CITY OF CHICAGO
DEPARTMENT OF AVIATION
CHICAGO O'HARE INTERNATIONAL AIRPORT
REHABILITATION FOR TAXIWAYS Y, Y1, Y2, Y3, Y4

PART THREE OF THREE
TECHNICAL SPECIFICATIONS

SPECIFICATION NO.: 1217758

PROJECT NO.: H6237.21-00

A.I.P. PROJECT NO.: TBD

CITY OF CHICAGO
Lori E. Lightfoot,
Mayor

DEPARTMENT OF AVIATION
Jamie L. Rhee
Commissioner

Issued by:

DEPARTMENT OF PROCUREMENT SERVICES
Shannon E. Andrews
Chief Procurement Officer

MARCH 31, 2021
ISSUED FOR BID

REHABILITATION FOR TAXIWAYS Y, Y1, Y2, Y3, Y4

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REHABILITATION FOR TAXIWAYS Y, Y1, Y2, Y3, Y4

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PROJECT REQUIREMENTS
SECTION 01010

PART 1 - DESCRIPTION

1.01 SCOPE OF WORK

A. Work under this Contract consists of furnishing all labor, materials, tools, equipment, transportation and service for the Rehabilitation of Taxiway Y and associated connecting taxiways at O'Hare International Airport, as shown on the Plans and for the Work shown under all Sections of the Technical Specifications subject to the requirements of the Contract Documents, including all appurtenant Work and accessories, to the complete satisfaction, approval and acceptance by the Commissioner. The Work is to be performed under a unit price basis Contract. The Work under this contract includes but is not limited to:

1. Milling and resurfacing Taxiway Y pavement, including the pavement shoulders.

2. Milling and resurfacing of portions of Taxiways Y1, Y2, Y3, Y4.

3. Replacement and adjustment of taxiway centerline, and RWSL lights; installation of new of taxiway edge lights at Taxiway Y3 fillet; construction of electrical manhole and associated ductbank; and pulling new homeruns for airfield circuits.

4. Widening of existing Taxiway Y3 fillet at intersection with Taxiway Y; construction of full-depth bituminous taxiway pavement, shoulders, storm sewers, underdrain, and infield grading and shaping.

5. Repair of various existing pavement areas.

6. Pavement markings for Taxiway Y and associated connecting taxiways, as shown on the plan.

7. Remove non-compliant airfield signage and appurtenances along Taxiway Y and associated connecting taxiways and replace with CDA-provided, compliant airfield signs.

1.02 COMMISSIONER'S REPRESENTATIVE

A. The Commissioner's representative on this Project is Connect Chicago Alliance. A Resident Engineer will be assigned to the Project. All contacts, inquiries, correspondence, and all submittals of any type,

including but not limited to schedules, shop Drawings, Project data and samples, must be sent exclusively to the Resident Engineer unless otherwise directed by the Resident Engineer. The only exceptions are for notices that are required in the General Conditions - Part Two of the Contract, which are to be sent to the Chief Procurement Officer with copies of such notices sent to the Resident Engineer.

1.03 ARCHITECT/ENGINEER

A. The Architect/Engineer on this Project is exp U.S. Services Inc. The Contractor must not have any direct contact with the Architect/ Engineer, regarding this Project before or after Contract award. All inquiries regarding the Contract Documents must be made to the Resident Engineer only.

1.04 DIRECTOR/COMMISSIONER

A. Where the Contract Documents refer to Commissioner or Director, it will be understood to be interchangeable and mean the Commissioner of the Chicago Department of Aviation (CDA), or their designated representative.

1.05 USE AND ADOPTION OF IDOT SSRBC

A. Where the Illinois Department of Transportation "Standard Specifications for Road and Bridge Construction" (IDOT SSRBC) is adopted or referenced in the CDA technical specifications and standards, the following interpretations and translations will apply:

1. Where the SSRBC refer to "Engineer", it will be understood to mean "Commissioner".

2. Where the SSRBC refer to "Engineer" for required tests and inspection, it will be understood to mean "Contractor".

3. The Contractor will perform the Quality Control (QC) tests and inspections, the Commissioner will perform the Quality Assurance (QA) as specified in the SSRBC.

4. Unless otherwise indicated in the CDA specification, the SSRBC method of measurement and basis of payment will not apply.

5. The SSRBC must be the current (or latest revision).

B. Reference use of the SSRBC will include the current IDOT Supplemental Specifications and Recurring Special Provisions and Policy Memorandums.

C. The above interpretations and provisions will apply and govern all specifications and standards where IDOT SSRBC is adopted or referenced, regardless of whether the individual specification fully defined them or not.

1.06 TYPICAL SUBGRADE PREPARATION FOR MISCELLANEOUS STRUCTURES

A. In addition to the requirements shown on the Drawings, the Contractor must verify the required minimum allowable bearing on the subgrade beneath miscellaneous structures including storm and sanitary sewer manholes, catch basins, junction chambers, valve basins, and electrical manholes and handholes and other structures as directed by the Commissioner.

B. Contractor QC to verify bearing to 3 feet minimum or to depth as directed by the Commissioner.

C. The cost of verifying the required bearing will be considered included and incidental to the price of the structure.

1.07 SCHEDULED WORK HOURS

A. The Contractor should anticipate that all Work, except as noted otherwise in the Contract Documents, will be Night Time Work to be performed during the hours of 10:30 p.m. to 6:00 a.m. central time, or as allowed by the restrictions noted in the plans and the approved Construction Safety and Phasing Plan (CSPP).

B. Work schedule may be restricted due to operational impacts including impacts to instrument flight rules (IFR) due to construction equipment heights or proximity to runway surfaces and NAVAID equipment, or the O'Hare FlyQuiet program. Night Work may be required where working height penetrates above the PART 77 contours, unless otherwise specifically allowed by the Commissioner. Requests for closure of any movement area to facilitate any and all work, including night work, must be coordinated and scheduled during the weekly ORD Short-Term Operational Phasing (STOP) meeting.

C. For other restrictions that may affect scheduling, refer to the "Standard Notes on General Requirements," Part One "Instructions and Execution Documents," and Contract Documents.

1.08 PERMIT REQUIREMENTS

A. In addition to the General Conditions (Part 2), Article III – Property, Item E – Permits and Licenses, the following permits are required to be obtained by the Contractor:

1. FAA_7460-1 Notice of Proceed Construction or Alteration.

2. City of Chicago Department of Water Management. (CDWM) Sanitary and Storm Installation Permit.

B. The Contractor must include in the Baseline Schedule:

1. All permits required for the Work.

2. Tasks for the submittal of each permit application to the Commissioner thirty (30) days in advance of the milestone submittal to the appropriate agency for permit. This thirty day duration is for the review of the application by the Commissioner. The content and accuracy of each permit application is solely the Contractor's responsibility.

C. Submittals:

1. Schedule of permits for the Work to be submitted during mobilization.

2. Copy of each permit application and all correspondence associated with the permit application and permit approval.

1.09 WORKFORCE DEVELOPMENT PROVISIONS FOR CDA FEDERALLY FUNDED PROJECTS

A. Employment Outreach Requirements:

1. The City is committed to improving access to employment for low income individuals and residents of socio-economically disadvantaged areas. To this end, the City supports and encourages the promotion of work opportunities to Chicago residents living in socio-economically disadvantaged areas. Contractor is strongly encouraged to employ residents of socio-economically disadvantaged areas and other low-income individuals.

2. The City is also committed to connecting veterans to employers, and employers to veterans. Therefore, the Contractor is reminded of its obligations under 49 USC 47112(c) (Veteran's

Preference) and is encouraged to employ Chicago veterans and partner with the City's Office of Veterans Affairs to advertise job openings, obtain resumes, and promote general hiring outreach.

3. No later than the Notice to Proceed Date, the City may identify Socio-Economically Disadvantaged Areas. Contractor must conduct a minimum of one job fair in each of up to three Socio-Economically Disadvantaged Areas (to be identified by the City) to foster hiring employees from such areas. The job fairs are to be held no later than 30 days following the Notice to Proceed unless otherwise agreed by the City. Job fairs must include contractor's subcontractors to the extent practicable. Contractor must also participate in any City-sponsored job fairs or similar outreach events as reasonably requested by the City, including but not limited to job fairs for veterans. Nothing in this section prohibits Contractor from conducting additional job fairs in other locations or at other times. Pay Item 01010-02, "Allowance for Workforce Development" will cover the actual cost of renting a City approved hall or venue for Community Outreach Activities. This allowance will be measured for payment in accordance with Article X, "Changes in the Work," of Part 2 – General Conditions. Contractor must provide the cost estimate with name of hall or venue for the City's approval. All other work for conducting community outreach is considered incidental to the Contract.

4. For any new hires of Contractor or its Subcontractors, Contractor or Subcontractors must provide job postings or employment listings to area workforce development groups or agencies as identified by the City, assist agencies, and the City's Office of Veterans Affairs.

5. In order to help promote the efficiency of the Work, Contractor must designate and identify a member of its team as an Employment Services Coordinator who will be assigned to assist employees, particularly new hires who are low income or are from Socio-Economically Disadvantaged Areas, or employees who are veterans, regarding access to information and social services that may help them be successful employees.

6. The Employment Services Coordinator will also serve as a liaison between the Contractor and social services organizations, assist agencies, workforce development groups or agencies, and labor organizations to help Contractor advertise job openings, obtain resumes, and plan and execute job fairs in Socio-Economically Disadvantaged Areas in order to promote hiring outreach throughout Chicago and especially in Socio-Economically

Disadvantaged Areas. Likewise, the Employment Services Coordinator will also serve as a liaison between the Contractor and the City's Office of Veterans' Affairs and other veterans' affairs organizations to promote the employment of veterans.

7. Contractor must report to the City in a form acceptable to the Commissioner regarding its efforts under this section, and also the number of employees ultimately hired who are veterans or are from Socio-Economically Disadvantaged Areas.

B. Employment Plan:

1. No later than twenty business days after contract award Contractor must provide a written plan outlining the steps it intends to take to ensure compliance with its Equal Employment Opportunity obligations as well as its plans for outreach to veterans and to workers in Socio-Economically Disadvantaged Areas.

C. Sustainable Airport Commuting:

1. In accordance with CDA's commitment to sustainability and reducing carbon emissions associated with the airport, as well as reducing construction related traffic impacts on the traveling public, Contractor and its Subcontractors must encourage employees to access their jobs at the Airport by using public transportation. To this end, an allowance amount has been established for Contractor to provide a shuttle bus free to workers on the project between, at minimum, the worksite and the CTA Blue Line Rosemont station under Pay item 01010-02, "Allowance for Workforce Development". This allowance will be limited to the Contractor's actual costs of operating the shuttle bus, and will be measured for payment in accordance with Article X, "Changes in the Work," of Part 2 – General Conditions. Contractor must provide a shuttle bus plan, including cost estimates, for the City's approval within twenty days of contract award.

1.10 MATERIAL STOCKPILE (FOR CONTRACTOR'S USE) AND EQUIPMENT STORAGE

A. Material stockpiled for the Contractor's use must only be in locations designated as the construction staging areas shown on the Plans or directed by the Commissioner.

B. The storage of equipment, when not in use, must be located in areas and in such a manner which must not interfere with normal operations of the Airport. Locations selected for collection of debris and/or storage of equipment and material must be approved by the Commissioner.

1.11 SOIL BORINGS

A. Where applicable, subsurface soil investigations from referred drawings are included in the Plans. Additional sub-surface soil investigations are available at the Commissioner's office. Data is for general information for the Contractor only. The Commissioner will not assume responsibility for variations of subsoil conditions.

1.12 BENCH MARKS

A. The Contractor must use established bench marks and other reference points. The Contractor must replace same if they are destroyed or disturbed in any manner, due to Contractor operations.

1.13 CLEANING

A. Maintain all paved areas free from all dirt, dust, and debris.

PART 2 - PRODUCT (NOT USED)

PART 3 - EXECUTION (NOT USED)

PART 4 - METHOD OF MEASUREMENT

4.01 MEASURMENTS

A. Allowance for CDA/FAA Facility Modifications: An allowance has been established for updates of CDA systems or infrastructure. Work will be measured for payment in accordance with Article X, "Changes in the Work," of Part 2 – General Conditions. Unused portions of this allowance will not be paid to the Contractor, but will be returned to the City in the form of an appropriate credit.

B. Allowance for Workforce Development is as measured under Section 1.09A.3 and 1.09B of this specification. Unused portions of this allowance will not be paid to the Contractor, but will be returned to the City in the form of an appropriate credit.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENTS

A. Allowance for CDA/FAA Facility Modifications: Necessary and related work to CDA and FAA modifications, updates of systems or infrastructure, as directed by the Commissioner, will be paid from the Contract Allowance in accordance with this Section, and must be authorized by the Commissioner prior to beginning the Work. The Contractor must receive written notice from the Commissioner and Chief Procurement Officer to proceed with the Work. The Work will be paid for as shown in Article X, "Changes in the Work," of Part 2 - General Conditions. Upon completion of the Project, any remaining balance in this Allowance will be returned to the City in the form of an appropriate credit.

B. Allowance for Workforce Development: Contractor will be paid for actual costs associated with renting a hall or venue approved by the City for community outreach activities and providing contractor shuttle bus service from the CTA to the work site. All other work for community outreach activities is considered incidental to the Contract. The Work will be paid for as shown in Article X, "Changes in the Work," of Part 2 - General Conditions. Upon completion of the Project, any remaining balance in this Allowance will be returned to the City in the form of an appropriate credit.

PART 6 - Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
01010-01	ALLOWANCE FOR CDA/FAA FACILITY MODIFICATIONS	AL
01010-02	ALLOWANCE FOR WORKFORCE DEVELOPMENT	AL

END OF SECTION 0101

AIR QUALITY – EQUIPMENT EMISSIONS
SECTION 01111

PART 1 - GENERAL

1.01 SUMMARY

A. The diesel emissions of vehicles and equipment used for work pertaining to this Contract shall be in accordance with Section 2-92-595 of the Chicago Municipal Code ('Code") with exceptions as noted in this Specification Section.

B. This Section includes use and tracking requirements and procedures for compliance with certain sustainable design guidelines based on the Chicago Department of Aviation Sustainable Airport Manual (SAM), current version. References can be found at www.airportsgoinggreen.org.

C. This Section includes tracking requirements and forms necessary for compliance with this Specification and in accordance with the requirements of Credit 7.1 of the Design & Construction Chapter of the SAM.

1.02 RELATED DOCUMENTS

A. Section 2-92-595 "Clean Diesel Contracting" of the Chicago Municipal Code (attached at the end of this specification section)

B. Additional information can also be found on the City's website at http://www.cityofchicago.org/city/en/progs/env/clean-diesel.html including federal and state grant and rebate programs to help defray costs to repower or retrofit diesel equipment.

C. Section 9-80-095 "Idling Reduction" of the Chicago Municipal Code

1.03 PERFORMANCE REQUIREMENTS

A. The Contractor will adhere to Section 2-92-595 of the City of Chicago Municipal Code with exceptions as noted in this Specification Section.

1.04 SUBMITTALS

A. In addition to submittal requirement pursuant to the Section 2-92-595 of the City of Chicago Municipal Code, the Contractor must transmit the

submittals described below to the Commissioner/Construction Manager and to the following email address: samdocs@cityofchicago.org.

B. The Contractor shall submit documentation pursuant to 2-92-595 of the Code with the following additions:

1. The Contractor shall submit a Diesel Emissions Compliance Plan (see 1.04C) prior to the Contractor's initial Application for Payment for Mobilization.

2. The Chicago Department of Aviation Diesel Emissions Compliance Form (attached at the end of this Specification and available electronically at www.airportsgoinggreen.org) shall be submitted monthly with the Contractor's Application for Payment.

3. The Contractor shall submit a final Chicago Department of Aviation Diesel Emissions Compliance Form with the Closeout Documentation.

C. Diesel Emissions Compliance Plan: The Plan shall be developed by the Contractor and shall be submitted to the Commissioner for review with the Contractor's Application for Payment for Mobilization: The Plan shall include the following sections, at a minimum:

1. General: Provide an overall strategy for complying with the requirements of this specification with the Project.

2. Contractor Identification: List names, addresses, and telephone numbers of the Contractor and all subcontractors operating equipment listed in the report. Identify any contractors or subcontractors that have a clean fleet score annual waiver as defined in Section 2-92-595 (a)(4).

3. Equipment Identification: Indicate anticipated types and quantities of equipment, applicable to this specification, using the Diesel Emission Compliance Form to calculate the pre-construction estimate of the clean fleet score for the Project.

D. Diesel Emissions Compliance Submittal Transmittal: When submitting the documentation to the Commissioner as required in Paragraphs 1.04B and 1.04C, the Contractor must complete the Submittal Transmittal Cover Sheet attached at the end of this Specification section and attach this with the appropriate submittal.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications: Diesel emissions reporting as it pertains to this specification must be performed only by a qualified Contractor. The term qualified means experienced in performing the Work required by this Section. The qualified Contractor must have experience on Projects similar in size and scope to this Project. The Contractor will submit evidence of such qualifications (e.g. Project list, timeframe, diesel equipment emission compliance reports) upon request by the Commissioner.

B. Regulatory Requirements: In addition to City Ordinances regarding diesel emission requirements described herein, Contractor will comply with emission requirements of authorities (e.g. state, local, or federal) having jurisdiction.

1.06 SPECIAL REQUIREMENTS

A. (Not Used)

PART 2 - PRODUCTS

2.01 FUEL USE REQUIREMENTS

A. The fuel use requirements apply to all off-road vehicles and equipment utilized by Contractors, Subcontractors and Suppliers.

B. The fuel use requirements apply to all on-road vehicles and equipment utilized by Contractors, Subcontractors and Suppliers.

C. The Contractor must utilize Ultra Low Sulfur Diesel (ULSD) for all diesel-powered vehicles and equipment (both mobile and stationary) with engine horsepower ratings of 50 hp or more that are utilized on the Project site. The ULSD must conform to the American Society of Testing and Materials (ASTM) D975 with the following additional specifications:

1. ASTM D5453 15 ppm Sulfur maximum

2. ASTM D6078 Lubricity (Scuffing Load Ball-on-Cylinder Lubricity Evaluator - SBOCLE) 3100g minimum

3. ASTM D613 Cetane 45 minimum

2.02 EQUIPMENT TECHNOLOGY REQUIREMENTS

A. The equipment technology requirements apply to all off-road vehicles and equipment utilized by Contractors, Subcontractors and Suppliers.

B. These requirements do not apply to on-road vehicles and equipment; however, Contractors, Subcontractors and Suppliers that transport materials regularly to and from the Project site are encouraged to follow these requirements to the best of their ability.

C. Requirements:

1. All off-road diesel-powered vehicles and equipment (both mobile and stationary), as applicable, with engine horsepower ratings of 50 hp or more, must install and/or retrofit with emissions control devices that will reduce emissions prior to utilization of said equipment on the Project. The retrofit emission control devices must consist of diesel oxidation catalysts, diesel particulate filters or similar retrofit equipment control technology that:

   a. is included on the EPA Verified Retrofit Technology List (http://www.epa.gov/otaq/retrofit/retroverifiedlist.htm) or verified by the California Air Resources Board (CARB) (http://www.arb.ca.gov/diesel/verdev/verdev.htm) or

   b. meets one of the following diesel emission control devices as defined in Section 2-92-595 of the Chicago Municipal Code:

      (1) "Level 1 Control" is defined as an emission control device that achieves a particulate matter (PM) emission reduction of 25% or more.

      (2) "Level 2 Control" is defined as an emission control device that achieves a PM emission reduction of 50% or more.

      (3) "Level 3 Control" is defined as an emission control device that achieves a PM emission reduction of 85% or more.

2. Per Section 2-92-595 of the Chicago Municipal Code, diesel equipment emissions for all applicable equipment used in the performance of the contract shall be calculated using the clean fleet score (CFS) calculation described in 2-92-595 (c)(3) and included on the Diesel Emissions Compliance Form.

3. Per Section 2-92-595 of the Chicago Municipal Code, compliance with diesel equipment emissions shall be measured as described in 2-92-595 (b) using the average CFS for all diesel equipment used in the performance of the contract.

   a. After January 1, 2014, the average CFS shall be a minimum of 2.1.

   b. After January 1, 2017, the average CFS shall be a minimum of 3.0.

   c. After January 1, 2020, the average CFS shall be a minimum of 4.0.

D. Biodiesel must meet the requirements of ASTM D 6751. Any heavy-duty diesel vehicle, non-road diesel vehicle, or non-road equipment meeting the requirements of 2-92-595 (c)(3)(i) to (c)(3)(vii) that uses only a biodiesel blend of B20 (20% by volume of biodiesel in petroleum-based diesel) or greater during the reporting period can increase its clean fleet score by 0.5 points.

