional details pertaining to a specific system covered in this item are contained in the latest revision of the FAA Advisory Circulars listed in paragraphs 125-1.3 through 125-1.5.

125-1.3 FAA Advisory Circular 150/5340-30 (latest revision), Design and Installation of Airport Visual Aids.

125-1.4 FAA Advisory Circular 150/5340-18 (latest revision), Taxiway Guidance Sign System.

125-1.5 FAA Advisory Circular 150/5345-52 (latest revision), Generic Visual Glideslope Indicators (GVGI).

EQUIPMENT AND MATERIALS

125-2.1 GENERAL.

- A. Airport lighting equipment and materials covered by these specifications shall have the prior approval of the Federal Aviation Administration, Airports Service, Washington, D. C. 20591, and shall be listed in the current addendum to FAA Advisory Circular 150/5345-53 (latest revision), Airport Lighting Equipment Certification Program.
- B. All other equipment and materials covered by other referenced specifications shall be subject to acceptance through the manufacturer's certification of compliance with the applicable specifications.
- C. Lists of the equipment and materials required for a particular system are contained in the applicable FAA Advisory Circulars.

Except as specified otherwise, all new equipment shall be provided by the Contractor and shall be tested for specification conformance as part of the Airport Lighting Equipment Certification Program.

All lighting system construction shall include all items necessary to construct a complete unit including, but not restricted to, concrete bases, light cans, conduit, connectors, fixtures, and transformers.

The Contractor shall ascertain that all lighting system components furnished by him (including FAA approved equipment) are compatible in all respects with each other and remainder of the new/existing system. Any noncompatible components furnished by the Contractor shall be replaced by him at no additional cost with a similar unit, approved by the Engineer (different model or different manufacturer) that is compatible with the remainder of the airport lighting system.

125-2.2 TAPE. Rubber and plastic electrical tapes shall be Scotch Electrical Tape Numbers 23 and 88, respectively, as manufactured by the Minnesota Mining and Manufacturing Company, or an approved equal.

125-2.3 CONCRETE. All Portland cement concrete shall meet the requirements of Item 610.

125-2.4 CONDUIT. Rigid steel conduit and fittings shall conform to the requirements of Federal Specification WW-C-581.

125-2.5 SQUEEZE CONNECTORS. Squeeze connectors, if specified, shall be equal to Crouse-Hinds Company, type CGB cable connector with neoprene rubber bushing.

125-2.6 TEES. Large radius bend tees, if specified, shall be equal to Crouse-Hinds Company No. ET-43.

125-2.7 ISOLATION TRANSFORMERS. New isolation transformers shall be as required by the contract Special Provisions and as shown in the plans.

125-2.8 LIGHT CANS. Light cans for the new concrete base mounted airfield signs, threshold, runway and taxiway lights and splice cans shall be L-867 Size B in conformance with FAA Advisory Circular AC 150/5345-42 (latest revision).

125-2.9 LIGHT LENS. Lenses for new runway edge lights both elevated and in-pavement shall be clear except for the last 2000' where the lights shall be 180° amber/180° clear.

Threshold light lenses shall be 180° red/180° green (red facing the runway).

Taxiway light lenses shall be blue.

125-2.11 AIRFIELD SIGNS. All signs shall be double faced.

Sign components, transformers, and lengths shall be as recommended by the manufacturer.

All signs shall conform to FAA Advisory Circular 150/5345-44 (latest edition) for Type L-858 Taxiway and Runway Signs. Manufacturer shall submit certification of compliance as tested by ETL Testing Laboratories.

125-2.12 SAND. Sand for backfill around lights, transformers, etc. shall be an IDOT FA-01, FA-02 or that approved by the Engineer.