2.03 INTERPRETATION OF REQUIREMENTS

A. The interpretation of these requirements and any determination of lack of compliance with these requirements may be made the subject of a claim to the Commissioner. However, the Commissioner's decision will be final. The Contractor may not file a dispute under Article XVII of Part 2 General Conditions.

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement the Diesel Emission Compliance Plan as approved by Commissioner. All vehicles and equipment to which this requirement is applicable will be subject to random inspections to ensure full compliance with these requirements. If any equipment is found to be non-compliant, the Contractor, Subcontractor or Supplier must remove or retrofit this equipment or vehicle within 24 hours or be subject to possible impoundment by the Chicago Department of Aviation until that piece of equipment or vehicle is removed from the Project.

B. Throughout the Project, the Contractor will submit a certified monthly fuel report to the Commissioner, which lists the supplier and the amount of fuel delivered to each piece of equipment and each vehicle used on the Project to which the fuel use requirements apply (refer to template

"Contractor Monthly Fuel Usage Summary Report"). The Commissioner has the option, in addition to any other remedies available to the City, to withhold monthly progress payments until such time as the Contractor submits the required information.

Prior to the start of construction the Contractor must submit in writing a list of equipment to the Commissioner that will be utilized as part of the Project for inspection to ensure that all of these requirements have been implemented. Equipment and vehicles brought on-site over the course of the Project must be submitted in writing on or before the date the equipment or vehicle is delivered to the site. The list(s) must include the following:

1. Contractor/sub-contractor name,

2. Equipment number, type, make, model, year, horsepower rating, and VIN,

3. EPA tier-rule compliant level or the emission control device make, model and EPA or manufacturer verification letter.

4. The Commissioner has the option, in addition to any other remedies available to the City, to withhold monthly progress payments until such time as the Contractor submits the required information.

C. Diesel Equipment Coordinator: Assign a Diesel Equipment Coordinator to be a single point of contact responsible for implementation, monitoring, and reporting of the diesel emission compliance requirements. Coordinator must be present for the duration of the Contract.

D. Training: Contractor is responsible for training workers, subcontractors, and suppliers on diesel emission compliance requirements as applicable to this Contract. Distribute the Diesel Emissions Compliance Plan to all subcontractors and suppliers when Contract work begins.

E. Idling Restrictions

1. Idling of diesel powered vehicles and equipment must not be permitted during periods of non-active vehicle use. Diesel powered engines shall not be allowed to idle for more than three consecutive minutes in a 60-minute period when the equipment is not in use, occupied by an operator, or otherwise in motion, except only as follows:

a. When equipment is forced to remain motionless because of traffic conditions or mechanical difficulties over which the operator has no control

b. When it is necessary to operate auxiliary systems installed on the equipment, only when such system operation is necessary to accomplish the intended use of the equipment

c. To bring the equipment to the manufacturers recommended operating temperature

d. When the ambient temperature is below forty (40) degrees F or above eighty (80) degrees F, or

e. When equipment is being repaired.

2. The use of idling reduction devices is encouraged. Idle reduction technology allows engine operators to refrain from long-duration idling of the main propulsion engine by using an alternative such as automatic engine shutoff, direct-fired/fueled heaters, auxiliary power units or electrified heat/air conditioning units. An idle reduction technology is generally defined as the installation of a technology or device that:

a. Reduces unnecessary main engine idling of the vehicle or equipment and /or

b. Is designed to provide services (e.g., heat, air conditioning and/or electricity) to the vehicle or equipment that would otherwise require the operation of the main drive equipment while the vehicle or equipment is temporarily parked or remains stationary.

F. Clean Buses/Light Duty Vehicles

1. Contractors are to incorporate, to the greatest extent possible, any other measures that may assist in reducing air quality emissions during the performance of the contract. For example, many cleaner vehicle options now exist for employee shuttle buses and Light Duty Vehicles (LDVs) including compressed natural gas (CNG), hybrid (fuel/electric), flex fuel, biodiesel (B20 or greater), and demand on displacement. The availability of cleaner vehicle options is anticipated to expand over time and over the course of the Project. Contractors working on the Project are strongly encouraged to consider these options when making purchase decisions.

2. Each Shuttle Bus used in the performance of this contract must be outfitted with a functioning idle-shutdown timer to automatically shut down the vehicle's engine after three minutes of idling. Idle-reduction devices must allow for the elimination of unnecessary idling while providing for the comfort and safety of the driver and passengers. Such equipment may include, but is not limited to, additional battery storage, auxiliary fuel-fired heaters; auxiliary battery powered air conditioners and packaged auxiliary-power-unit solutions. The Contractor must strictly enforce a no-idling policy on all drivers involved in performance of this contract while ensuring that vehicle scheduling and on-board idle-reduction equipment function to reduce any need for idling.

3. See also SAM Credit 7.8 – Alternative Transportation During Construction.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Air Quality - Equipment Emission Compliance will not be measured separately for payment, but will be considered included in the overall Contract.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. All costs associated with meeting these requirements are included in the overall Contract. No additional time or monies will be granted to the Contractor for compliance with these requirements and any associated regulations.

END OF SECTION 01111

CHICAGO DEPARTMENT OF AVIATION

01111 AIR QUALITY - EQUIPMENT EMISSIONS

SUBMITTAL TRANSMITTAL COVER SHEET

Date: _____

Project: _____

WBS No. _____

Attention: Construction Manager

To: O'Hare Modernization Program
10501 W. Zemke Blvd.
Chicago, Illinois 60666

and via email to:
samdocs@cityofchicago.org

The following form(s) are submitted to comply with the requirements of the Specification Section 01111 Air Quality – Equipment Emissions (Check one):

☐ Diesel Emission Compliance Plan and Pre-Construction Diesel Emission Compliance Form

☐ Monthly Diesel Emission Compliance Form

☐ Final Diesel Emission Compliance Form

From:	
Company:	
Printed Name:	
Title:	
Signature:	
Date:	

Reviewed by:	
	Resident Engineer

Note: These submittal requirements are in addition to the requirements put forth by the City of Chicago as outlined in Section 2-92-595 of the Chicago Municipal Code.

Submittal Date: ______________________

Reporting Period: ______________________

Contractor Information 2-92-595 (c)(2)(i)	
Contractor	
Contact Person	
Address	
Telephone	

Contractor's/Sub's Equip. No.	Equipment Information 2-92-595 (c)(2)(ii)							
	Type	Make	Model	Year	HP	Fuel Type	VIN	Hours of Operation

EPA Compliance 2-92-595 (c)(2)(iii)
EPA Tier Rule Compliant Level

or

Emission Control Device 2-92-595 (c)(2)(iv)					
Make	Model	Emission Control Device Used	EPA or Manufacturer's Verification Letter?	Model No.	Serial No.

	City of Chicago Compliance 2-92-595 (c)(2)(v)
	Clean Fuel Score (CFS)
Average CFS	#DIV/0!

Certification Statement 2-92-595 (c)(2)(vi)
In connection with the above captioned project: I, (name), (title) of (company name), do hereby state that the information as it is portrayed above on this Diesel Emissions Compliance Report conforms to Chicago Municipal Code 2-92-595 and is a true and ac

Company ______________________

Print Name ______________________

Title ______________________

Signature ______________________

Date ______________________

REVIEWED BY: ______________________
(Resident Engineer)

Office of Chicago City Clerk

O2011-1418

Office of the City Clerk

Tracking Sheet

Meeting Date:	3/9/2011
Sponsor(s):	Mayor Daley
Type:	Ordinance
Title:	Amendment of Chapter 2-92 of Municipal Code by adding new Section 595 regarding requirements associated with diesel equipment use
Committee(s) Assignment:	Committee on Energy, Environmental Protection and Public Utilities

ENERGY

OFFICE OF THE MAYOR

CITY OF CHICAGO

RICHAHD M. DALEY
MAYOR

March 9, 2011

TO THE HONORABLE, THE CITY COUNCIL
OF THE CITY OF CHICAGO

Ladies and Gentlemen:

At the request of the Commissioner of the Environment, I transmit herewith an ordinance amending the Municipal Code regarding requirements associated with diesel equipment use.

Your favorable consideration of this ordinance will be appreciated.

Very truly yours,

Mayor

ORDINANCE

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF CHICAGO:

SECTION I. Chapter 2-92 of the Municipal Code of Chicago is hereby amended by inserting a new section 2-92-595, as follows:

2-92-595 Clean diesel contracting.

(a) Definitions. For purposes of this section, the following definitions shall apply:

(1) "Biodiesel" means a fuel comprised of mono-alkyi esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100, and meeting the requirements of the American Society for Testing Materials ("ASTM") D 6751.

(2) "Biodiesel blend" means a blend of biodiesel meeting ASTM D 6751 with petroleum-based diesel fuel, designated BXX, where XX represents the volume percentage of biodiesel fuel in the blend.

(3) "CARS" means the California Air Resources Board.

(4) "Clean fleet score ("CPS") waiver grantee" means any construction firm to which the commissioner of environment has granted a clean fleet score annual waiver certificate pursuant to subsection (f) of this section.

(5) "Compression-ignition engine" means a reciprocating, internal-combustion engine that is not a spark-ignition engine.

(6) "Contract" means any contract, the amount of which is $2,000,000 or more, awarded by the city and whose cost is to be paid from funds belonging to or administered by the city, for construction projects including, but not limited to, the construction, demolition, restoration, repair, renovation, environmental remediation or environmental abatement of any building, structure, tunnel, excavation, roadway, bridge, transit station or parcel of land. The term "contract" does not include a fixed-price, fixed term, and indefinite quantity contract, such as contracts commonly referred to as "job order contracts," unless the estimated value of an individual order under the contract is $2,000,000 or more.

(7) "Contractor" means any person that enters into a contract with the city.

(8) "Department" means any city department or city agency that manages or supervises a contract awarded to a contractor.

(9) "Engine model year" means the year designating the annual new model production period during which the engine was produced, determined in accordance with 42 U.S.C. § 7521(b)(3), 40 C.F.R. § 86.082-2, 40 C.F.R. § 89.2, or 13 C.C.R. § 2421(a)(37) for purposes of compliance with US EPA or CARB emissions certification requirements and may differ from the model year of the vehicle or equipment powered by the engine.

(10) "Heavy-duty diesel vehicle" means a motor vehicle with a gross vehicle weight rating of at least 8,500 pounds that is powered by a compression-ignition engine and which is not a "heavy-duty alternative-fuel vehicle."

(11) "Heavy-duty alternative-fuel vehicle" means a motor vehicle with a gross vehicle weight rating of at least 8,500 pounds that is powered by an engine fueled at a minimum 80 percent, as measured by energy content, by natural gas, liquefied petroleum gas (commonly known as "propane"), hydrogen, or another fuel designated as an alternative fuel by the United States Department of Energy.

(12) "Level 1 Control" means a verified diesel emission control retrofit device that achieves a particulate matter (PM) emission reduction of 25 percent or more from uncontrolled compression-ignition engine emission levels.

(13) "Level 2 Control" means a verified diesel emission control retrofit device that achieves a particulate matter (PM) emission reduction of 50 percent or more from uncontrolled compression-ignition engine emission levels.

(14) "Level 3 Control" means a verified diesel emission control retrofit device that achieves a particulate matter (PM) emission reduction of 85 percent or more from uncontrolled compression-ignition engine emission levels.

(15) "Motor vehicle" means any self-propelled vehicle designed for transporting persons or property on a street or highway.

(16) "Non-road engine" means a fifty horsepower or greater compression-ignition engine: (i) in or on a piece of equipment that is self-propelled (such as a cart or truck that is not a motor vehicle) or serves a dual purpose by both propelling itself and performing another function (such as garden tractors, off-highway mobile cranes and bulldozers); or (ii) in or on a piece of equipment that is intended to be propelled while performing its function (such as pushed or towed equipment); or (iii) that, by itself or in or on a piece of equipment, is portable or transportable, meaning designed to be and capable of being carried or moved from one location to another. Indicia of transportability include, but are not limited to, wheels, skids, carrying handles, dolly, trailer, or platform. The term "non-road engine" does not include an engine that is used in a motor vehicle or vehicle used solely for competition, or in a stationary source, except that this term shall include compression-ignition engines used to power portable generators, portable compressors or similar equipment used in any construction program or project.

(17) "Non-road equipment" means equipment that is powered by a non-road engine.

(18) "Non-road vehicle" means a vehicle that is powered by a non-road engine and that is not a motor vehicle or a vehicle used solely for competition.

(19) "Reporting day" means the fifth day on which city business is transacted following the last working day of every reporting period.

(20) "Reporting period" means (i) every 60 working day period from the beginning of work on the contract; or (ii) the period between the first working day and the last working day, if the contract is completed in less than a 60 working

day period; or (iii) any period following the last day of the last 60 working day period up to and including the last working day, if such period consists of not more than 75 working days and, if such period consists of more than 60 working days, the contractor provides a written notice to the department before the 60th working day that such period will consist of more than 60 working days.

(21) "Solicitation" means the process used to communicate procurement requirements and to request responses from interested vendors.

(22) "Spark-ignition engine" means a gasoline-fueled engine or other engine with a spark plug (or other sparking device) and with operating characteristics significantly similar to the theoretical Otto combustion cycle and uses a throttle to regulate intake air flow to control power during normal operation.

(23) "Subcontractor" means any person that enters into a contract with a contractor to perform work on a contract.

(24) "Tier 1 Non-road Diesel Standards," "Tier 2 Non-road Diesel Standards," "Tier 3 Non-road Diesel Standards," or "Tier 4 Non-road Diesel Standards" means US EPA's Tier 1, Tier 2, Tier 3, or Tier 4 Non-road engine emission standards, respectively, as specified in 40 C.F.R. § 89.112(a), 40 C.F.R. § 1039.101, and 40 C.F.R. § 1039.102.

(25) "Ultra low sulfur diesel fuel" means diesel fuel that has a sulfur content of no more than fifteen parts per million.

(26) "US EPA" means the United States Environmental Protection Agency.

(27) "Verified diesel emission control retrofit device" means an emission control device or strategy that has been verified to achieve a specified diesel PM reduction by US EPA or CARB. "Verified diesel emission control retrofit device" does not mean the use of ultra low sulfur diesel fuel alone or a device installed by the engine manufacturer for purposes of compliance with US EPA or CARB emissions certification requirements.

(28) "VIN" means vehicle identification number.

(29) "Working day" means a day on which work is performed on a construction project site pursuant to a contract.

(b) *Emission reduction.* (1) Any solicitation for a contract advertised or otherwise communicated on or after June 1, 2011, and any contract entered into as a result of such solicitation shall include a specification that the contractor and any subcontractor, including a CFS waiver grantee, shall use ultra low sulfur diesel fuel for any heavy-duty diesel vehicle, non-road vehicle or non-road equipment used in the performance of the contract.

(2) Any solicitation for a contract advertised or otherwise communicated on or after June 1, 2011, and any contract entered into as a result of such solicitation shall include a specification that the contractor or any subcontractor, including a CFS waiver grantee, shall minimize idling of motor vehicles and non-road vehicles used in the performance of the contract during periods of inactivity and shall comply with the anti-idling requirements imposed by any applicable federal, state or local law.

(3) Any solicitation for a contract advertised or otherwise communicated on or after January 1, 2014, and any contract entered into as a result of such solicitation shall include a specification that any contractor or any subcontractor, including a CFS waiver grantee, shall not use any of the following vehicles and equipment in the performance of the contract:

(i) any heavy-duty diesel vehicle not meeting or exceeding the US EPA's emission standards for heavy-duty diesel vehicles for the 1998 engine model year, unless such vehicle is fitted with a verified diesel emission control retrofit device; or

(ii) any non-road vehicle or non-road equipment not meeting or exceeding the US EPA's Tier 1 Non-road Diesel Standards, unless such vehicle or equipment is fitted with a verified diesel emission control retrofit device.

(4) Any solicitation for a contract advertised or otherwise communicated on or after January 1, 2014, and any contract entered into as a result of such solicitation shall include a specification that the heavy-duty diesel vehicles, non-road vehicles and non-road equipment used in the performance of such contract must incorporate such engine or retrofit technology so that the contractor, through such engine or retrofit technology used directly by the contractor and all subcontractors, shall have a minimum of 2.1 clean fleet score per a reporting period, as calculated by using the methodology described in subsection (c)(5) of this section. Such solicitation and contract shall also include a specification that the contractor may exclude from the calculation of the clean fleet score all of the heavy-duty diesel vehicles, non-road vehicles and non-road equipment used in the performance of the contract during a reporting period that are owned or leased by any CFS waiver grantee.

(5) Any solicitation for a contract advertised or otherwise communicated on or after January 1, 2017, and any contract entered into as a result of such solicitation shall include a specification that the heavy-duty diesel vehicles, non-road vehicles and non-road equipment used in the performance of such contract must incorporate such engine or retrofit technology so that the contractor, through such engine or retrofit technology used directly by the contractor and all subcontractors, shall have a minimum of 3.0 clean fleet score per a reporting period, as calculated by using the methodology described in subsection (c)(5) of this section. Such solicitation and contract shall also include a specification that the contractor may exclude from the calculation of the clean fleet score up to fifty (50) percent of all the heavy-duty diesel vehicles, non-road vehicles and non-road equipment used in the performance of the contract during a reporting period that are owned or leased by any CFS waiver grantee.

(6) Any solicitation for a contract advertised or otherwise communicated on or after January 1, 2020, and any contract entered into as a result of such solicitation shall include a specification that the heavy-duty diesel vehicles, non-road vehicles and non-road equipment used in the performance of such

contract must incorporate such engine or retrofit technology so that the contractor, through such engine or retrofit technology used directly by the contractor and all subcontractors, shall have a minimum of 4.0 clean fleet score per a reporting period, as calculated by using the methodology described in subsection (c)(5) of this section. Such solicitation and contract shall also include a specification that the contractor may exclude from the calculation of the clean fleet score up to twenty-five (25) percent of all the heavy-duty diesel vehicles, non-road vehicles and non-road equipment used in the performance of the contract during a reporting period that are owned or leased by any CFS waiver grantee.

(c) Compliance. (1) Any solicitation for a contract advertised or otherwise communicated on or after January 1, 2014, and any contract entered into as a result of such solicitation shall include a specification that the contractor shall submit a written compliance plan to the department with respect to compliance with the requirements of this section within 14 days following the notice to proceed. The plan shall detail the strategy to be used by the contractor to comply with the requirements of this section. The chief procurement officer and the commissioner of environment are authorized to determine the contents of a compliance plan by rules and regulations promulgated pursuant to subsection (h) of this section.

(2) On every reporting day, the contractor must submit to the department a detailed report of all heavy-duty diesel motor vehicles, non-road vehicles and non-road equipment used in the performance of such contract during the reporting period preceding the reporting day. The report shall, on a form provided by the city, include the following:

(i) names, addresses, and telephone numbers of the contractor, any subcontractor, and the person responsible for the operation of the vehicles or equipment listed on the report;

(ii) for each heavy-duty diesel vehicle, the manufacturer, engine manufacturer, engine model year, VIN, the specific type of fuel that was used, and estimated hours of operation during the period covered by the report;

(iii) for each non-road vehicle and non-road equipment, the manufacturer, engine manufacturer, serial number or engine serial number, engine US EPA Tier rating, the specific type of fuel that was used, and estimated hours of operation during the period covered by the report;

(iv) for any heavy-duty diesel vehicle, non-road vehicle or non-road equipment fitted with a verified diesel emission control retrofit device, the retrofit device type, US EPA or CARB verification level and year of installation, in addition to the information required by subsections (c)(2)(ii) and (c)(2)(iii) of this subsection;

(v) a clean fleet score calculated in accordance with the provisions of this subsection; and

(vi) a certification that the contractor has met the requirements of this section and the terms of the contract specified pursuant to the provisions of this section.

(3) For the purpose of calculating a clean fleet score, each heavy-duty diesel vehicle, heavy-duty alternative-fuel vehicle, non-road vehicle and non-road equipment used in the performance of the contract shall be assigned a numerical value, as follows:

(i) 0 points for any heavy-duty diesel vehicle with an engine model year of 2003 or earlier not fitted with any verified diesel emission control retrofit device;

(ii) 0 points for any non-road vehicle and non-road equipment meeting US EPA's Tier 1 Non-road Diesel Standards and not fitted with any verified diesel emission control retrofit device;

(iii) 1 point for any heavy-duty diesel vehicle with an engine model year of 2004, 2005 or 2006 and not fitted with any verified diesel emission control retrofit device;

(iv) 1 point for any heavy-duty diesel vehicle, non-road vehicle and non-road equipment fitted with a Level 1 Control;

(v) 2 points for any non-road vehicle and non-road equipment meeting US EPA's Tier 2 Non-road Diesel Standards and not fitted with any verified diesel emission control retrofit device;

(vi) 2.25 points for any non-road vehicle and non-road equipment meeting US EPA's Tier 3 Non-road Diesel Standards and not fitted with any verified diesel emission control retrofit device;

(vii) 3 points for any heavy-duty diesel vehicle, non-road vehicle and non-road equipment fitted with a Level 2 Control;

(viii) 3 points for any heavy-duty alternative-fuel vehicle with an engine model year of 2004, 2005 or 2006;

(ix) 4 points for any heavy-duty diesel vehicle with an engine model year of 2007, 2008 or 2009 and not fitted with any verified diesel emission control retrofit device;

(x) 4 points for any heavy-duty alternative-fuel vehicle with an engine model year of 2007, 2008 or 2009;

(xi) 4 points for any non-road vehicle and non-road equipment meeting US EPA's Tier 4 Non-road Diesel Standards and not fitted with any verified diesel emission control retrofit device;

(xii) 4 points for any heavy-duty diesel vehicle, non-road vehicle or non-road equipment fitted with a Level 3 Control;

(xiii) 5 points for any heavy-duty diesel vehicle with an engine model year of 2010 or later;

(xiv) 5 points for any heavy-duty alternative-fuel vehicle with an engine model year of 2010 or later; and

(xv) 5 points for any heavy-duty diesel vehicle, non-road vehicle and non-road equipment fitted with a verified diesel emission control retrofit device exceeding the efficiency levels of a Level 3 Control to the

extent that the verified diesel emission control retrofit device provides emissions reductions equivalent to the US EPA requirements for heavy-duty diesel vehicles engine model year 2010.

(4) Each heavy-duty diesel vehicle, non-road vehicle and non-road equipment used in the performance of the contract shall be assigned only the maximum assigned point value for which it qualifies during one reporting period; provided, however, that the maximum assigned value for each heavy-duty diesel vehicle, non-road vehicle and non-road equipment listed in subsections (c)(3)(i) through (c)(3)(vii) of this section that consumed only a B20 or greater biodiesel blend during the reporting period shall be increased by one half point.

(5) The clean fleet score for each reporting period shall be calculated by adding the numerical point values allocated, in accordance with subsections (c)(3) and (c)(4) of this section, to each heavy-duty diesel vehicle, non-road vehicle and non-road equipment used in the performance of the contract during the reporting period and dividing the total numerical point values by the total number of all heavy-duty diesel vehicles, non-road vehicles and non-road equipment used in the performance of the contract during the reporting period; provided, however, the contractor may, to the extent specified in the contract pursuant to subsections (b)(4), (b)(5) and (b)(6) of this section, exclude from the calculation of the clean fleet score heavy-duty diesel vehicles, non-road vehicles and non-road equipment used in the performance of the contract during the reporting period that are owned or leased by all CFS waiver grantees.

(d) *Costs.* All costs associated with meeting the requirements imposed pursuant to this section are incidental to the overall contract. No additional time or monies will be granted to the contractor for compliance with the requirements imposed pursuant to this section and any regulations promulgated pursuant thereto.

(e) *Enforcement.* Any solicitation for a contract subject to the provisions of this section and any contract entered into as a result of such solicitation shall include terms necessary to enforce the provisions of this section, including, but not limited to, terms

(1) requiring the contractor and subcontractors to comply with the provisions of this section;

(2) specifying that any city agency may conduct an audit to verify the contractor's compliance with the requirements of this section and the terms of the contract specified pursuant to the provisions of this section;

(3) specifying that the commissioner or head of the department or the commissioner of environment or any other city agency designated by the commissioner or head of the department or the commissioner of environment is authorized to inspect or to have inspected any vehicle or equipment in order to ensure full compliance with contract requirements specified pursuant to subsections (b)(1), (b)(2), and (b)(3) of this section;

(4) specifying that in the event of violation of any of the specifications required pursuant to subsections (b)(1), (b)(2), and (b)(3) of this section, liquidated damages shall be assessed against the contractor in the amount of $5,000 for each violation and that each day of noncompliance shall be a separate violation; provided, however, the damages shall not exceed a total of $50,000 for any one vehicle or piece of equipment; that such liquidated damages are not imposed as a penalty but as an estimate of the damages that the city will sustain from delay in completion of the project and inspection and other enforcement costs, as well as the resultant damages to the public health of its citizens, which damages by their nature are not capable of precise proof; and authorizing the city to withhold and deduct from monies otherwise payable to the contractor the amount of liquidated damages due to the city;

(5) specifying that in the event the contractor has not met the minimum clean fleet score specified pursuant to subsections (b)(4), (b)(5) or (b)(6) of this section during any reporting period, liquidated damages shall be assessed against the contractor in the dollar amount that shall be calculated as follows:

(RCFS - ACFS) x $500.00 x the number of working days in the reporting period; where RCFS stands for the minimum required clean fleet score during the reporting period and ACFS stands for the actual clean fleet score obtained by the contractor in the reporting period.

Such solicitation or contract shall also specify that noncompliance during each reporting period shall be a separate violation; that such liquidated damages are not imposed as a penalty but as an estimate of the damages that the city will sustain from delay in completion of the project and inspection and other enforcement costs, as well as the resultant damages to the public health of its citizens, which damages by their nature are not capable of precise proof; and authorizing the city to withhold and deduct from monies otherwise payable to the contractor the amount of liquidated damages due to the city; and

(6) specifying that any person who knowingly makes a false statement of material fact to any city agency with respect to compliance with any of the contract requirements specified pursuant to any of the provisions of this section or rules and regulations promulgated thereunder shall be fined not less than $1,000.00 nor more than $5,000.00 for each such false statement. For purposes of this section, a person knowingly makes a false statement of material fact when such person makes a false statement of material fact as described in subsection (d) of section 1-21-010 of this Code.

(f) *Clean fleet score annual waiver.* (1) Any construction firm may apply to the commissioner of environment for a clean feet score annual waiver certificate. Applications for a clean feet score annual waiver certificate shall be on a form provided by the department of environment and shall be accompanied by a non-refundable application fee of $100.00. The

application shall also include all of the following information and statements which shall be verified by affidavit:

(i) list of all heavy-duty diesel vehicles, non-road vehicles and non-road equipment owned or leased by the applicant at the time of application, including the horsepower, and, to the extent applicable, the manufacturer, engine manufacturer, engine model year, VIN, serial number or engine serial number, and engine US EPA Tier rating of each of such vehicles and equipment (for purposes of this subsection, "listed vehicles and equipment");

(ii) a statement that the sum total horsepower of all of the listed vehicles and equipment is less than or equal to 2,500 horsepower (hp); and

(iii) a statement that repowering, replacing or retrofitting all or some of the listed vehicles and equipment in order to comply with contract requirements that shall be specified in accordance with the provisions of this section will cause the applicant to suffer an undue financial hardship.

(2) If, upon review of the application, the commissioner of environment or the commissioner's designee determines that the applicant has met all of the requirements set forth in subsection (f)(1) of this section, the commissioner is authorized to grant a clean feet score annual waiver certificate to the applicant.

(3) Any contractor may exclude from the calculation of the clean fleet score, to the extent allowed in subsection (b)(4), (b)(5), and (b)(6) of this section, the heavy-duty diesel vehicles, non-road vehicles and non-road equipment used in the performance of the contract during a reporting period that are owned or leased by any CFS waiver grantee.

(4) A clean fleet score annual waiver certificate granted pursuant to this subsection shall be valid as long as the grantee continues to qualify for such waiver; provided, however, no such waiver shall be valid for more than a one year period from the time it has been granted; and further provided that the commissioner may renew the clean fleet score annual waiver certificate for additional one year periods upon submission by the CFS waiver grantee of a statement verified by affidavit that any of the information and statements that the CFS waiver grantee submitted to the commissioner to qualify for the waiver are not changed.

(5) Any person who knowingly makes a false statement of material fact to the commissioner of environment with respect to a clean feet score annual waiver certificate application specified in this subsection or rules and regulations promulgated thereunder shall be subject to the penalties provided in section 1-21-010 of this Code. For purposes of this section, a person knowingly makes a false statement of material fact when such person makes a false statement of material fact as described in subsection (d) of section 1-21-010 of this Code.

(6) No clean fleet score annual waiver certificate shall be granted as of January 1, 2023.

(g) *Recordkeeping*. The contractor shall maintain copies of plans, reports and clean fleet scores prepared or calculated and submitted in accordance with subsections (c)(1) and (c)(2)

of this section for a period of three years after the completion of the contract, and, if requested by any city agency, shall make them available for the purpose of auditing.

(h) *Regulations.* The chief procurement officer and the commissioner of environment are authorized to jointly adopt rules and regulations they may deem appropriate for the administration and enforcement of the provisions of this section.

(i) *Scope.* (1) This section shall not apply to any contract to the extent that the requirements imposed by this section are inconsistent with procedures or standards required by any law or regulation of the United States or the State of Illinois to the extent such inconsistency is not permitted under the home rule powers of the city.

(2) Any contractor, subcontractor or CFS waiver grantee, performing a contract that the commissioner of aviation is authorized to enter into in relation to the design, construction, operation and maintenance of all public airports owned or operated by the city, including, but not limited to, O'Hare Modernization Program contracts, as the term "O'Hare Modernization Program" is defined in section 2-20-025(a) of this Code, shall comply with (i) the construction air quality specifications set forth in any such contract, and (ii) all contract requirements that shall be specified in accordance with the provisions of this section; provided, however, for the purpose of this subsection (i)(2)(ii), any contractor may exclude from the calculation of the clean fleet score the vehicles and equipment used in the performance of the contract during a reporting period that are owned or leased by any CFS waiver grantee to the extent allowed in subsection (b)(4), (b)(5), and (b)(6) of this section.

(j) *Sunset.* Unless otherwise provided by ordinance, the provisions of subsections (c)(1) and (c)(2) of this section shall expire on December 31, 2030.

SECTION II. This ordinance shall take effect 10 days after its passage and approval.

LOCAL / REGIONAL MATERIALS
SECTION 01355

PART 1 - GENERAL

1.01 SUMMARY

A. This Specification includes use and tracking requirements and procedures for compliance with certain sustainable design guidelines based on the latest version of the Chicago Department of Aviation Sustainable Airport Manual (SAM). Reference can be found at https://www.flychicago.com/community/environment/sam/Pages/default.aspx

B. This Section includes tracking requirements and forms necessary for compliance with this Specification and in accordance with the requirements of Credit 4.8 of the SAM.

1.02 DEFINITIONS

A. Regional Materials: Materials and products that are manufactured, extracted, harvested, or recovered within a radius of 500 miles from the Project location. Materials and products manufactured, extracted, harvested, or recovered beyond 500 miles from the Project location but purchased within 500 miles (e.g. through a product sales representative) shall not be considered a Regional Material.

B. Local Materials: Materials and products that are manufactured, extracted, harvested, or recovered within a radius of 250 miles from the Project location. Materials and products manufactured, extracted, harvested, or recovered beyond 250 miles from the Project location but purchased within 250 miles (e.g. through a product sales representative) shall not be considered a Local Material.

C. Manufacturing refers to the final assembly of components into the building product that is installed at the Project site.

D. Extracted, harvested, or recovered materials include raw building materials that are not manufactured but used in their final form at the Project site. This includes but is not limited to soil, aggregate, wood, salvaged masonry, and reclaimed concrete.

1.03 SUBMITTALS

A. Pre-Construction Estimate - Prior to the initial Application for Mobilization Payment, the Contractor shall submit an estimate that

identifies total Project material cost (less labor and equipment) and all Local/Regional Materials that are proposed for the Project. For each material, its source and cost shall be identified.

B. Final Construction Total - With the Closeout Documentation, the Contractor shall submit the final actual total Project material cost (less labor and equipment) and all Local/Regional Materials that were used for the Project. For each material, its source and cost shall be identified.

C. The above submittal must be transmitted to the Commissioner/ Construction Manager and to the following email address: samdocs@cityofchicago.org.

1.04 CALCULATIONS

A. Only include items in CSI Divisions 2-10 in the calculation of the percentage of materials obtained locally and/or regionally.

B. Mechanical, electrical, plumbing components, and specialty items (CSI Divisions 11-16) must not be included in this calculation.

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION

3.01 DOCUMENTATION TEMPLATE

A. Local/Regional Materials Pre-Construction Estimate – Template Form 01355-1.03B attached at the end of this Specification should be used by the Contractor as guidance for completion of the Local/Regional Materials submittal requirements as outlined in Part 1 of this Specification Section.

B. Local/Regional Materials Final Construction Total – Template Form 01355-1.03C attached at the end of this Specification should be used by the Contractor as guidance for completion of the Local/Regional Materials submittal requirements as outlined in Part 1 of this Specification Section.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Regional Materials will not be measured separately for payment, but will be considered included in the overall Contract.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. All costs associated with meeting these requirements are included in the overall Contract. No additional time or monies will be granted to the Contractor for compliance with these requirements and any associated regulations.

END OF SECTION 01355

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Local/Regional Materials Pre-Construction Estimate (01355-1.03B)

Contractor:
Project:
WBS No.:

Description of Material Spec Section / Item	Source of Material/Location	Total Construction Cost [$]	-	Labor (Subtract from Total) [$]	-	Equipment (Subtract from Total) [$]	=	Local Materials within 250 miles (per 01355-1.02A) [$]	Regional Materials within 500 miles (per 01355-1.02A) [$]
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Company:
Printed Name:
Title:
Signature:
Date:

Local/Regional Materials Final Construction Estimate (01355-1.03C)

Contractor: ______________________

Project: ______________________

WBS No.: ______________________

Contractor Certification

I, ______________________ (Contractor), declare the building materials and products as indicated are manufactured, extracted, harvested, or recovered locally/regionally (within 250/500 mile radius of the Project site).

Description of Material Spec Section	Item	Source of Material/Location	Total Construction Cost [$]	-	Labor (Subtract from Total) [$]	-	Equipment (Subtract from Total) [$]	=	Total Material Cost (Less Labor & Equipment) [$]	Local Materials within 250 miles (per 01355-1.02A) [$]	Regional Materials within 500 miles (per 01355-1.02A) [$]
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Company: ______________________

Printed Name: ______________________

Title: ______________________

Signature: ______________________

Date: ______________________

Reviewed by: ______________________
(Resident Engineer)

RECYCLED CONTENT
SECTION 01356

PART 1 - GENERAL

1.01 SUMMARY

A. This Specification includes use and tracking requirements and procedures for compliance with certain sustainable design guidelines based on the latest version of the Chicago Department of Aviation Sustainable Airport Manual (SAM). Reference can be found at https://www.flychicago.com/community/environment/sam/Pages/default.aspx

B. This Section includes tracking requirements and forms necessary for compliance with this Specification and in accordance with the requirements of Credit 5.7 of the SAM.

1.02 RELATED DOCUMENTS

A. Recycled Content of materials will be defined in accordance with 16 CFR 260.7(e) of the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims".

1.03 DEFINITIONS

A. Recycled Materials: Materials that are manufactured, extracted, harvested, or recovered and contain some amount of post-consumer and/or pre-consumer recycled content.

B. Recycled Content: The percentage by cost of the constituents of a product or building material that have been recovered or otherwise diverted from a solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).

C. Post-Consumer Recycled Content is consumer waste that has become a raw material (feedstock) for another product. The post-consumer recycled content of an item will be given as a percentage by weight for the purposes of calculating the overall recycled content of the item.

D. Pre-Consumer Recycled Content contains waste from industrial processes that has been traded through the marketplace. The pre-consumer recycled content of an item will be given as a percentage by weight for the purposes of calculating the overall recycled content of the item.

1.04 CALCULATIONS

A. Only include items in CSI Divisions 2-10 in the calculation of the percentage of materials that have recycled content. This includes but is not limited to concrete and concrete products, masonry, aggregate, paving materials, steel and steel products, particle boards and other manufactured wood or fiber products, metal siding and roofing, tile paneling, carpet and pads, glazing.

B. Mechanical, electrical, plumbing components, and specialty items (CSI Divisions 11-16) and items in FAA electrical specification sections (L-100, L-108, L-110, L-115, L-118, L-120, L-140) must not be included in this calculation. Items that are not to be considered include but are not limited to pumps, fans, heaters, HVAC equipment, wiring, ductwork, lighting fixtures and controls.

C. The overall Recycled Content for a product or building material shall be the percentage of total materials by cost of post-consumer recycled materials plus one half of the pre-consumer recycled materials.

D. In the case where the recycled content of an item could not be obtained from a vendor or manufacturer, use the default recycled content percentages for the following materials in the table below (from SAM Credit 5.7). The default values are conservative and, in most cases, the actual recycled content percentages may be higher.

Material	Recycled Content (%)	
	Post-consumer	Pre-consumer
Steel	25%	–
Copper	65%	–
Aluminum	80%	–
Reinforced Concrete Pipe	2 %	–
Asphaltic Paving Materials	45%	45%

1.05 SUBMITTALS

A. Pre-Construction Estimate - Prior to the Contractor's initial Applications for Mobilization Payment, the Contractor shall submit an estimate (see Form 01356-1.05B, "Recycled Materials Pre-Construction Estimate") that identifies total Project material cost (less labor and equipment) and the Recycled Content of the materials and products that are proposed for the Project. For each material, its post-consumer recycled content, pre-consumer recycled content, and cost shall be identified.

B. Final Construction Total - With the Closeout Documentation, the Contractor shall submit the final actual total Project material cost, less labor and equipment (see Form 01356-1.05C, "Recycled Content Final Construction"), and the Recycled Content of the materials and products that were used for the Project. For each material, its post-consumer recycled content, pre-consumer recycled content, and cost shall be identified.

C. The above submittals must be transmitted to the Commissioner/Construction Manager and to the following email address: samdocs@cityofchicago.org.

PART 2 - PRODUCTS [NOT USED]

PART 3 - EXECUTION

3.01 DOCUMENTATION TEMPLATE

A. Recycled Content Pre-Construction Estimate – Template Form 01356-1.05B attached at the end of this Specification Section should be used by the Contractor as guidance for completion of the Recycled Content submittal requirements as outlined in Part 1 of this Specification Section .

B. Recycled Content Final Construction Total – Template Form 01356-1.05C attached at the end of this Specification Section should be used by the Contractor as guidance for completion of the Recycled Content submittal requirements as outlined in Part 1 of this Specification Section .

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Recycled Materials will not be measured separately for payment, but will be considered included in the overall Contract.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. All costs associated with meeting these requirements are included in the overall Contract. No additional time or monies will be granted to the Contractor for compliance with these requirements and any associated regulations.

END OF SECTION 01356

Recycled Content Pre-Construction Estimate (01356-1.05B)

Contractor:

Project:

WBS No.:

Description of Material: Spec Section	Description of Material: Item	Total Construction Cost [$]	-	Labor (Subtract from Total) [$]	-	Equipment (Subtract from Total) [$]	=	Total Material Cost (Less Labor & Equipment) [$]	Recycled Content (per 01356-1.02A) Overall = Post-Consumer + 1/2 Pre-Consumer: Post-Consumer [%]	Post-Industrial [%]	Overall [$]
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
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			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
		$ -	-	$ -	-	$ -	=	$ -			$ -
										TOTAL RECYCLED CONTENT OF MATERIALS AS A PERCENT OF TOTAL MATERIAL COST	#DIV/0!

Company:

Printed Name:

Title:

Signature:

Date:

Recycled Content Final Construction Total (01356-1.05C)

Contractor: ______________________
Project: ______________________
WBS No.: ______________________

Contractor Certification

I, ______________(Contractor), declare the building materials and products below have the following recycled content.

Description of Material Spec Section	Item	Total Construction Cost [$]	-	Labor (Subtract from Total) [$]	-	Equipment (Subtract from Total) [$]	=	Total Material Cost (Less Labor & Equipment) [$]	Recycled Content (per 01356-1.02A) Overall = Post-Consumer + 1/2 Pre-Consumer Post-Consumer [%]	Post-Industrial [%]	Overall [$]
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
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			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
		$ -	-	$ -	-	$ -	=	$ -			$ -
TOTAL RECYCLED CONTENT OF MATERIALS AS A PERCENT OF TOTAL MATERIAL COST											#DIV/0!

Company: ______________________
Printed Name: ______________________
Title: ______________________
Signature: ______________________
Date: ______________________

Reviewed by: ______________________
(Resident Engineer)

SUSTAINABLE TEMPORARY CONSTRUCTION MATERIALS SECTION 01360

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes use and tracking requirements and procedures for compliance with certain sustainable design guidelines based on the latest version of the Chicago Department of Aviation Sustainable Airport Manual (SAM). Reference can be found at https://www.flychicago.com/community/environment/sam/Pages/default.aspx.

B. This Section includes tracking requirements and forms necessary for compliance with this Specification and in accordance with the requirements of Credit 6.11 of the SAM.