125-2.13 OTHER ELECTRICAL EQUIPMENT. Junction boxes, transformers, circuit breakers, and all other regularly used commercial items of electrical equipment not covered by FAA equipment specifications shall conform to the applicable rulings and standards of the Institute of Electrical and Electronic Engineers or the National Electrical Manufacturers Association. When specified, test reports from a testing laboratory indicating that the equipment meets the specifications shall be supplied. In all cases, equipment shall be new and a first-grade product. This equipment shall be supplied in the quantities required for the specific project and shall incorporate the electrical and mechanical characteristics specified in the proposal and plans.

CONSTRUCTION METHODS

125-3.1 GENERAL. The installation and testing details for the systems shall be as specified in the latest revision of the applicable FAA Advisory Circulars.

New edge lights, threshold lights and signs shall conform to the details and dimensions shown in the plans.

125-3.2 PLACING LIGHTS. The light fixtures shall be installed at the approximate location indicated in the plans. The exact location shall be as directed by the Resident Engineer.

The Contractor shall exercise caution in the installation of all light units. Any units damaged by the Contractor's operations shall be repaired or replaced to the satisfaction of the Engineer at no additional cost to the contract.

125-3.3 MAINTENANCE OF AIRFIELD LIGHTING DURING CONSTRUCTION. The Contractor shall maintain lighting of the runway and taxiways during the various phases of the work as shown on the sequence of construction or as directed by the Engineer.

The Contractor shall be responsible for all temporary connections in the field or at the regulator necessary for operation of the circuits during construction.

METHOD OF MEASUREMENT

125-4.1 The quantity of lights to be paid for under this item shall be the number of each type installed as completed units in place, ready for operation, and accepted by the Engineer.

BASIS OF PAYMENT

125-5.1 Payment will be made at the contract unit price for each complete light installed in place by the Contractor and accepted by the Engineer. This price shall be full compensation for furnishing all materials and for all preparation, assembly, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete this item.

DIVISION VII- TESTING

ITEM 611 COMPACTION CONTROL TESTS

GENERAL

611-1.1 DESCRIPTION. This specification shall govern the determination of the maximum density, field density, and percent compaction of those materials for which a minimum percent compaction is specified. It covers the basic procedures to be followed in performing the test for maximum density, field density, and percent compaction. In all cases density shall be stated as the dry weight in pounds per cubic foot.

611-2.1 MAXIMUM DENSITY. Maximum density is defined as the maximum dry weight in pounds per cubic foot obtained when a material is mixed with different percentages of water and compacted in a standard manner. The percentage of water at which maximum density is obtained is termed the optimum moisture content.

611-2.2 LABORATORY COMPACTION TESTS. The maximum density shall be determined by the appropriate method shown below:

- A. Where All of the Material Passes a No. 4 Sieve. Use ASTM D 1557, Method A (or B) for areas designed for aircraft weighing 60,000 pounds or more, and ASTM D 698, Method A (or B) for areas designed for aircraft weighing less than 60,000 pounds.
- B. Where the Material Contains Particles Larger Than a No. 4 Sieve. Use ASTM D 1557, Method C (or D) for areas designed for aircraft weighing 60,000 pounds or more and ASTM D 698, Method C (or D) for areas designed for aircraft weighing less than 60,000 pounds.
- C. Where the Material Contains Particles Larger than 3/4 Inch. Follow the replacement procedure given in the note under Method C of ASTM D 698 or D 1557.

611-3.1 FIELD DENSITY. Field density refers to the dry density expressed in pounds per cubic foot of a layer of compacted material in place at the site as determined by a sample representative of the compacted layer. The field density shall be determined in accordance with ASTM D 1556, ASTM D 2167, ASTM D 2922 or other methods approved by the Engineer.

611-4.1 PERCENT COMPACTION. The percent compaction is defined as the density of the compacted layer expressed as a percentage of the maximum density of the material when tested in accordance with these specifications.

611-4.2 COMPUTATION. The percentage of compaction is computed by the formula:

$$\text{Percent compaction} = \frac{\text{Field density}}{\text{Maximum density}} \times 100$$