C. The requirements of this Section are applicable only for temporary construction materials defined as those materials that are used for construction that are not incorporated into the final development which may include, but are not limited to, items such as erosion control materials, temporary roadway pavements, shoring materials, formwork, temporary carpentry, and traffic control devices and signage.

1.02 RELATED DOCUMENTS

A. Recycled Content of materials will be defined in accordance with 16 CFR 260.7(e) of the Federal Trade Commission's "Guide for the Use of Environmental Marketing Claims".

1.03 DEFINITIONS

A. Recycled Materials: Materials that are manufactured, extracted, harvested, or recovered and contain some amount of post-consumer and/or pre-consumer recycled content.

B. Recycled Content: The percentage by cost of the constituents of a product or building material that have been recovered or otherwise diverted from a solid waste stream, either during the manufacturing process (pre-consumer), or after consumer use (post-consumer).

C. Post-Consumer Recycled Content is consumer waste that has become a raw material (feedstock) for another product. The post-consumer recycled content of an item will be given as a percentage by weight for the purposes of calculating the overall recycled content of the item.

D. Pre-consumer Recycled Content contains waste from industrial processes that has been traded through the marketplace. The pre-consumer recycled content of an item will be given as a percentage by weight for the purposes of calculating the overall recycled content of the item.

E. Rapidly Renewable Materials: Materials and products that are made from plants that are typically harvested within a 10-year or shorter cycle.

F. Certified Wood: Wood and wood products that are certified in accordance with the Forest Stewardship Council (FSC) criteria.

1.04 CALCULATIONS

A. Recycled Content of Temporary Construction Materials:

1. Only include items in CSI Divisions 2-10 in the calculation of the percentage of temporary construction materials that have recycled content. This includes but is not limited to temporary pavements, masonry, aggregate, erosion control items such as silt fence, steel products such as construction fences, temporary carpentry including manufactured wood or fiber products, metal formwork, and temporary construction signage.

2. Mechanical, electrical, plumbing components, and specialty items (CSI Divisions 11-16) and items in FAA electrical specification sections (Sections 16010, 16100, 16195, 16452, 16950, X-100, L-100, L-108, L-110, and L-118) must not be included in this calculation. Items that are not to be considered include but are not limited to pumps, fans, heaters, wiring, ductwork, lighting fixtures and controls.

3. Do not include rented or leased items.

4. The overall recycled content for the temporary construction materials will be the percentage of post-consumer recycled materials plus one half of the pre-consumer recycled materials with respect to the total temporary construction materials by cost.

5. In the case where the recycled content of an item could not be obtained from a vendor or manufacturer, use the default recycled

content percentages for the following materials in the table below (from SAM Credit 4.7). The default values are conservative and, in most cases, the actual recycled content percentages may be higher.

Material	Recycled Content (%)	
	Post-consumer	Pre-consumer
Steel	25%	-
Copper	65%	-
Aluminum	80%	-
Reinforced Concrete Pipe	2%	-
Asphaltic Paving Materials	45%	45%

B. Rapidly Renewable Temporary Construction Materials

1. Only include items in CSI Divisions 2-10 in the calculation of the percentage of temporary construction materials that have recycled content. This includes but is not limited to erosion control items such as silt fence, woven blankets, logs, and temporary carpentry including bamboo or fiber products.

2. Do not include rented or leased items.

3. The overall percentage of renewable materials used for the temporary construction materials will be the percentage of renewable materials and products by cost with respect to the quantity of the total temporary construction materials by cost.

C. Certified Wood Temporary Construction Materials

1. Include only temporary carpentry or wood materials in the calculation. This includes but is not limited to scaffolding, stakes, shoring, temporary railings and walkways.

2. Do not include rented or leased items.

3. The overall percentage of certified wood used for the temporary construction materials will be the percentage of certified wood materials and products by cost with respect to the quantity of the total temporary construction materials by cost.

1.05 SUBMITTALS

A. Final Construction Total - Concurrent with the Closeout Documentation, the Contractor must submit the final actual total Project material cost, less labor and equipment (see Form 01360-1.05B, "Sustainable Temporary Construction Materials Final Construction Total"), and the Recycled, Rapidly Renewable, and Certified wood percentages of the materials and products that were used for the Project.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 DOCUMENTATION TEMPLATE

A. Pre-Construction Estimate – Prior to the initial Application for Mobilization Payment, the Contractor must submit an estimate (see Form 01360-1.05A, "Sustainable Temporary Construction Materials Pre-Construction Estimate") that identifies total Project material cost (less labor and equipment) and the Recycled Content, Rapidly Renewable and Certified wood portions of the materials and products that are proposed for the Project.

B. Sustainable Temporary Construction Materials Final Construction Total – Template Form 01360-1.05B attached at the end of this Specification Section should be used by the Contractor as guidance for completion of the Sustainable Temporary Construction Materials submittal requirements as outlined in Part 1 of this Specification Section

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. The tracking of Sustainable Temporary Construction Materials will not be measured separately for payment, but will be considered included in the overall Contract.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

A. All costs associated with meeting these requirements are included in the overall Contract. No additional time or monies will be granted to the Contractor for compliance with these requirements and any associated regulations.

END OF SECTION 01360

Sustainable Temporary Construction Materials
Pre-Construction Estimate (01360-1.05A)

Contractor:
Project:
WBS No.:

RECYCLED CONTENT Description of Material	Total Construction Cost	-	Labor	-	Equipment	=	Total Material Cost	Recycled Content (per 01360-1.03B) Overall = Post-Consumer + 1/2 Pre-Consumer		
Spec Section Item	[$]		(Subtract from Total) [$]		(Subtract from Total) [$]		(Less Labor & Equipment) [$]	Post-Consumer [%]	Pre-Consumer [%]	Overall [$]
		-		-		=	$ -			$ -
		-		-		=	$ -			$ -
		-		-		=	$ -			$ -
		-		-		=	$ -			$ -
		-		-		=	$ -			$ -
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		-		-		=	$ -			$ -
		-		-		=	$ -			$ -
		-		-		=	$ -			$ -
	$ -	-	$ -	-	$ -	=	$ -			$ -
TOTAL RECYCLED CONTENT OF MATERIALS AS A PERCENT OF TOTAL TEMPORARY CONSTRUCTION MATERIALS COST										#DIV/0!

RENEWABLE MATERIALS Description of Material	Total Construction Cost	-	Labor	-	Equipment	=	Total Material Cost	Rapidly Renewable Materials (per 01360-1.03C)
Spec Section Item	[$]		(Subtract from Total) [$]		(Subtract from Total) [$]		(Less Labor & Equipment) [$]	Overall [$]
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
	$ -	-	$ -	-	$ -	=	$ -	$ -
RAPIDLY RENEWABLE MATERIALS AS A PERCENT OF TOTAL TEMPORARY CONSTRUCTION MATERIALS COST								#DIV/0!

CERTIFIED WOOD Description of Material	Total Construction Cost	-	Labor	-	Equipment	=	Total Material Cost	Certified Wood (per 01360-1.03D)
Spec Section Item	[$]		(Subtract from Total) [$]		(Subtract from Total) [$]		(Less Labor & Equipment) [$]	Overall [$]
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
		-		-		=	$ -	
	$ -	-	$ -	-	$ -	=	$ -	$ -
CERTIFIED WOOD MATERIALS AS A PERCENT OF TOTAL TEMPORARY CONSTRUCTION MATERIALS COST								#DIV/0!

Company:
Printed Name:
Title:
Signature:
Date:

Sustainable Temporary Construction Materials
Final Construction Total (01360-1.05B)

Contractor:
Project:
WBS No.:

Contractor Certification

I, *[insert Contractor's name]* declare that this list constitutes all of the temporary building materials and products and that, where applicable, the items as shown meet the definition of Recycled Content, Rapidly Renewable, and Certified Wood materials per the specification section(s).

RECYCLED CONTENT Description of Material		Total Construction Cost	-	Labor	-	Equipment	=	Total Material Cost	Recycled Content (per 01360-1.03B) Overall = Post-Consumer + 1/2 Pre-Consumer		
Spec Section	Item	[$]		(Subtract from Total) [$]		(Subtract from Total) [$]		(Less Labor & Equipment) [$]	Post-Consumer [%]	Pre-Consumer [%]	Overall [$]
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
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			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
			-		-		=	$ -			$ -
		$ -	-	$ -	-	$ -	=	$ -			$ -
TOTAL RECYCLED CONTENT OF MATERIALS AS A PERCENT OF TOTAL TEMPORARY CONSTRUCTION MATERIALS COST											#DIV/0!

RENEWABLE MATERIALS Description of Material		Total Construction Cost	-	Labor	-	Equipment	=	Total Material Cost	Rapidly Renewable Materials (per 01360-1.03C)
Spec Section	Item	[$]		(Subtract from Total) [$]		(Subtract from Total) [$]		(Less Labor & Equipment) [$]	Overall [$]
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
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			-		-		=	$ -	
			-		-		=	$ -	
		$ -	-	$ -	-	$ -	=	$ -	$ -
RAPIDLY RENEWABLE MATERIALS AS A PERCENT OF TOTAL TEMPORARY CONSTRUCTION MATERIALS COST									#DIV/0!

CERTIFIED WOOD Description of Material		Total Construction Cost	-	Labor	-	Equipment	=	Total Material Cost	Certified Wood (per 01360-1.03D)
Spec Section	Item	[$]		(Subtract from Total) [$]		(Subtract from Total) [$]		(Less Labor & Equipment) [$]	Overall [$]
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
			-		-		=	$ -	
		$ -	-	$ -	-	$ -	=	$ -	$ -
CERTIFIED WOOD MATERIALS AS A PERCENT OF TOTAL TEMPORARY CONSTRUCTION MATERIALS COST									#DIV/0!

Company:
Printed Name:
Title:
Signature:
Date:

Reviewed by: _____
(Resident Engineer)

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CONSTRUCTION WASTE MANAGEMENT
SECTION 01524

PART 1 - GENERAL

1.01 SUMMARY

A. The disposal of non-hazardous construction waste generated by work pertaining to this Contract shall be in accordance with Section 11-4-1905 of the Chicago Municipal Code ("Code") with exceptions as noted in this Specification Section.

B. This Section includes use and tracking requirements and procedures for compliance with certain sustainable design guidelines based on the latest version of the Chicago Department of Aviation Sustainable Airport Manual (SAM). Reference can be found at https://www.flychicago.com/community/environment/sam/Pages/default.aspx.

C. This Section includes tracking requirements and forms necessary for compliance with this Specification and in accordance with the requirements of Credit 5.3 of the SAM.

1.02 RELATED DOCUMENTS

A. Section 11-4-1905, "Construction or Demolition Site Waste Recycling", of the Chicago Municipal Code. (attached at end of this Specification Section)

B. Section 13-32-125, "Construction Site Cleanliness", of the Chicago Municipal Code.

C. Related Specification Sections include the following:

1. Section 01525 – Disposal of Clean Construction or Demolition Debris (CCDD) and Uncontaminated Soil

2. X-100 Site Demolition

1.03 PERFORMANCE REQUIREMENTS

A. The Contractor will adhere to Section 11-4-1905 of the City of Chicago Municipal Code with exceptions as noted in this Specification Section.

1.04 SUBMITTALS

A. The Contractor must transmit the submittals described below to the Commissioner/Construction Manager and to the following email address: samdocs@cityofchicago.org.

B. The Contractor shall submit documentation pursuant to 11-4-1905 of the Code with the following additions:

1. The City of Chicago C&D Debris Recycling Compliance Form (attached at the end of this Specification) shall be submitted monthly with the Contractor's Application for Payment. Do not complete beyond Line D (p.3) under the "Calculation of Recycling Percentage" of the C&D Debris Recycling Compliance Form and do not include the "Election Form and Contractor Affidavit" (p.4).

2. The Contractor shall submit a Waste Management Plan and a preconstruction estimate of the C&D debris quantities prior to the Contractor's Mobilization.

3. The Contractor shall submit a post-construction City of Chicago C&D Debris Recycling Form with the Contractor's Closeout Documentation.

C. Waste Management Plan: The Plan shall be developed by the Contractor and shall be submitted to the Commissioner for review within thirty (30) days from the Notice to Proceed.. The Plan shall include the following sections, at a minimum:

1. General: Provide an overall strategy for managing the C&D debris associated with the Project.

2. Waste Identification: Indicate anticipated types and quantities by weight of demolition, site-clearing and construction waste generated by the Project. Include estimated quantities by weight and assumptions for estimates, including proposed disposal facilities for all materials including soils (Subtitle D and CCDD).

3. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total weight of each type of waste, final disposition for each waste type, and handling and transportation procedures.

a. Salvaged Materials: For each type of material that is salvaged or recycled, describe the type of material, source,

estimated quantity, and receiving entity. Include names, addresses, and telephone numbers for the receiving individuals and/or organizations.

b. Disposed Materials: Indicate how and where materials will be disposed. Include name, address, and telephone number of each landfill and incinerator facility. For soil, coordination in advance of Contractor bid will be required to disclose and receive approval for potential per- and polyfluoroalkyl substances (PFAS) which may be present in the soil. This is discussed further in Section 3.02 – Disposal of Waste. Reference Specification P-152 for additional details.

c. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

d. Stockpiles: For on-airport stockpiles, indicate location(s) and proposed materials to be received at each stockpile location.

4. Preconstruction C&D Quantities Estimate: For every material recycled, salvaged, or disposed, estimate the quantity of each that is anticipated to be reused on-site, recycled off-site, or disposed off-site. Use the City of Chicago C&D Debris Recycling Form as a template (attached at the end of this Specification).

D. Construction Waste Management Submittal Transmittal: When submitting the documentation to the Commissioner as required in Paragraphs 1.04B and 1.04C, the Contractor must complete the Submittal Transmittal Cover Sheet attached at the end of this Specification section and attach this with the appropriate submittal.

E. All Chicago Department of Aviation (CDA) Projects must submit the documents outlined in Paragraph 1.04B to the Commissioner even if exempted by Section 11-4-1905 (3) of the Municipal Code.

1.05 QUALITY ASSURANCE

A. Contractor Qualifications: Construction waste management work must be performed only by a qualified Contractor. The term qualified means experienced in performing the Work required by this Section. The qualified Contractor must have experience on Projects similar in size and

scope to this Project. The Contractor will submit evidence of such qualifications (e.g. Project list, timeframe, amount of materials recycled, construction cost) upon request by the Commissioner.

B. Regulatory Requirements: In addition to City Ordinances regarding waste recycling described herein, Contractor will comply with waste transport and disposal regulations of authorities (e.g. state, local, or federal) having jurisdiction.

1.06 SPECIAL REQUIREMENTS (NOT USED)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PLAN IMPLEMENTATION

A. General: Implement Waste Management Plan as approved by Commissioner. Provide means of handling, containers, storage areas, signage transportation, and other items to facilitate implementation of the Waste Management Plan for the duration of the Contract.

B. Waste Management Coordinator: Assign a Waste Management Coordinator to be a single point of contact responsible for implementation, monitoring, and reporting of the waste management activities. Coordinator must be present for the duration of the Contract.

C. Training: Contractor is responsible for training workers, subcontractors, and suppliers on proper waste management procedures as applicable to this Contract. Distribute Waste Management Plan to all subcontractors and suppliers when Contract work begins.

D. Site Access and Temporary Controls: Waste management operations shall be conducted in a manner to minimally impact airport and public roadways, streets, walks, and adjacent occupied facilities. A site will be designated and identified as such for the classification of materials to be salvaged, recycled, reused, sold, donated, or disposed.

3.02 DISPOSAL OF WASTE

A. General: Except for materials to be recovered, recycled, or reused, all other materials will be removed from the Project site. The Contractor will legally dispose of these remaining materials in a legal manner.

1. Unless otherwise specified, do not allow waste materials to accumulate on-site. Unauthorized dumping is not allowed on airport property under any circumstances.

2. Remove and transport C&D debris in a manner that will prevent spillage and all trucks to be tarped or covered at all times during transport en route to ultimate destination.

3. Obtain Commissioner's approval of disposal facility in advance of off-site disposal of soil material. The Contractor must provide a letter from the proposed disposal facility, stating that the disposal facility acknowledges and will accept material from an airport environment, that may contain per- and polyfluoroalkyl substances (PFAS) from aqueous film-forming foam (AFFF) used for fire-fighting. The letter will be included with the bid documents to CDA. The purpose of this letter is for the Contractor and CDA to be transparent and avoid coordination delays following Notice to Proceed. Coordinating the testing and acceptance of this material is the responsibility of the contractor. There will be no additional payments made to the Contractor for facilities rejecting the material or delays resulting from sample lead times. Reference Specification P-152 for additional details.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Construction Waste Management will not be measured separately for payment, but will be considered included in the overall Contract.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. All costs associated with meeting these requirements are included in the overall Contract. No additional time or monies will be granted to the Contractor for compliance with these requirements and any associated regulations.

END OF SECTION 01524

CHICAGO DEPARTMENT OF AVIATION

01524 CONSTRUCTION WASTE MANAGEMENT

SUBMITTAL TRANSMITTAL COVER SHEET

Date: _____
Project: _____
WBS No. _____

Attention: Construction Manager

To: Chicago Department of Aviation
10510 W. Zemke Blvd.
Chicago, Illinois 60666

and via email to:
samdocs@cityofchicago.org

The following form(s) are submitted to comply with the requirements of the 01524 Construction Waste Management Specification Section (Check one):

☐ Waste Management Plan and Pre-Construction C & D Debris Estimate
☐ Final C & D Debris Recycling Compliance Form
☐ Monthly C & D Debris Recycling Compliance Form

From:	
Company:	
Printed Name:	
Title:	
Signature:	
Date:	

Reviewed by:	
	Resident Engineer

Note: These submittal requirements are in addition to the requirements put forth by the City of Chicago as outlined in Section 11-4-1905 of the Chicago Municipal Code.

responsibilities under this chapter and to coordinate the activities of the department of streets and sanitation with the department of the environment.
(Added Coun. J. 12-11-91, p. 10978)

11-4-1880 Fee-for-service contracts.

Wherever recycling services are not to be directly provided by the department of streets and sanitation to households in low-density dwellings, the department shall adopt regulations governing the issuance of fee-for-service contracts to provide for-profit and not-for-profit recycling operations. Such regulations shall, at a minimum, include criteria for providing diversion credits, tax credits and any other forms of financial assistance deemed appropriate by the department.
(Prior code § 99.1-7; Added Coun. J. 2-28-90, p. 12605; Amend 12-11-91, p. 10978)

11-4-1890 Promotion of economic development—Markets for recycled materials.

In order to promote economic development within the city and to encourage markets for recycled materials, the city department of planning and development in coordination with the department of the environment and other city departments, as appropriate, shall implement programs to build demand for recycled products among Chicago businesses, residents and local governments; to build markets for recycled materials by attracting to the city manufacturers that use recycled material as raw material; and to assist businesses in developing capacity to use recycled material in place of virgin material.
(Prior code § 99.1-8; Added Coun. J. 2-28-90, p. 12605; Amend 12-11-91, p. 10978)

11-4-1900 Promotion of recycling.

(a) On or before July 1, 1990, the department of planning and development in cooperation with the department of the environment and the department of streets and sanitation, shall develop and implement programs for issuing grants and loans to promote recycling in the City of Chicago.

(b) The department of planning and development shall submit an annual report to the mayor and the city council concerning the implementation of this section, as well as programs to build demand for recycled products among Chicago businesses, residents and local governments, programs for attracting to the city manufacturers that use recycled material as raw material, and programs to assist businesses in developing capacity to use recycled material in place of virgin material. Such report shall be available on September 1st of each year.
(Prior code § 99.1-9; Added Coun. J. 2-28-90, p. 12605; Amend 12-11-91, p. 10978)

ARTICLE XIV. REPROCESSABLE CONSTRUCTION/DEMOLITION MATERIAL

11-4-1905 Construction or demolition site waste recycling.

(1) For purposes of this section, the term[s]:

(a) "Contractor" shall have the meaning of general contractor as defined in Section 4-36-010 and shall also include any person engaged in the demolition or wrecking of a structure for which a permit is required under Section 13-32-230.

(b) "Construction and demolition debris" has the meaning ascribed to the term in Section 11-4-120 of this Code, but does not include materials that are contaminated by lead, asbestos, or other hazardous materials in such a way as to render recycling illegal or impossible.

(2) Any project subject to this section shall be required to recycle construction or demolition waste produced on site as part of construction or demolition activities by meeting the following requirements:

(a) The contractor on a project that is issued a permit on or after January 1, 2006, but before January 1, 2007, shall cause to be recycled at least 25 percent of construction and demolition debris, as measured by weight, produced on site.

(b) The contractor on a project that is issued a permit on or after January 1, 2007, shall cause to be recycled at least 50 percent of construction and demolition debris, as measured by weight, produced on site.

(3) The following projects are subject to this section:

(a) Residential projects with four or more units that involve the construction of a new structure or that involve buildings or structures that have been substantially rehabilitated, as determined by the commissioner of the department of buildings.

(b) Any construction that will require a certificate of occupancy to issue from the department of buildings.

(c) Any building demolition, other than projects for which the total cost is less than $10,000.00.

A project is exempt from this section if only a plumbing permit, only an electrical permit or only a mechanical permit is required.

(4) The contractor shall submit documentation as described herein to the department of the environment to verify compliance with this section. Projects meeting the requirements of (2)(a) or (2)(b) of this section shall submit documentation prior to the issuance of a certificate of occupancy by the department of buildings. Projects meeting the requirements of (2)(c) of this section shall submit documentation within 60 days of completion of a project. Documentation shall be in a form prescribed by the commissioner of the department of environment and consist of notarized affidavits from the contractor and the waste-hauler for the project certifying that the project fully complies with subsection (1) or, in the case of an application for a certificate of occupancy for a portion of a partially completed project, that the project is in compliance with subsection (1) at the time the application is made. The department of environment will certify to the department of buildings and the department of construction and permits that the contractor has complied with this ordinance if: (i) the contractor has met the stated recycling goals; or (ii) the contractor has been fined for that project under subsection (6), and the fine has been paid in full. In addition, a contractor must comply with all reasonable requests for information and documentation made by the department pursuant to an audit to monitor compliance with this section. Whenever any affiant knowingly and falsely states that a project has met the requirements of this section, or whenever any contractor knowingly submits an affidavit with such a false statement, or whenever any person knowingly fails to comply with a reasonable request made pursuant to an audit under this section, such action will be grounds to deny or revoke the issuance of a certificate of occupancy, will subject the person to a fine of $200.00 to $500.00, and will subject the person to additional penalties and fines pursuant to this Code or state law including, but not limited to, the revocation or suspension of an affiant's or contractor's general contractor's license pursuant to Chapter 4-36.

(5) The commissioner of the department of environment, the commissioner of the department of buildings, the commissioner of the department of streets and sanitation or the executive director of the department of construction and permits may promulgate such rules and regulations as necessary to implement the provisions of this section.

(6) Projects that fail to meet the recycling percentages identified in subsection (1) shall be subject to the following fines:

For construction projects or involving demolitions greater than 10,000 square feet of renovated, newly constructed, or demolished space	$5,000 for each percentage point of difference between the amount by this section to be recycled and the amount actually recycled
For construction projects or demolitions involving less than 10,000 square feet of renovated, newly constructed, or demolished space	$2,000 for each percentage point of difference between the amount required by this Section to be recycled and the amount actually recycled

(Added Coun. J. 12-15-04, p. 40435, § 3)

CITY OF CHICAGO
CONSTRUCTION & DEMOLITION DEBRIS RECYCLING
COMPLIANCE FORM - 2006

This is a • •construction project / • •demolition project. (Check one.)

(Please see the instructions on page 4.)

Contractor Information	**Construction/Demolition Site Information**
_____ Contractor Name	_____ Address of Project Site
_____ Contractor License Number	_____ Building/Demolition Permit Number
_____ Street Address	_____ Project Completion Date
_____ City State Zip Code	_____ Size of Project (square feet)
_____ Telephone Number	_____ Project Manager's Name & Telephone Number
_____ Contact Name and Title	_____ Property Owner's Name & Telephone Number

Construction and Demolition Debris Information

C&D Debris Weight Information	**Recycled C&D Debris Information**
1) _____ Tons of all C&D debris produced on site **(This amount must match the total on page 2.)**	4) _____ Tons of C&D debris recycled/reused off site **(Completed Waste Hauler/Recycler Affidavit(s) must be attached to account for all debris taken to a recycler.)**
minus:	*plus:*
2) _____ Tons of contaminated C&D debris (with asbestos or other hazardous material)	5) _____ Tons of reprocessed C&D debris used on site **(Copy of DOE construction site reprocessing authorization must be attached.)**
equals:	*equals:*
3) _____ Total amount of recyclable C&D debris (List this amount on page 3, line "B.")	6) _____ Total amount of recycled/reused C&D debris (List this amount on page 3, line "A.")

NOTE: Pursuant to Section 11-4-1905(4) of the Chicago Municipal Code, all contractors are subject to audit to verify compliance. All documentation that supports this form (such as weight tickets and receipts) must be retained for no less than three years from the date that this form is filed.

Breakdown of all C&D Debris Produced on Site

C&D Debris Type	On site Reused (tons)*	Off Site Reused/Recycled (tons)*	Off Site Disposed (tons)*
Bricks			
Concrete			
Masonry materials (cinder blocks, mortar etc.)			
Rock, stone, gravel			
Soil, dirt			
Sand			
Reclaimed asphalt pavement	----------		
Wood	----------		
Ferrous metal (iron, steel etc.)	----------		
Nonferrous metal (copper wiring etc.)	----------		
Plaster	----------		
Gypsum drywall	----------		
Paint	----------		
Plumbing fixtures and piping	----------		
Carpet and Pad	----------		
Non-asbestos insulation	----------		
Roofing shingles & other roof coverings	----------		
Cardboard, paper, packaging	----------		
Plastics	----------		
Glass	----------		
Landscape debris	----------		
Hazardous materials (please specify):	----------	----------	
Other (please specify):			

Subtotals: _____ _____ _____ **

Total of all C&D debris produced on site (sum of the above 3 columns): _____

***If weight measurements are not available, convert volume to weight and retain documentation to support the accuracy of the converted measurement.**

****Waste Hauler/Recycler affidavits must be attached to account for the amount of C&D debris recycled or disposed of off site. To account for C&D debris reused on or off site, the contractor must provide supporting documentation upon request by the Dept. of Environment.**

Calculation of Recycling Percentage

A) Total amount of **Recycled/Reused** C&D debris ..... _____ tons
(from line 6, page 1)

B) Total amount of **Recyclable** C&D debris ..... _____ tons
(from line 3, page 1)

If Line B is zero, skip to Contractor Affidavit on page 4.

C) Percent of C&D debris Recycled ..... _____ percent
(divide A by B and multiply by 100)

Example:
A. Total amount of Recycled/Reused C&D debris.... 2,025 tons
B. Total amount of Recyclable C&D debris ..... 5,700 tons

- 2,025 ÷ 5,700 = 0.36 (rounded to the nearest hundredth)
- 0.36 x 100 = 36

C. Percent of C&D debris Recycled ..... 36 percent

D) Percent required to be recycled (for 2006) ..... 25 percent

E) Line D minus line C ..... _____ percent

If Line E is greater than 0%, go to Line F; if not, skip to Contractor Affidavit on page 4.

F) Multiply line E by:

$1,000 - if project space is 10,000 square feet or more

-or-

$500 - if project space is less than 10,000 square feet

Total penalty ..... _____ dollars

If a penalty is owed, make payment to: *City of Chicago Department of Revenue*
(City Hall, 121 N. LaSalle, Room 107A)

**Staple original receipt here: .....
(Please keep a copy for your records.)

For Department of Revenue use only:

Funds Code: **EB58 100-72-3035-2713 Ordinance 11-4-1905 Penalties**

Election Form And Contractor Affidavit

Select one option, then sign the affidavit below before a Notary Public.

- I have complied with the recycling requirements set forth in Section 11-4-1905 of The Chicago Environmental Protection and Control Ordinance; and all the information provided herein and attached hereto is correct.

or

- I have paid the penalty calculated on page 3; all the information provided herein and attached hereto is correct; and I will not contest this penalty.

or

- I have completed this form in full; all the information provided herein and attached hereto is correct; and I hereby request a hearing on the applicability of Section 11-4-1905 and/or the amount of penalty due. (You will receive a notice by mail, specifying the date, time, and location of the hearing).

_____
Signature

_____
Name Title

Date _____ _____
Notary Public

****

INSTRUCTIONS

1) Complete this 4-page compliance form and sign before a Notary Public.
2) Attach one or more signed and notarized Waste Hauler/Recycler Affidavits.
3) Attach a Construction Site Reprocessing Authorization letter from the Department of Environment, if applicable.
4) Attach a receipt from the Department of Revenue, if a penalty was paid.
5) Return forms to the environment desk at DCAP, Room 906, City Hall, 121 N. LaSalle Street, within **30 days** from project completion.

If you have any questions about this form, please call 312-744-7672.

DISPOSAL OF CLEAN CONSTRUCTION OR DEMOLITION DEBRIS (CCDD) AND UNCONTAMINATED SOIL SECTION 01525

PART 1 - GENERAL

1.01 APPLICABILITY

A. Requirements of this Section shall apply only when Clean Construction or Demolition Debris (CCDD) as defined below, is planned for placement off airport property at a CCDD Fill Site that is appropriately permitted or registered with the Illinois EPA in accordance with 35 Illinois Administrative Code Part 1100 and any and all other applicable laws.

1.02 SUMMARY

A. "Clean Construction or Demolition Debris (CCDD)" has the meaning assigned to term "Clean construction and demolition debris" in 35 Illinois Administrative Code 1100.103. There is no soil or soil mixtures identified as suitable for CCDD disposal on this project. All references to sampling and offsite disposal of soil in this manner have been eliminated from the Specifications.

B. "Uncontaminated Soil" has the meaning assigned to the term "Uncontaminated soil" in 35 Illinois Administrative Code 1100.103. Due to material being generated from an airport property, per- and polyfluoroalkyl substances (PFAS) may be present in the soil, as PFAS is present in Aqueous Film-Forming Foam (AFFF) used at airports for fire-fighting. Soil disposed of off airport will not be classified as "Uncontaminated Soil" for this project due to the leaching potential of PFAS. Reference Specification Section P-152 for additional details.

C. CCDD as defined above, can be transported to CCDD Fill Operations approved by the Commissioner, that are appropriately permitted or registered in accordance with 35 Illinois Administrative Code Part 1100 and any and all other applicable laws, so long as the Contractor complies with all requirements of 35 Illinois Administrative Code Part 1100 and any and all other applicable laws.

1.03 SUBMITTALS

A. Proposed CCDD Disposal Facility name and current/active permit number issued by Illinois Environmental Protection Agency (IEPA).

1.04 RELATED WORK

A. Related Sections include the following:

1. Section 01524 Construction Waste Management

2. Section P-150 Pavement Removal

3. Section P-152 Excavation and Embankment

4. Section X-100 Site Demolition

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DOCUMENTATION IMPLEMENTATION

A. Contractor will have the responsibility to submit the forms, along with any other applicable paperwork.

B. Contractor will retain any testing firm needed to take samples or perform chemical analysis of the samples as needed to support their proposed CCDD approval.

C. Following any additional sampling and subsequent Toxicity Characteristic Leaching Procedure (TCLP) analysis conducted by the Contractor, the analytical data will be submitted to the Commissioner for approval. Any exclusion area will be depicted on an exhibit and submitted to the Commissioner.

PART 4 - MEASUREMENT OF PAYMENT

4.01 MEASUREMENT OF PAYMENT

A. All documentation, testing, laboratory analysis, and certification by a licensed Professional Engineer or licensed Professional Geologist, including all state and local tipping fees to meet the requirements of Public Act 96-1416 will not be measured separately for payment but will be considered included in the unit price for the associated removal or excavation items in the Contract.

PART 5 - BASIS OF PAYMENT

5.01 BASIS OF PAYMENT

A. All costs associated with meeting these requirements are included in the unit prices for the associated removal or excavation items in the Contract. No additional time or monies will be granted to the Contractor for compliance with these requirements and any associated regulations.

END OF SECTION 01525

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CONTROL OF WATER
SECTION 02241

PART 1 - DESCRIPTION

1.01 GENERAL

A. The work of this Section includes control, handling, treatment, and disposal of groundwater, surface water, storm water from existing pipelines, and any other water that may be encountered during the construction.

B. This Section includes bypass pumping of live storm and sanitary sewers.

C. Work performed in this Section must be coordinated with Section P-156 of these Specifications.

1.02 RELATED WORK

A. Related Sections include the following:

1. Section P-156 – Temporary Air and Water Pollution, Soil Erosion and Sediment Control

1.03 PERFORMANCE REQUIREMENTS

A. Design, provide, operate, monitor and maintain systems of sufficient scope, size and capacity to control groundwater, surface water, storm water, and all other water flow into excavations and to permit construction to proceed on dry, stable subgrades.

1. Maintain water control systems to ensure erosion control, and stability of excavations and constructed slopes, such that excavation does not flood and that damage to subgrades and permanent structures is prevented.

2. Prevent surface water from entering excavations by grading, dikes, ditches, and other means.

3. Accomplish control of water and dewatering without damaging existing buildings adjacent to excavation.

4. Remove water control systems when no longer needed.

B. For tunneled pipe construction, ground water level must be lowered to 4 feet below the tunnel prior to any tunneling and kept at that level during tunneling.

1.04 SUBMITTALS

A. Submit a Water Control Plan describing the proposed method for control, handling, treatment, and disposal of water. As a minimum, describe the following:

1. Methods of controlling water (such as cutoff, dewatering, sumping), equipment, and power supply.

2. Details of dewatering wells and wellpoints, including location, size, depth, spacing, length and type of screen; pumping capacity; locations of headers and discharge lines; means of discharge and disposal of water; and method of monitoring discharge.

3. Schedule of installation and operation of water control facilities.

4. Means of monitoring groundwater levels and piezometric pressures.

5. Sediment and pollution control facilities as described in Section P-156 of these Specifications.

6. Discharge locations to be used.

7. Method of bypassing existing live sewers.

8. Resubmit, as appropriate, if the system or any part thereof is modified during installation or operation.

B. Submit, for information only, copies of all required permits for control, handling, treatment, and disposal of water.

C. Submit, for information only, copies of required monitoring records.

D. Record Drawings at Project closeout identifying locations and capping depth of wells and well points.

1.05 REGULATORY REQUIREMENTS

A. Comply with water disposal requirements of City of Chicago, North Cook County Soil and Water Conservation District (NCCSWCD), Kane Dupage Soil and Water Conservation District (KDSWCD), Corps of Engineers,

Section P-156 of these Specifications, and as required by the Commissioner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Control, handle, treat, and dispose of water continuously during the course of construction. Perform this work without interference with the operations of other Contractors, or the rights of public and private owners, and without damage to structures, adjacent property, and the environment.

B. Protect structures, utilities, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by dewatering operations.

3.02 CONTROL OF SURFACE WATER

A. Prevent surface water from ponding on the site and from draining into excavations, and prevent runoff from adjacent properties from entering the construction site, in quantities that might interfere with prosecution of the Work.

B. Intercept and divert surface water by use of surface grading, dikes, curbs, ditches, sumps, and other means and in accordance with Section P-156 of these Specifications.

3.03 CONTROL OF WATER IN EXCAVATIONS

A. Control water inflows to excavations to prevent loss of fines, soil erosion or piping, flowing ground, slope instability, or softening of subgrade or foundation soils.

B. Allow no standing water in the bottom of the excavation during construction activities not specifically intended to be performed in a flooded excavation. Allow no standing water during placement of bedding and backfill, erection of formwork, placement and curing of concrete, placement of pipe, or other permanent construction.

C. Reduce or counteract groundwater pressure in soils outside the excavation to prevent bottom heave in trenches, shafts, and other excavations.

D. Minimize reduction of groundwater pressure outside the excavation to avoid consolidation of compressible soil strata.

E. Provide standby pumps and standby power supply where disruption of water control systems could allow water inflows to threaten the Work or the safety of personnel. Take immediate steps to control water inflow to the excavation that could cause loss or damage to adjacent structures or property.

3.04 DEWATERING WELLS

A. Dewatering from wells must be kept to the minimum necessary to accomplish the work. Design screens and operate wells so as to prevent removal of fine soils.

B. Provide means to adjust water discharge from each well independently. Monitor the discharge from each well on a daily basis, and provide discharge records to the Commissioner weekly.

C. Abandon dewatering wells and piezometers by grouting the full depth of casings and pipes by tremie method or by pressure injection from the ground surface. Grout must consist of cement and water, with the minimum amount of water necessary to allow pumping. Cut off or remove casings and pipes to at least 3 feet below final grade. Obtain any required permits for well abandonment in accordance with local regulations.

3.05 TREATMENT AND DISPOSAL OF WATER

A. Discharge water into a sediment trap, into a ditch or temporary ditch that leads to a sediment trap, or into a sediment containment filter bag in accordance with Section P-156 of these Specifications.

B. Prior to discharging water, remove suspended solids, oils, cement, bentonite, and other contaminants by use of settling basins, on-site treatment plant, or other means. Reduce contaminant concentrations to levels acceptable to authorities having jurisdiction over receiving waters. Select treatment systems that can accommodate expansion if greater capacity becomes necessary during the course of the work.

C. On completing the work, clean out and dispose of all sediments and residues in settling basins and treatment facilities. Dispose of sediments and residues in accordance with applicable regulations.

3.06 BYPASS PUMPING

A. Maintain sewer and storm water flows around work areas in a manner that will not cause surcharging or damage to sewers, and that will protect

public and private property from damage and flooding. The Contractor must not stop or impede the main flows under any circumstances.

B. Provide, maintain, and operate temporary facilities including dams, plugs, pumping equipment, and conduits necessary to intercept flow before it reaches the point where it would interfere with the work, carry the flow past the work, and return flow to the existing sewer downstream of the work.

C. Utilize pumps, power systems, and other equipment that will accommodate the cyclic nature of effluent flows.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Work under this section will not be measured for separate payment.

PART 5 - BASIS OF PAYMENT

5.01 BASIS OF PAYMENT:

A. Any work required to control water will be considered included in the Contract prices of those items requiring the various work items specified in this section.

END OF SECTION 02241

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RECYCLED ASPHALT PAVEMENT
SECTION 02245

PART 1 - DESCRIPTION

1.01 GENERAL

A. Furnish all labor, materials, equipment, and processes required to produce screened recycled asphalt pavement (RAP) in accordance with this specification. This work will include site restoration at the end of operations.

1.02 DESCRIPTION OF WORK

A. The Contractor will be responsible for hauling and screening RAP prior to placement. Only bituminous from this project is to be utilized.

B. The RAP will be subject to monitoring by the Commissioner to ensure that the material is clean, free of large chunks and maintains reasonable consistency throughout the Project. Uniformity in production of clean recycled asphalt and uniformity of placement in the field free of segregation are required. Precautions shall be taken to avoid segregation of material while stockpiling or during placement. RAP must be free of jointing material, PVC pipes, metals, geotextile fabric, and other objectionable materials. Gradations of the material will be required in accordance with Specification Section P-154 to verify material consistency.

1.03 RELATED WORK

A. Section 01111 Construction Air Quality - Diesel Vehicle Emissions Controls

B. Section 01355 – Local/Regional Materials

C. Section 01356 Recycled Content

D. Section 01524 Construction Waste Management

E. Section 02710 Dust Control

F. Section M-103 Airport Safety and Security Section P-154 – Frost Protection Course

1.04 SUBMITTALS

A. Prior to beginning the work, the Contractor must submit a Work Plan at the Pre-Construction conference to the Commissioner for approval. The Work Plan must include a description of all equipment and processes that will be utilized to process the asphalt, estimated daily production, estimated total quantities of RAP, removal of deleterious materials, and stockpile management. No work is to commence until the Work Plan has been approved by the Commissioner.

B. The Contractor must submit a Dust Control Plan for the methods for accomplishment for the alleviation and prevention of dust nuisance originating from construction operations within the project limits in accordance with Section 02710 – Dust Control. The Contractor must have a sufficient number of operating vacuum power sweepers and operators on the job site at all times.

C. The Contractor must submit a Waste Management Plan and comply with reporting requirements in accordance with Section 01524 – Construction Waste Management.

PART 2 - PRODUCTS

2.01 MATERIALS

A. The Contractor must satisfy himself as to the nature of the on-site materials to be recycled and provide all required labor, materials, equipment and processes in order to maximize the amount of RAP is produced.

B. It is the responsibility of the Contractor to determine if portions of the removed bituminous are unsuitable and not appropriate for RAP. The Contractor must dispose of the unsuitable material offsite at no additional cost to the City.

C. Milled bituminous designated to be used for RAP must be screened. No bituminous chunks larger than 4” diameter are permitted.

D. The Contractor is to only use materials from this project.

PART 3 - EQUIPMENT

3.01 GENERAL

A. Provide a portable screen capable of producing the necessary RAP product. The Contractor must check the screening operations and RAP

produced. Oversized products are to be discarded or crushed and re-screened. The Commissioner will make the final determination of the adequacy of the Contractor's operation.

B. A suitable device or method of separating deleterious materials from the asphalt to be used as RAP must be employed. Hand picking may also be required. The Contractor must take possession of the removed materials for removal off the airport property at his discretion.

C. No deleterious materials are to remain on the airport property. Comply with the requirements of Section 01524 – Construction Waste Management.

D. Equipment and fuel shall comply with the requirements of Section 01111 – Construction Air Quality-Diesel Vehicle Emission Controls.

PART 4 - OPERATION / PRODUCTION

4.01 GENERAL

A. The Commissioner will check the screening operations and will make the final determination of the adequacy of the Contractor's operations and the amount of RAP being produced.

B. If stockpiles are used the Contractor must obtain approval from the Commissioner prior to stockpiling. Sites for stockpiles must be cleaned of deleterious materials which could contaminate the stockpiles. When loading out of stockpiles, the vertical faces must be limited to reasonable heights to eliminate segregation due to tumbling. Segregation or degradation due to improper handling, stockpiling or loading out of stockpiles will be just cause for rejection of the material. The Commissioner will make the final determination as to the acceptability of the RAP.

C. Stockpiles must be removed at the end of each work shift unless approval is received from the Commissioner allowing the stockpile to remain.

PART 5 - METHOD OF MEASUREMENT

5.01 MEASUREMENT

A. No separate measurement will be made to provide RAP, including any measurement to furnish all equipment, preparation, processing of the recycled material, removal and disposal of deleterious materials and disposing of offsite, and for all labor, tools, incidentals and all work

necessary to complete the item, including removal of the screening equipment and of any necessary site facilities and site restorations at the end of operations.

PART 6 - BASIS OF PAYMENT

6.01 PAYMENT

A. No separate payment will be made for items described in this specification.

END OF SECTION 02245

ABANDONING EXISTING STORM/SANITARY SEWER SYSTEM AND STRUCTURES
SECTION 02705

PART 1 GENERAL

1.01 DESCRIPTION

A. This item includes abandoning existing storm or sanitary sewer system by completely filling the abandoned sewers with grout. This item also includes properly backfilling structures with sewer grout or sand.

B. Work under this Section is subject to the requirements of the Contract Documents.

1.02 RELATED WORK

A. As specified in the following Sections:

1. Section P-610 – Structural Portland Cement Concrete
2. Section P-152 – Excavation and Embankment
3. Section P-157 – Trench Backfilling
4. Section X-100 – Site Demolition

1.03 REFERENCES

A. SSRBC – Illinois Department of Transportation, 'Standard Specifications for Road and Bridge Construction', latest edition

B. ASTM C39 Standard Practice for Compressive Strength of Cylindrical Concrete Specimens

C. ASTM C172 Standard Practice for Sampling Freshly Mixed Concrete

D. ASTM C495 Standard Test Method for Compressive Strength of Lightweight Insulating Concrete

E. ASTM C796 Standard Test Method for Foaming Agents Used in Producing Cellular Concrete

1.04 SUBMITTALS

A. Product Data: Submit product data or certification showing

B. conformance with Specifications.

C. Sewer grout mix design to be in conformance with these Specifications. Mix design must include as a minimum: proportions, gradations, admixtures, certifications, density, and 28 day compressive strengths. Unit weight must be a minimum of 24 – 30 pcf and compressive strength must be 50 psi minimum at 28 days, or as directed by the Commissioner.

D. Plug/Bulkhead: Submit the method of plugging/bulkheading sewer to be grouted with sewer grout. For pipes greater than 36 inches in diameter, submit design of bulkhead to the Commissioner for approval.

PART 2 PRODUCTS

2.01 MATERIAL

A. Sewer Grout: Sewer grout to be used for filling the abandoned sewer must consist of a minimum of 1 part of Portland cement, and when required, up to three parts of sand as specified herein. Complete filling of the abandoned sewer must be accomplished by pumping grout.

1. Portland Cement: Must be ASTM C 150, Type I and conform to the requirements of Section 1001 of the SSRBC, latest edition.

2. Fly Ash: If used, pozzolanic admixtures must be fly ash or raw or calcined natural pozzolans meeting the requirements of ASTM C 618, Class C or F.

3. Sand: If used, must be fine aggregate, gradation FA-1 or FA-2 conforming to Article 1003.02 of the SSRBC, latest edition.

4. Water must be fresh, clean, and free from oil, acid, alkali, salts, or organic matter conforming to Section 1002 of the SSRBC, latest edition.

5. Admixtures:

   a. Provide an approved air entrainment admixture or performed foam.

      1) When using an air entrainment admixture, the amount of entrained air shall not be less than 5% or more than 8% of the volume of concrete, or as approved by the Commissioner.

a) Air-entraining admixtures must meet the requirements of ASTM C 260.

b) Air-entraining admixtures must be added at the mixer in the amount necessary to produce the specified air content.

2) When using a preformed foam admixture, the amount of air must be a minimum of 25% of the volume of the grout. Preformed foam must meet the requirements of ASTM C 796.

a) c. If needed, provide an approved admixture to achieve complete filling of the pipe and improved pumpability.

B. Portland Cement Concrete: For placing concrete plugs must be in accordance with Section P-610, Structural Portland Cement Concrete.

C. Mortar: Cement must conform to the requirements of ASTM C 150, Type I. The sand must conform to the requirements of ASTM C 144.

PART 3 EXECUTION

3.01 FILLING EXISTING SEWERS

A. The Contractor must fill the existing sewer not remaining in service or being abandoned as indicated in the Drawings or as directed by the Commissioner.

B. Sewer to be abandoned must be completely filled with sewer grout. Grout must be installed by pumping into the pipe injection port against the opposite plugged/bulkheaded end of the sewer with vent pipe.

3.02 PLUGGING EXISTING SEWERS

A. Abandoned sewers and drains shown on the Drawings or directed by

B. the Commissioner must be plugged with a PCC plug/bulkhead for a minimum length equal to the diameter of the pipe, or as shown on the Drawings. For pipes greater than 36 inches in diameter, submit design of bulkhead to the Commissioner for approval. Alternately, if approved by the Commissioner, brick and mortar plugs/bulkheads may be approved for certain small diameter pipes.

C. The utility cap or PCC plug/bulkhead must be made as shown on the Drawings. Form must be tight fitting and composed of non-degradable material. Wooden plugs or forms must not be used. Plug/bulkhead must be sufficiently cured or tight before grouting of pipe can begin as directed by the Commissioner.

D. Install minimum 2 inches diameter Schedule 40 PVC pipe injection port into plug/bulkhead where grouting is to begin.

E. Install minimum 2 inches diameter Schedule 40 PVC pipe vent into opposite plug/bulkhead pumping grout against.

3.03 FILLING EXISITNG STRUCTURES

A. The tops of any existing manholes, catch basins, other structures to be abandoned must be removed to an elevation of at least 3.0' below proposed grade or structure must be removed completely, as indicated on the Drawings.

B. Where the pipe connections are removed, the pipe openings must be securely sealed with concrete and the existing structure backfilled with FA-6 sand compacted to 95% modified proctor ASTM D 1557 per Section X-100, Site Demolition.

C. Where the pipe connections remain and the intent is to pump grout through and through the structures, the sewer grout used to fill the pipe must be placed in the structure to a point of at least flush with the top of the sewer crown up to a point approximately 6 inches above the sewer crown, in order to function as a PCC plug. The remaining structure must then be backfilled with FA-6 sand compacted to 95% modified proctor ASTM D 1557 per Section X-100, Site Demolition.

D. Backfill and compact the area above the abandoned structure in accordance with Section P-152, Excavation and Embankment or Section P-157, Trench Backfilling, as applicable, and as directed by the Commissioner.

3.04 FIELD QUALITY CONTROL

A. The Contractor's qualified QC organization must make a minimum of one set of four (4) 3" x 6" cylinders for each 100 CY of sewer grout placed, or a minimum of one set per day. The compressive strength of an average of four (4) cylinders must be tested at 28 days in accordance with ASTM C495.

B. The Contractor must make and initially cure and store the test specimens in accordance with ASTM C495. The Contractor must transport and deliver the test specimens to the Commissioner's laboratory for testing. A Chain of Custody form provided by the Commissioner must be used. The Contractor must be responsible for developing a system of recording the initial curing temperatures and this data must be sent to the Commissioner's laboratory with the test specimens. The Commissioner will make the actual tests on the specimens in accordance with ASTM C 39, at no expense to the Contractor.

3.05 DISPOSAL OF MATERIALS

A. On completion of grouting, remove all waste material, injection ports and vent pipes, and spilled grout from the work area. All material resulting from removal of upper portions of any structures, spilled grout, and other unusable materials must be disposed of by the Contractor legally off the Airport or as directed by the Commissioner.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Filling Existing Sewers – Will not be measured for the volume of sewer grout installed in the abandoned sewer, but will be considered as incidental to the associated pay item: abandon existing sewer of size and type shown on the Drawings or as specified.

B. Plugging Existing Sewers – Will not be measured in place for each unit plugged, but considered included in the abandonment of existing sewer.

C. Filling Existing Manholes, Catch Basins, other Structures – Will not be measured in place for each unit filled, but considered as incidental to the associated pay item: abandon existing manhole. No separate measurement will be made for any type of structure.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

A. No separate payment will be made for filling of existing storm/sanitary sewers, manholes, catch basins, or other structures to be abandoned.

Proposed or existing PCC plugs in sewers to be plugged will also be included. This work, including materials, labor, tools and equipment, will be incidental to associated pay items found in Section X-100 – Site Demolition.

END OF SECTION 02705

DUST CONTROL
SECTION 02710

PART 1 - DESCRIPTION

1.01 GENERAL

A. This work consists of the exclusive control of dust resulting from construction operations and is not intended for use in the compaction of earth embankments.

PART 2 - PRODUCTS

2.01 GENERAL

A. Water for the Project is to be obtained in accordance with the requirements of Article XIV. J, 2b of Part Two, General Conditions.

PART 3 - EXECUTION

3.01 GENERAL

A. Prior to the start of construction, the Contractor must submit a plan and methods to alleviate and prevent dust nuisance originating from earthwork and construction operations from within the Project. Work will not commence until dust control plan has been accepted and approved by the Commissioner.

B. Dust will be controlled by the uniform application of sprinkled water and will be applied only when advised by the Commissioner in a manner meeting the Commissioner's approval.

C. All equipment used for this work must meet the Commissioner's approval.

D. The Contractor will investigate the availability of an adequate supply of suitable water, make all arrangements (including permit if required) for the purchase of the water and provide necessary facilities to furnish water for use during construction, solely at the Contractor's expense. Water may be obtained from creeks and streams on the Airport property. The availability and quality of the water obtained from these sources is not guaranteed.

E. The Contractor must submit an FAA facility HVAC intake air filter shop drawing for review and approval by the FAA and the Commissioner. The

Contractor must not order the filter until shop drawings have been approved

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. With the exception of the Allowance for FAA & CDA Facilities Cleaning and Maintenance, Dust Control will not be measured separately for payment, but will be considered as included in the overall Contract price.

B. Allowance for FAA & CDA Facilities Cleaning and Maintenance will be subject to prior review and approval by the Commissioner. Unused portions of this allowance will not be paid to the Contractor, but will be returned to the Commissioner in the form of an appropriate credit.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. With the exception of expenses from the Allowance for FAA & CDA Facilities Cleaning and Maintenance, all costs associated with meeting these requirements will not be paid for separately but will be considered included in the overall Contract price.

B. Allowance for FAA & CDA Facilities Cleaning and Maintenance will compensate the Contractor for costs associated with furnishing and installing HVAC intake air filters on FAA or CDA Facilities on a bi-monthly basis and prior to project completion. The price must be full compensation for furnishing all labor, equipment, tools, and all work necessary to complete the item. The Contractor must receive written notice from the Commissioner and Chief Procurement Officer to proceed with the work. The work will be paid for as shown in Article X, "Changes in the Work," of the Part 2, General Conditions. Upon completion of the Project, any remaining balance in this Allowance will be returned to the City in the form of an appropriate credit.

ITEM NO.	DESCRIPTION	UOM
02710-01	ALLOWANCE FOR FAA & CDA FACILITIES CLEANING AND MAINTENANCE	AL

END OF SECTION 02710

BASIC ELECTRICAL REQUIREMENTS
SECTION 16010

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Work under this Section is subject to the requirements of the Contract Documents.

B. Apparatus, appliance, material or work not shown on the Drawings, but mentioned in the Specifications, or vice versa, or any accessories necessary to make the work complete and ready for operation without additional expense.

C. The Contractor must furnish, erect, install, connect, clean, adjust, test and condition all manufactured articles, materials and equipment, and place in service in accordance with the manufacturer's directions and recommendations except as otherwise noted on the Drawing or specified herein.

1.02 RELATED WORK:

A. As specified in the following divisions:

1. SECTION 16100 BASIC MATERIALS AND METHODS

1.03 REFERENCES:

A. Materials and installation must comply with all codes, laws and ordinances of Federal, State and local governing bodies having jurisdiction.

B. In every installation where regulations of electric and\or telephone companies apply, conformance with their regulations must be mandatory and any costs incurred must be included in the Contract.

C. In case of differences between building codes, State and Federal laws, local ordinances and utility company regulations and the Contract Documents, the most stringent must apply.

D. All design, equipment and materials specified must conform to all acts, laws, rules and regulation of the following organizations:

1. City of Chicago Electrical Code (CEC) must take jurisdictional precedence over all other authoritative bodies.

2. Federal Aviation Administration (FAA)

3. National Electrical Code (NEC) (ANSI/NFPA 70).

4. National Electrical Safety Code (NESC-ANSI C2).

5. American National Standards Institute (ANSI).

6. National Fire Protection Association (NFPA).

7. Institute of Electrical and Electronics Engineers (IEEE).

8. Insulated Cable Engineers Association (ICEA).

9. National Electrical Manufacturers Association (NECA).

10. Illuminating Engineering Society (IES).

11. Underwriters Laboratories, Inc. (UL)

12. Canadian Standards Association (CSA).

13. Occupational Safety and Health Administration (OSHA).

14. Americans with Disabilities Act (ADA).

15. International Association of Electrical Inspectors (IAEI)

16. SOARES – Book on Grounding.

17. International Electrical Testing Association (NETA)

18. NETA – ATS- Acceptance Testing Specifications for

19. Electrical Power Distribution Equipment and Systems.

E. Should Work be performed which does not comply with the requirements of the applicable building codes, State and Federal laws, local ordinances, industry standards, utility company regulations and the Contract Documents changes for compliance must be done by the Contractor at no cost to the City.

F. The Contractor will notify the Commissioner of any materials or apparatus believed to be inadequate, unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction.

1.04 SUBMITTALS:

A. The Contractor must submit Project data to the Commissioner prior to purchasing and installation. The data must include, but not be limited to, the following:

1. Installation design Drawings - schematic, wiring, and one line diagrams; lighting panel schedules; lighting; conduit; duct banks; conduit and cable schedules; grounding; symbols and legends; etc. must be included.

2. Power system short circuit and coordination calculations. The calculations must be performed under the supervision of a Professional Engineer registered in the State of Illinois. The calculations must bear the stamp of the responsible Engineer.

3. The equipment manufacturers' schematic diagrams must be "JIC" ladder type. Schematics must identify all devices, wire codes, and terminal numbers.

4. The equipment manufacturers' wiring diagrams must show terminal blocks for external wiring. Wiring diagrams must identify all devices, wire codes, and terminal numbers.

5. The equipment manufacturers' internal point to point and external wiring diagrams between cubicles, panels and components within the equipment line up must be provided.

6. Catalog cuts and major electrical equipment manufacturers' Drawings must include, but are not limited to, relays, meters, current and potential transformers, disconnect switches, fuses, contactors, lighting and more.

7. Complete descriptive literature, performance and test data and rating data for all equipment must be provided.

8. Instruction books, Operation and Maintenance manuals with spare parts must be provided.

9. Complete and accurate "As Built" Drawings must be provided by the Contractor to the Consulting Engineer for verification and drafting.

B. Shop Drawings

1. The Contractor must submit Shop Drawings and Samples in accordance with the Contract Documents and supplementary requirements as stated under each Section of the Specifications.

2. Shop Drawings must include manufacturers' names, catalog numbers, cuts, diagrams, schedules and other such descriptive data specifically prepared for the Work by the Contractor, Sub-contractor and/or manufacturer to illustrate that the materials, equipment or system conform to the Contract requirements.

3. Additional submittal requirements are described in individual sections of the Specifications.

4. Any listed materials, fixtures, apparatus, or equipment that are not in accordance with the Contract Document requirements can and must be rejected for use in this Contract.

5. Any materials, fixtures, apparatus or equipment installed without reviewed and accepted submittals must be removed by the Contractor and replaced at the direction of the Commissioner and without cost to the City.

6. Substitutions to listed acceptable manufacturers equipment and material must not be accepted until the Contractor has complied with the requirements of Part Two, Article VI of the Contract Documents.

C. Installation Drawings

1. The initial copy of all installation Drawings must be submitted to the Commissioner for review.

2. The installation Drawings must be made under the direction and supervision of the Contractor and must show all electrical work including, but not limited to, conduit, wiring, electrical equipment and devices, lighting fixture locations and elevations, points where conduit enters or leaves structural slabs and walls, junction boxes, conduit supports and inserts. Symbol representation for home run circuits must not be acceptable. These Drawings must include all ductbank work, embedded conduit plans, electrical room layouts and elevations as well as all circuiting and locations of all electrical equipment.

3. In addition to the preparation and submittal of Shop Drawings for manufactured electrical equipment and materials, the Contractor must prepare and maintain in current status, a complete set of

detailed, completely circuited, and dimensioned electrical construction Drawings for all electrical work included under this Contract. These Drawings must be made at the Contractors expense.

4. Shop Drawings for manufactured electrical equipment and materials, the Contractor must prepare and maintain in current status, a complete set of detailed, completely circuited, and dimensioned electrical construction Drawings for all electrical work included under this Contract. These Drawings must be made at the Contractor's expense.

5. No electrical work will begin until these installation Drawings are so drawn, and thereafter finally accepted by the Commissioner.

6. The complete electrical distribution system from the sources, including each branch circuit panelboard, must be shown and dimensioned exactly as to be installed, with all feeders located on the installation Drawings. Major equipment, lighting controls and apparatus must be shown to scale and properly located.

7. The Contractor must provide a separate set of installation Drawings for the lighting system; a separate set of installation Drawings for the power and control; and a separate set of installation Drawings for the special systems.

8. The Contractor must provide a single line diagram describing the power distribution system. This diagram must include ratings for all equipment and cable sizes from the service connection to the 120 Volt lighting and distribution panels.

9. The installation Drawings must include floor plans and reflected ceiling plans with electrical layouts drawn at a scale (or scales) as required with a minimum scale of 1/8 inch equal 1'-0". It is intended that installation Drawings of each trade be the same scale(s) in order to permit respective plans to be superimposed upon all others of each trade.

10. In addition to the floor plans, the layouts of all congested areas such as mechanical and/or electrical equipment rooms, and all functionally critical areas must be drawn at a minimum scale of 1/4 inch equals 1'-0", and with all details of construction shown. Additional installation Drawings may be requested if in the opinion of the Commissioner they are required to properly coordinate the Project.

11. The installation Drawings must include schedules for all panelboards. Schedules must depict the bus arrangement of the panelboard, the size of all circuit breakers, the connected load on each breaker, and a description of the load and it's location.

12. The installation Drawings must indicate the electrical installation exactly as to be constructed and therefore must be periodically revised to reflect all changes inclusive of those required by the Commissioner, those which are or have been found necessary in the field, those which may be suggested by the Contractor and approved by the Commissioner, etc.

13. All installation Drawings must be made on 3 mil Mylar sheets of the same size and with the same border lines and title blocks as the Chicago Department of Aviation Drawings, with the Contractor's name added.

14. Revisions must be performed when considered necessary by the Commissioner or the Contractor in order to facilitate proper coordination.

15. The Contractor must be responsible for the coordination of electrical work with the work of all other trades and must, in preparing the installation Drawings, continually check the work of all other trades (inclusive of that indicated by Shop Drawings) in order to avoid possible installation conflicts arising therefrom. It must be understood that the work shown on the installation Drawings has been so coordinated. In the event of conflicts or interferences that cannot be resolved in the field, the Contractor must request a written clarification from the Commissioner.

16. Upon completion, the initial installation Drawings, and all revised installation Drawings thereafter, must be dated and certified as having been fully coordinated by the Contractor. It must then be understood that the work shown thereupon is ready for construction.

17. All installation Drawings must be made in accordance with an approved schedule, prepared by the Contractor, and arranged to coincide with actual construction in such a manner as to allow the latter work to proceed without delay.

18. If, in the opinion of the Commissioner, the installation Drawings are in acceptable condition after each has been finally revised and accepted, the Contractor may submit same as the field record Drawings called for elsewhere in the Specifications.

19. The Contractor must include wiring diagrams and schematic diagrams. Each schematic diagram must be "JIC" ladder type. Wire and terminal numbers must be shown on all schematic and wiring diagrams.

20. The minimum drafting letter size must be 1/8 inch in height and must be block type lettering.

D. The Contractor must submit test reports as described under this Contract.

1.05 QUALITY CONTROL:

A. After all equipment, devices and raceways are installed and wires and cables are in place and connected to devices and equipment test the system for continuity, proper phase rotation, short circuit, improper grounds, and other defects. Testing must be in accordance manufacturers' recommendations, individual sections of this Specification, and Section 16950 - Testing of these Specifications.

B. The Contractor must be responsible for protecting all equipment and systems against harmful exposures to, or accumulations of dust and moisture, flooding, corrosion or other forms of damage and must clean and restore damaged finishes as may be required to place installations in a "Like New" condition before acceptance by the Commissioner.

1.06 DELIVERY STORAGE AND HANDLING:

A. Equipment and materials must be delivered to the site and stored in the original containers, suitably sheltered from the elements and mechanical injury, but readily accessible for inspection until installed.

1. Items subject to moisture damage must be stored in dry, heated spaces.

2. Manufacturer's directions must be followed in the delivery, handling, storage, protection, installation and operation of all equipment and materials.

B. The Contractor must coordinate with the Commissioner the movement of heavy machinery, equipment and heavy parts thereof brought into or onto the building or premises.

C. Conduit openings must be kept closed by means of plugs or caps to prevent the entrance of foreign matter.

D. The Contractor must cover all fixtures, equipment and apparatus as required to protect them against dirt, water, chemical, solar, or

mechanical damage. The Contractor must also provide any supplementary heating and cooling required to prevent moisture and thermal damage.

E. Equipment must be inherently safe and moving parts must be covered with guards.

F. Equipment in storage having moving parts, which may be damaged or distorted by being idle, must be rotated or exercised periodically and all lubricants must be properly maintained.

G. Additional requirements are described in individual sections of these Specifications.

1.07 CONTRACT DRAWINGS:

A. The Drawings are diagrammatic and/or home-run type which are intended to convey the scope of work and indicate the general arrangement and/or sizes of conduit, equipment, fixtures and other work included in the Contract.

B. The location of items required by the Contract Documents are not definitely fixed by dimensions and are approximate only. The exact locations necessary to secure the best conditions and results must be determined at the site and will be subject to the review of the Commissioner.

C. The Contractor must lay out the Work, check Drawings of all trades to verify spaces in which Work must be installed, and maintain maximum headroom and space conditions at all points.

1. Where headroom or space conditions appear inadequate, the Contractor will notify the Commissioner, in writing, before proceeding with installation.

2. Any minor changes in the locations of equipment, fixtures, lighting fixtures, conduits, outlets, devices, etc., from those locations as shown on the Contract Drawings must be made without extra charge to the Contract. A minor change in location must be considered to be within 10 feet of the location as may be scaled from the Drawings for all interior work and within 25 feet for all exterior work.

1.08 EXECUTION, CORRELATION AND INTENT OF DOCUMENTS:

A. Scaled measurements from Drawings will not be used to determine installation locations.

1.09 INSTRUCTIONS AND ADJUSTMENTS:

A. Before Final Completion and before final Contract payment is made, the Contractor must demonstrate and explain to the Commissioner the function, operation and maintenance of all equipment and systems installed.

B. The primary adjustments of the system(s) must be accomplished by the Contractor to the complete satisfaction of the Commissioner at the time of completion of the installation.

C. Where required in individual sections of this Specification, the Contractor will arrange for training City personnel as specified.

1.10 OPERATING AND MAINTENANCE MANUAL:

A. General - Assemble manuals to include definite and specific information and instructions on materials, apparatus, equipment and systems provided under the Contract. Include only the latest standard commercial data.

1. Maintenance period to be represented by the manufacturers' maintenance data is five (5) years.

2. Coordinate contents of manuals with the actual needs of the City's staff.

B. Contents - Include for each item the following data, as applicable, edited to include items specific to this Contract. Make data, including notations, completely legible - typewritten or printed.

1. Manufacturer's operating instructions, maintenance and repair manuals which set forth the manner of operation, precautions, care to be followed and periodic preventive maintenance requirements.

2. Final accepted Shop Drawings, Product Data and catalog cuts, including final comments and responses.

3. Printed Data - Manufacturer's original catalog cuts, brochures, operating and maintenance data.

4. Manufacturer's recommended maintenance and cleaning procedures, methods and materials for exposed finish.

5. Manufacturer's Specifications, including performance curves, wiring diagrams, and tabulation of sizes and identifying numbers.

6. Complete and detailed material list and parts list and assembly drawing.

7. Recommended inventory of spare parts and emergency parts and sources of purchase.

8. Governing agency and manufacturer test certificates, permits and inspection reports, including pressure test, insurance inspections and approvals, and shop or field performance tests.

9. Certified factory and field performance report as required by the Contract Documents

10. Final compliance certificates as required by the Contract Documents.

11. Manufacturer's guarantee or warranty as normally provided and as specifically required by the Contract Documents.

12. An index of volumes, in each volume of multiple volume systems.

13. An index in and for each volume. List and combine the literature, for each system, in the sequence of operation.

14. Name, address and telephone numbers of or, Subcontractors, suppliers, and installers.

15. Name, address and telephone number of manufacturer's nearest service representative.

16. Name, address and telephone number of nearest parts vendor and service agency.

17. Anticipated date City assumes responsibility for maintenance.

18. Description of system and component parts.

19. Pre-operation check or inspection list.

20. Procedures for starting, operating and stopping equipment.

21. Post-operation check or shut down list.

22. Inspection and adjustment procedures.

23. Emergency operating instructions.

24. Accepted test data.

25. Maintenance schedules and procedures.

26. One (1) copy of each wiring diagram.

27. One (1) copy of each piping diagram.

28. One (1) copy of each duct diagram.

29. Manufacturer's parts list with catalog names, numbers and illustrations.

30. An exploded view of each piece of the equipment with part designations.

31. List of special tools and test equipment required for the operation, maintenance, adjustment, testings, and repair of the equipment, instructions and components. Include lubricants, fuels, identification systems, control sequences, hazards, start up, shut down, noise and vibration adjustments, safety procedures, economy and efficiency adjustments and effective energy utilization.

32. Scale and corrosion control procedures.

33. Dismantling and re-assembly instructions.

34. Trouble shooting, repair instructions.

35. Calibration procedures.

36. Ordering information.

C. Binding - Assemble each group of documents for materials, apparatus, equipment or systems in binders identified for the items covered. Organize the contents in binders as follows:

1. Group documents for each item in the order listed above for contents.

2. Index group of documents for each item in accordance with the filing system of the Contract Specification format.

3. Fold Drawings and other documents larger than 8-1/2" x 11" to properly fit in binders so that they can be fully unfolded without removal from the binder. Reinforce edges of large Drawings.

4. Provide each binder with a Table of Contents.

1.11 BINDERS:

A. General - Hard-cover, three-hole, D-ring, loose leaf binders of size using standard 8-1/2" x 11" sheets. Binding is subject to the approval of the Commissioner.

B. Quantity - As required for the amount of data to be contained.

C. Flysheets - Separate each portion of the manual with colored, neatly prepared flysheets briefly describing contents of the ensuing portion.

D. Cover - Clearly identify the manual on the cover with at least the following information:

1. OPERATION AND MAINTENANCE INSTRUCTIONS

2. Chicago O'Hare International Airport

3. City of Chicago

4. (Complete Project name and Project number)

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT:

A. Materials and equipment must be new and must be labeled in accordance with CEC Section 14-64-010 and must bear the manufacturer's name, model number and other identification markings.

B. Materials and equipment must be the standard product as may be modified by these Specifications, of a specified manufacturer regularly engaged in the production of the required type of material or equipment for at least five (5) years (unless specifically exempted by the Commissioner) and must be the manufacturer's latest design with published properties.

C. Equipment and materials of the same general type must be of the same manufacturer throughout the Project to provide uniform appearance, operation and maintenance.

D. Equipment and materials must be without blemish or defect and must not be used for temporary light or power purposes, including lamps, without the Commissioner's written authorization.

E. Equipment and materials must comply with the requirements of the Contract Documents.

PART 3 - EXECUTION

3.01 INSTALLATION OF WORK:

A. The Contractor must perform all work with trained mechanics of the particular trade involved in a neat and workmanlike manner as accepted by the Commissioner.

B. With the acceptance of the Commissioner and without additional cost to the City, the Contractor must make minor modifications in the Work as required by structural interferences, by interferences with work of other trades and for proper execution of the Work.

C. Work installed before coordinating with other trades so as to cause interferences with the Work of such other trades will be changed as directed by the Commissioner to correct such condition without cost to the City.

D. The equipment must be installed with ample space allowed for removal, repair or changes to equipment. Ready accessibility to removable parts of equipment and to wiring must be provided without moving other equipment which is to be installed or which is in place.

E. The Contractor must compare the Drawings and Specifications, checking all measurements to determine the intent of the Contract Documents. Any discrepancies will be brought to the Commissioner's attention for interpretation.

F. Locations of electrical outlets, lighting panels, cabinets, equipment, etc. are approximate and exact locations must be determined by the Contractor at the Project site.

G. The Contractor must refer to Contract Documents for details, reflected ceiling plans, and large scale Drawings.

3.02 EQUIPMENT NOISE LIMITATION:

A. Noise levels of electrical devices and equipment must be within acceptable limits as established by NEMA or other valid noise rating agencies. Commissioner's acceptance will be based on practical and reasonable considerations of occupancy requirements.

B. The Contractor must check and tighten the fastenings of sheet metal plates, covers, doors, and trims to prevent vibration and chatter under normal conditions of use.

C. When located other than in high-noise-level equipment rooms, the enclosures or solenoid-operated switching devices and other noise-producing devices must have anti-vibration mountings and non-combustible sound-absorbing linings.

D. Transformers, reactors, dimmers, lamp ballasts, and solenoids must be designed and rated for "quiet" operation.

E. The Contractor must remove and replace any individual electrical item or device that is found to produce a sound energy output exceeding that of other identical devices installed on this Project or the requirements of the Contract Documents.

3.03 TRANSMISSION OF VIBRATION:

A. Electrical equipment, conduit, and fittings must not be mounted to or supported by elements subject to vibration except by methods which must prevent transmission thereof.

B. Where flexible conduit lengths are utilized as a means of isolating equipment and conduit systems vibration, care must be exercised to assure continuity of ground throughout.

3.04 PROTECTION:

A. The Contractor must protect conduit and wireway openings against the entrance of foreign matter by means of plugs or caps. The use of such materials as tape, plastic bags, paper, rags, etc. is expressly forbidden. For conduits with threaded ends, as required by the Specifications, the Contractor must provide threaded caps for the protection of the conduit end.

B. The Contractor must cover fixtures, materials, equipment and devices furnished or installed under this Contract or otherwise protect against damage, before, during, and after installation.

C. Fixtures, materials, equipment, or devices damaged prior to final acceptance of the Work must be restored to their original condition or replaced at no cost to the City.

D. Equipment must be inherently safe and moving parts must be covered with guards.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT:

A. Basic Electrical Requirements associated will not be measured separately for payment.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT:

A. No individual payment for this section. All work in this section is to be included in the contract prices of those items requiring the various work items delineated in this specification.

END OF SECTION 16010

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BASIC MATERIALS AND METHODS
SECTION 16100

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Work under this Section is subject to the requirements of the Contract Documents.

B. Furnish and install all electrical work, materials and accessories indicated schematically by Drawings, schedules and as specified herein including, but not limited to, the following:

1. Rigid Galvanized Steel Conduit (RGSC)

2. RGS conduit with PVC coating

3. Electrical Metallic Tubing (EMT)

4. Flexible Metal Conduit (FMC)

5. Intermediate Metal Conduit (IMC)

6. Liquid-tight Flexible Metal Conduit (LTFC)

7. Underground PVC Conduit

8. Bushings

9. Fittings

10. Boxes

11. Wire and Cable

1.02 RELATED WORK:

A. As specified in the following divisions:

1. Section P-610 - Structural Portland Cement Concrete

1.03 REFERENCES:

A. See Specification Section 16010.

1.04 SUBMITTALS:

A. See Specification Section 16010.

B. The Contractor must submit with the wire submittal a listing of the code numbers used by the Manufacturer of the wire/cable the Contractor is submitting.

1.05 QUALITY CONTROL:

A. See Specification Section 16010.

1.06 DELIVERY STORAGE AND HANDLING:

A. See Specification Section 16010.

1.07 WARRANTIES AND GUARANTEES:

A. See Specification Section 16010.

1.08 EXTRA MATERIALS AND SPARE PARTS:

A. None required

1.09 ENVIRONMENTAL REQUIREMENTS:

A. None required

1.10 SPECIAL REQUIREMENTS:

A. Field Measurements - Before proceeding with the fabrication of the Work, the Contractor must verify all dimensions and take such measurements as are required for proper fabrication and erection of the Work.

B. Coordination - Coordinate Work of this section with related Work specified in the other divisions/sections of the Contract Documents.

PART 2 - PRODUCTS

2.01 CONDUIT AND FITTINGS:

A. Rigid Galvanized Steel Conduit (RGSC):

1. Conduit and fittings must be rigid galvanized steel, heavy wall type, hot-dipped galvanized with zinc-coated threads and acceptable agency labeled.

2. Rigid Galvanized Steel conduit and couplings must be threaded, rigid steel, hot-dipped galvanized after fabrication and must be in accordance with UL 6, Federal Specification WW-C-581d and ANSI Standard C80.1.

3. RGSC must be used for all exposed work, unless permitted otherwise in these Specifications, outdoor conduit runs and for all conduit work installed in slabs.

4. Split, compression or setscrew couplings and connectors are not acceptable. All connections and fittings must be threaded.

B. Intermediate Metal Conduit (IMC)- Minimum size 2 inches:

1. Conduit and fittings for intermediate metal conduit (IMC) must be heavy wall type, hot-dipped galvanized with zinc-coated threads and acceptable agency labeled.

2. IMC and couplings must be threaded, rigid steel, hot-dipped galvanized after fabrication and must be in accordance with UL 6.

3. IMC can be used for indoor exposed work in dry locations. It must not be installed below 8 feet with the exception of completing conduit runs to cabinets, panels and pull and junction boxes where the installation has been in IMC.

4. The use of "Uni-swivel" type IMC is acceptable. The "Uni-swivel" system must employ a fully threaded connection. The use of set-screw type of connections are not acceptable.

5. Splice, compression or setscrew couplings and connectors are not acceptable. All connections and fittings must be threaded.

C. EMT Conduit

1. Electrical metallic tubing (EMT) "thin wall" conduit must be steel, electroplate galvanized after fabrication and acceptable agency labeled. The conduit must be in accordance with UL 6.

2. EMT couplings and connections must be of the compression type with insulated throats. The insulated throats must be of flameproof and non-combustible composition materials.

3. EMT must be used for indoor installations where the conduit is concealed in walls and above finished ceilings. EMT will not be installed in concrete.

4. Set-screw, die cast, white or pot metal and indenter type fittings are not acceptable.

D. PVC Coated RGS Conduit

1. PVC coated rigid galvanized steel conduit, including elbows and fittings must be made with RGS conduit, conforming to the RGSC Section if this Specification, to which is bonded a Polyvinyl chloride (PVC) coating for the protection of the conduit.

2. The minimum thickness of the exterior coating must be 40 mils.

3. A Urethane chemical coating must be uniformly and consistently applied to the interior of the conduit and fittings. The internal coating must be applied at a minimum thickness of 2 mils.

4. The PVC coated galvanized rigid conduit must be U.L. listed / labeled. The Manufacturer must submit certified test results from a recognized independent testing company validating that their product meets or exceeds the requirements of ASTM D870-02 Testing Water Resistance of PVC Coating Using Water Immersion and ASTM D2247-02 Testing Water Resistance of PVC Coating in 100% Relative Humidity, to signify compliance to the adhesion performance standards.

5. PVC coated conduit must conform to NEMA Standard RN1-1986.

6. All fittings and components for use with PVC coated conduits must be PVC coated as specified in this Specification. Each coupling must be furnished loose with each length of the conduit and must have a PVC sleeve extending one (1) pipe diameter, or 2 inches, whichever is greater, beyond the end of the coupling. The inside diameter of the sleeve must be the same as the outside diameter of the IPS conduit used with it. The wall thickness of the sleeve must be the same as the PVC coating in the conduit. All screws for fittings which are PVC Coated must be Stainless Steel.

7. For PVC-coated RGS conduit used in RWSL installation, grounding bushings must be installed at the connection to light bases. The bushings must be bonded at the conduit end to ensure connectivity of the conduit to the light bases.

8. PVC coated conduit must be used in chemical environments, and for exterior work and underground ductbanks where so specified.

9. Direct-buried RGS must be PVC-coated.

E. Any portion of the conduit system that shows corrosion within the guarantee/warranty period must be replaced at no cost to the City.

F. The minimum conduit size, unless specified otherwise, is 3/4 inch.

G. All conduit fittings must be of the types specified, must be in accordance with UL 514 for normal application, and UL 886 for hazardous applications

H. Acceptable conduit manufacturers must be Allied Tube and Conduit Corp., Wheatland Tube Company or Steel Duct Conduit Products.

I. Acceptable conduit fitting manufacturers must be Appleton, Crouse-Hinds, OZ Gedney, Bridgeport, Regal or T&B.

2.02 FLEXIBLE CONDUIT AND FITTINGS:

A. Liquid-Tite Flexible Conduit (LTFC) must be galvanized steel with a moisture and oil-proof plastic-coated jacket, listed and labeled by an acceptable agency. LTFC must be rated for the temperature environment in which it must be placed.

B. LTFC must be in accordance with UL 360, with PVC outer jacket and integral ground conductor.

C. Connectors must be malleable iron or steel with insulated throat, squeeze-type, with annular gripping rib. Particular attention must be given to maintaining ground bond and firm support through flexible connections. Liquid-tight connections must have insulated throats.

D. Flexible metal conduit (FMC) must be in accordance with UL 1.

E. Fittings for FMC must be specifically designed and manufactured for the use with FMC.

F. Flexible metal conduit installed in air return ceilings and other plenums will be as approved by the City of Chicago Bureau of Electrical Inspection.

G. Flexible metal conduit installed for FAA facilities must be installed with an external #6 green ground and connect to UL-listed connectors and fittings.

H. Acceptable manufactures are Anamet, Electro-Flex or Ultra-Tite.

2.03 PVC CONDUIT:

A. Non-metallic conduit must be PVC Schedule 40 with concrete encasement where shown on Drawings, except when the conduit contains only FAA cables used for lightning protection, grounding, or bonding.

B. PVC conduit, including elbows and couplings, must meet the requirements of NEMA Standard TC2 (latest edition), UL Standard 641, Federal Specifications WC-1094A and must be UL rated and listed for use with 90 degrees C rated conductors in compliance with Article 347 of the NEC. Materials must have a minimum strength of 7,000 psi, flexural strength of 11,000 psi, and compressive strength of 8,600 psi, all at an ambient temperature of 23 degrees C.

C. The conduit must be manufactured from virgin PVC compound that must meet the applicable requirements of ASTM D1784.

D. PVC conduit fittings must meet with the requirements of NEMA Standard TC3 (latest edition), UL Standard 514 supplement and Federal Specification WC-1094A.

E. Standard fittings and cement must be obtained from the conduit manufacturer. Assembly of the PVC conduit system must be in strict accordance with the manufacturers instructions.

F. Acceptable PVC conduit manufacturers must be National Pipe, Carlon (Lamson and Sessions), Cantex, and IPEX.

2.04 BUSHINGS:

A. Bushings for Rigid and IMC conduit must be malleable iron body with 105 degrees C and with 150 degrees C insulating ring. Insulator material must be molded in place and must be non-removable.

B. Acceptable manufacturers must be Appleton, Catalog Series BU75I, OZ/Gedney Catalog Series IBC-125.

C. Grounding bushings for RGSC and IMC must be Appleton Series GIB-75L or OZ/Gedney Series HBLG0722. Bushings must be hot-dipped galvanized or triple coated with an insulating ring molded into the bushing with a 150 degree C rating. Insulating ring must be non-removable.

D. All bushings must be of the threaded type. Set screw or compression type bushings are not acceptable.

2.05 CONDUIT SEALS:

A. Conduit seals must be Crouse-Hinds Type EYS or EZS, Appleton ESUF or ESUM or OZ Gedney and filled with compound after first damming with proper fiber per the manufacturers instructions. The fiber and compound must be from the same manufacturer as the fitting.

B. Combination seal and drain fittings may be used in lieu of two separate fittings.

C. Acceptable explosion-proof manufacturers must be Appleton Electric Co., Crouse-Hinds Co. or OZ Gedney.

2.06 PULL AND JUNCTION BOXES:

A. Pull and junction boxes in non-hazardous environment exterior of buildings, interior wet areas, and chemical environment where chemicals are stored or mixed with liquids and areas where subject to corrosive elements must be NEMA Type 4X, 316 stainless steel, with stainless steel hinged cover, stainless steel fasteners and stainless steel hardware. Minimum gauge must be 12 ga. for boxes with no dimension larger than 18 inches, and 10 ga. for all other boxes. The welds must be ground or polished to present a clean and neat finish.

B. Pull and junction boxes in non-hazardous and dry environment must be NEMA Type 12 gasketed, 12-gauge, seam welded, galvanized, with a rust inhibitive primer, screwed type or hinged as required by job conditions. All screws must be stainless steel.

C. Pull and junction boxes located in a hazardous environment must be explosion-proof type, rated for the environment into which they must be located.

D. Covers for non-hazardous boxes must be secured with round or flat head machine screws. Where required screws must be of the tamper-proof type.

E. Where required by building construction, special junction or pull boxes must be provided in sizes and shapes determined from field measurements as required to make a neat and workmanlike installation. Special size and/or shaped boxes must be sized in accordance with the Chicago Electrical Code.

F. Where required, boxes with metal barriers or separators for grouping of dissimilar conductors for voltage or system must be provided in compliance with the City of Chicago Electrical Code.

G. Where required by the Drawings or job site conditions special finishes must be provided. These may be hot-dipped galvanized, PVC coated, etc. The Contractor must take extreme precaution when working in these areas to insure that the proper finishes are provided.

H. Acceptable manufacturers must be Appleton Electric, Crouse-Hinds, Hoffman, Keystone, A.W. Circle, Chicago Switchboard or IEC.

2.07 OUTLET BOXES:

A. Outlet boxes for indoor, dry work must be of the galvanized, pressed steel, knockout type. Boxes must be suitable for the structural conditions with the size determined by the number of conduits entering, and the devices or fixtures attached as required by the manufacturer. All outlet boxes must be in accordance with UL 514 for normal application and UL 886 for applications in hazardous locations.

B. Outlet boxes must generally be 4 inches square or octagonal except as follows:

1. In masonry walls, where conduit is installed concealed, each outlet box must be square cut masonry boxes.

2. For concrete installation boxes must be suitable and constructed for installation in concrete.

3. In exposed work, suitable boxes must be used for switches and receptacles. The NEMA type must be as described in this Specification.

4. Outlet boxes for use outdoors or in wet/damp locations must be of the threaded hub, cast malleable iron type, with malleable iron cast covers. Covers must be gasketed unless of the threaded type.

5. In finished plaster walls, drywall, etc., raised device covers on outlet boxes must be provided.

6. Where 1-1/4-inch conduit is required, the box size must be a minimum of 4-11/16 inches square.

C. Proper covers on flush mounted boxes must be provided.

D. Device Boxes

1. Recessed ceiling fixtures, unless otherwise specified by the light fixture manufacturer, must have 4 inch square sheet steel box with blank cover.

2. Surface mounted ceiling fixture and surface mounted wall bracket fixtures must have 4 inch sheet steel octagon box with round opening plaster ring.

3. Ceiling outlets and wall bracket outlets in dry locations must have 4 inch sheet steel octagon box with proper plaster ring.

4. Outlet boxes on exposed conduit run in wet or damp locations must be a cast iron box with threaded hubs and gasketed cover.

5. Wall switch and receptacle boxes installed in tiled or plastered walls must have 4 inch square sheet steel box or multigang box with proper tile or plaster ring as required. Two (2) gang utilization may be provided by means of 4 inch square box with two (2) gang tile or plaster ring.

6. Wall switch and receptacle boxes in dry locations in brick walls, unfinished walls, woodwork, etc. must be a 4 inch square sheet box, with single gang or two (2) gang plate ring of the proper depth.

7. The use of single gang boxes is prohibited.

8. Extra deep boxes must be provided for such devices as dimmers, G.F.I.C.'s or where there are more than 4 wires spliced together with a wiring device(s) also contained in the same box.

E. Plaster covers must have threaded ears and must be of suitable depth for the application.

F. The Contractor must provide boxes with metal barriers, baffles or separators for grouping of dissimilar conductors or system separation.

G. Acceptable manufacturers must be Appleton, Raco, Steel City or Crouse-Hinds.

2.08 WIRE AND CABLE - 600 VOLT:

A. Wire and cable must be soft copper, properly refined and must have minimum conductivity of 98 percent. Aluminum conductors are <u>not</u> acceptable.

1. Conductors for power and lighting must have 600-volt type insulation, must be not less than No. 12 AWG, must conform to the latest CEC and must bear acceptable agency label.

2. Wire for signal and control systems must be No. 14 AWG stranded unless otherwise indicated on the Drawings, or elsewhere in the Specifications.

3. Factory wired equipment of a manufacturers' standard product line must be wired with the manufacturers' standard wire size and type provided that the wiring meets all applicable Code requirements. This does not apply to custom-built equipment as specified elsewhere in the Specifications.

B. Wire and cable must be delivered to the job site in original packaging or on factory reels. All wire and cable must bear tagging or marking on the finish at regular intervals and consisting of manufacturers' name or code number, as well as the insulation type, voltage rating and acceptable agency listing.

C. Wire and cable must be factory color-coded insulation and must be installed and connected as follows:

1. Color coding for voltage system of 250 volts and less must be

a. "A" Phase - Black

b. "B" Phase - Red

c. "C" Phase - Blue

d. Neutral - White

e. Ground - Green

2. Color coding for voltage system of over 250 volts and less than 600 volts must be

a. "A" Phase - Brown

b. "B" Phase - Orange

c. "C" Phase - Yellow

d. Neutral - Gray

e. Ground - Green

3. Green must be used for grounding only.

4. Three-way and four-way switch travelers must be of a different color from colors stated above and they must be of the same color.

D. The insulation must be applied tightly to the conductor and must be free stripping.

E. Branch circuit wiring must be solid copper No. 12 AWG unless otherwise specified.

F. Wire No. 10 AWG and larger must be stranded copper.

G. Conductors for RWSL or FAA cable smaller than No. 10 AWG must be solid.

H. Type THHN/THWN thermo-plastic insulated, 90 degrees C dry and 75 degrees C wet rated must be used for light, power and other wiring not specifically defined for all sizes. Type THHN thermo-plastic insulated 90 degrees C rated must be used for continuous row fluorescent fixture wiring.

I. Wire and cables 600-volt rated for installation in floor slabs, etc. and outdoor use in exposed conduit must be XHHW-2. All underground ductbank installation must be RHH/RHW/USE, either XLP-USE or EPR with a CPE jacket, insulated.

J. Wire types for the telephone, communications, public address, computer data, door security and fire alarm systems must be in accordance with recommendations of the equipment manufacturer. Acceptable manufacturers of this type of cable must be American Insulated Wire, Belden, Dekoron, Okonite, Pirelli or West Penn.

K. The 600-volt insulated wires and cables must be factory tested prior to shipment in accordance with the latest ICEA standards for the insulation specified.

L. All RWSL and FAA cable must also tested prior to installation, and after installation. Testing must be witnessed by the FAA and Commissioner, recorded, and included within the turnover binder.

M. Samples and reports on the results of shop tests for all wire and cables, descriptive literature for splices and terminations must be submitted and must be treated as a Shop Drawing submittal.

N. Acceptable cable manufacturers for 600-volt rated cable must be American Insulated Wire Corp., Southwire, Cerro, Aetna, Pirelli, and Draka Cableteq.

2.09 CONNECTORS:

A. For connections to bus bars, use copper compression connectors. Connectors must be crimp type. All connectors must be copper. Copper compression connectors must be long barrel, tin plated, closed end compression type. The barrel for each cable lug must be sized for the exact cable size specified. Copper-Aluminum connectors are not acceptable.

B. Mechanical or set screw types are not acceptable. The cables must be terminated with the die type compression tools. The compression connection must be UL rated. Use only those tools which must provide a UL rated connection for the manufacturers product used.

C. Conductors No. 2 AWG and larger must terminate in two-hole solderless lugs.

D. Conductors No. 10 AWG and No. 4 AWG, inclusive, must terminate in one (1)-hole lug.

E. Multiple-hole lugs must have NEMA spacing

F. Acceptable connector manufacturers must be Burndy Type YA, Anderson Type VHCL, Thomas & Betts Co., Series 54800 and 54900 or Panduit Series LCB.

2.10 TAPE:

A. Tape must be UL approved, black or colors as required, self-fusing jacketing tape, resistant to weather, oils, water and chemicals. Tape must meet or exceed Scotch 33+.

B. Acceptable manufacturers must be Amazon, Plymouth or 3-M.

2.11 WIRE-PULLING LUBRICANT:

A. Where necessary to use a lubricant for pulling wires, the compound must be listed by Underwriters Laboratories. Cable pulling lubricant must be biodegradable, non-flammable, non-toxic compound with a solid residue of not more than 1.5 percent and a viscosity of at least 50,000 C.P.S.

B. Cleaning agents or lubricants that have a deteriorous effect on conductors covering must not be used. Cable lubricant must contain no waxes, greases, silicones or polyalkylene glycol oils.

C. Lubricant must be rated to match temperature conditions at the time of installation.

D. Acceptable manufacturers must be Polywater J, High Performance Cable Lubricant, Ideal or Aqua-Jel 2.

2.12 SUPPORTS:

A. Where conduits are supported with one-hole straps, spacers must be used to provide 1/4 inch minimum clearance between the conduits and supporting surfaces. All hangers, racks and straps must be galvanized steel.

B. Perforated strap hangers are not acceptable. The use of tie wire is not acceptable.

C. Hanger rods for trapeze-type hangers must be made from high tensile strength carbon steel not less than 3/8 inch diameter. The rods must have free-running, burr-free Unified National Coarse threads, with an electro-galvanized finish. Threaded rods used outdoors, in wet areas or in corrosive areas must be Grade 316 stainless steel.

D. Conduit supports for trapeze hangers must be made from U-shaped steel components which are galvanized. Minimum material thickness must be 12 gauge. Supports must be hot-dipped galvanized or stainless steel for exterior use. For areas of corrosive nature, or where PVC Coated strut is used, PVC coated components must be provided. The use of painted components is prohibited. The miscellaneous components which are required to complete the support materials, except the threaded rod, must have the same finish as the U-shaped channel. Conduit supports must be as manufactured by Unistrut Corp., Kindorf, Powerstrut or B-line.

E. When conditions exceed the structural capabilities of U-shaped strut the Contractor must submit for review detailed Drawings indicating the proposed method of support. The submittal must contain complete details of fabrication, calculations, materials and finishes.

F. All field cut ends must be treated in a manner which must insure the integrity of the support system immediately after cutting and before installation. The repair must be done with materials which are compatible with the factory finish. In no case must spray on galvanizing be acceptable for PVC or other special finishes.

G. Supports must be held to concrete walls and ceilings by power-driven fasteners or electro-galvanized steel or stainless steel inserts as manufactured by Ramset, Unistrut Corp. or Hilti. The support type must be determined by the area conditions.

H. Where single conduits are supported in ceilings, products such as "minis", must be used. The hanger rod size must be as required by the hanger manufacturer.

I. In metal stud walls, products such as "Caddy clips" must be used to support conduits. These supports must be of the locking type which have an overstrap to lock the conduit into place. These supports must be held in place with screws which must attach them to the metal stud construction.

J. For 4 inch and 4-11/16 inch boxes, 1/4 inch rods must be the minimum size. Larger size boxes must have hanger rods sized in accordance with the load, but must not be smaller than 1/4 inch.

K. Boxes installed in stud walls must be secured to the studs by attaching to the stud with mounting brackets specifically designed for this purpose. No box will be installed with support supplied on only one side of the box. Acceptable manufacturers are Appleton, Raco, Steel City or Caddy.

2.13 SPLICES:

A. No splicing will be permitted except in junction boxes, handholes and manholes. Splices and terminations in wire/cable larger than 8 AWG must be made with compression type connectors and lugs. The tools used must provide a UL certified connection. Indenter type compression fittings must not be acceptable. Lugs must be one (1) or two (2)-hole, color keyed. Lug bolting must include a flat washer, Belleville washer and a locknut.

B. Outdoor splices of conductors must be made using heat shrink products which, when properly installed, must produce a completely sealed covering over the connectors or lugs. The tube or jacket must be completely coated with mastic to insure a 100 percent seal to the conductor jacket. The splice, when completed, must be watertight. An acceptable manufacturer of this type product is Raychem Inc.

C. All splices and pigtail connections in lighting and receptacles wiring No. 8 AWG and smaller must be made up with the pre-insulated spring connectors. Acceptable products are Buchannan, Ideal Wingnut or Scotch Lock 2.

D. Splices of RWSL or FAA cables are not allowed without prior approval of the FAA and Commissioner.

2.14 TERMINAL BOXES:

A. Terminal boxes must be UL 508 Listed for Type 12 and Type 13 or Type 4X. They must conform to NEMA Standards for Types 12 and 13 or Type 4X and they must conform to JIC Standard EGP-1-1967.

B. Each box must have provisions for the mounting of terminals, either on an internally mounted panel, or on metal strips which are provided by the manufacturer expressly for the purpose of attaching terminal strips. Wherever a panel or strips are provided they must be mounted on studs using lockwashers and nuts.

C. Terminal boxes in non-hazardous environments which are exterior of buildings, in interior wet areas, in chemical environment where chemicals are stored or mixed with liquids and in corrosive areas must be NEMA Type 4X, 10-gauge minimum for boxes with a dimension over 18 inches, 12 - gauge minimum for smaller boxes, 316 stainless steel with stainless steel hinged door, stainless steel fasteners and stainless steel hardware. Boxes must have provisions for external locks. The welds must be ground or polished to present a neat and clean appearance.

D. Terminal boxes in non-hazardous and dry environment must be NEMA Type 12 gasketed, 12-gauge, seam welded, galvanized, with a rust inhibitive primer, hinged door, and must have provisions for external locking. The interior must be painted with white enamel. The exterior will be painted, color as required by the Commissioner.

E. Acceptable manufacturers of enclosures are Hoffman, A. W. Circle and IEC.

F. The terminals must be 30 ampere, 600 volt rated, barriered, with pressure plate lugs for termination of control wiring. The terminals must be of modular design and must be held in place in such a manner as to prevent them from becoming loose when adding or removing terminals. Terminal blocks will be acceptable agency listed. Acceptable manufacturers are Buchanan, Allen Bradley, Eaton/Cutler-Hammer/Westinghouse, G. E., and Square D.

G. The terminal box assembly must be acceptable agency labeled. Identification of terminals and wiring must be per Specification 16195 - Identification.

H. Acceptable suppliers of the assembled terminal box are Panatrol, Chicago Switchboard, and Gus Berthold.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL:

A. Interferences:

1. Locations of conduits, fixtures and equipment must be adjusted and supported to accommodate the work in accordance with field conditions encountered, anticipating potential interferences.

2. The Contractor must determine the exact route and location of each pipe, duct and electrical raceway prior to fabrication.

B. Accessibility

1. The work must be installed to permit removal (without damage to or removal of other parts) of parts requiring periodic replacement or maintenance and as defined by the Chicago Electrical Code.

2. Conduits and equipment must be arranged to permit ready access to components and to clear the openings of swinging and overhead doors and of access panels.

3. The Contractor must provide necessary access panels in equipment as required for inspection of interior and for proper maintenance. Access panels must be as specified in other parts of the Contract Documents.

3.02 CONDUIT INSTALLATION:

A. All conduits must be installed as required. The conduit system must be installed complete with all accessories, fittings, boxes and supports in an approved and workmanlike manner to provide proper raceways for electrical conductors.

1. All conduit runs shown in the Drawings are shown diagrammatically for the purpose of outlining the general method of routing the conduits to avoid interferences.

2. Conduit systems must be run concealed or exposed as shown or as dictated by job-site conditions.

3. Exposed conduit runs must be installed true, plumb, parallel with or at right angles to adjacent building members, and must present an orderly, neat and workmanlike appearance.

4. Field bends must be carefully made to prevent conduit damage or reduction in internal areas. All bends must be made with equipment specifically made for the purpose of bending conduit. The bending radius must not be less than six (6) times the nominal diameters of the conduit, with carefully matched bends on parallel runs to present a neat appearance. The number of crossovers must be kept to a minimum. Where larger radii are required to meet utility company requirements, etc., they must be provided. Hickey bends are not acceptable.

5. For PVC conduit bends which exceed the radii available the Contractor must field bend the conduit using equipment and methods as directed by the conduit manufacturer. Extreme care must be taken not to deform the conduit.

6. Conduits which are crushed or deformed in any way will not be installed.

7. All conduits cut on the job must be carefully reamed inside and out to remove burrs. All field cut ends of conduits must be cut square and must be done with the proper tools. The use of tubing cutters is strictly prohibited. Conduits not properly cut will be replaced at no cost to the City.

8. For PVC coated conduits all field bends must be made using tools specifically designed for the purpose of bending PVC coated conduits. If the Contractor does not have these tools he must bend the PVC coated conduit using a bend radius one size larger than would normally be used for that size conduit.

9. All threads must be tapered. No running threads will be permitted. Threads on steel conduit must be given a coat of zinc duct in oil, or other approved compound. All joints must be properly tightened and must be watertight and insure a low resistance ground path in the conduit system.

10. For PVC coated conduits field cut threads must be done with tools as specified by the manufacturer of the PVC coated conduit. Extreme care must be taken to prevent damage to the PVC coating. The manufacturers' instructions must be followed for this operation. After the threads have been cut any damage to the coating must be immediately repaired using materials and methods as recommended by the manufacturer. The material thickness of any field repair must be equal to the factory finish which has been damaged. Repairs must be done immediately.

11. The Contractor must exercise extreme care in the assembly of PVC coated conduits. Metal jawed tools will not be used for this assembly. Conduits which are damaged as a result of using improper tools must be removed and replaced by the Contractor at no cost to the City.

12. All conduits must be carefully cleaned before and after installation and all inside surfaces must be free of imperfections likely to injure the cable. After installation of complete runs, all conduit must be snaked with an approved tube cleaner equipped with an approved cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the conduit. Any conduits through which the mandrel will not pass must be removed and replaced. All conduits installed in interior areas 1 inch and smaller must be cleaned by pulling clean rags thru the conduits. After cleaning, the ends of the conduits must be protected as specified to prevent the entrance of water and other foreign matter. The use of such items as plastic bags, tape, paper, rags, etc. will not be used under any circumstances. Failure to properly protect conduit ends must result in the Contractor having to again mandrel the conduits immediately before installing the wires.

13. Lines of nylon, polyolefin or polypropylene, propelled by carbon dioxide, vacuum or compressed air, must be used to snake or pull wire and cable into conduits. Flat steel tapes or "sparks" type tapes can only be used in conduit runs of 50 feet or less. They will not be used in PVC or PVC coated conduits. Metal cables are expressly forbidden for pulling wire/cable. Non-metallic pull tapes can be used for all types of conduits.

14. Where conduits are connected to boxes or equipment enclosures, drilled holes or full size knockout openings must provide electrical continuity for grounding and must be assured by the use of bonding type locknuts. Where connections are at slightly eccentric openings, jumper type grounding bushings and wire jumpers must be installed. Should the openings become excessively eccentric, as determined by the Commissioner, the box or equipment must be replaced at no cost to the City. The use of reducers will not be found acceptable under any circumstances.

15. Telephone conduit radius must not be less than 10 conduit diameters. The Contractor must verify with the company providing phone service as to their actual requirements for installation.

16. Conduit systems must be installed, with fittings, couplings, connectors, double locknuts, bushings, etc., and made up tight to insure ground continuity throughout the system.

B. As far as practicable, conduit must be pitched slightly to drain to the outlet boxes, or otherwise installed to avoid trapping of condensate. Where necessary to secure drainage, a breather-drain fitting must be installed in the boxes at low points. Each breather drain fitting must be manufactured by Crouse-Hinds Co., Appleton Electric Co., or O.Z. Gedney. Conduit must not run through columns or beams unless so specifically detailed, submitted and accepted by the Commissioner.

C. Each building expansion joint, each straight uninterrupted run of surface mounted conduit, and vertical risers in excess of 100 feet must be provided with appropriate expansion fitting. The distance between fittings as installed must not exceed 200 linear feet.

D. The Contractor must furnish and install expansion couplings and bonding jumpers for metallic conduit system where conduits cross building expansion joints or where conduits transfer between structurally independent pipes, poles or supports.

E. Conduits crossing building-expansion joints must be provided with expansion fittings and flexible grounding bonds bypassing the fittings to insure ground continuity.

F. Conduit Installed in Concrete Slab

1. Where conduit is to be installed in concrete slab, conduit must be placed in the center of slab and no closer than 3 diameters from adjacent conduits. The maximum outside diameter of conduits in the slab must be no greater than _ of the slab thickness. The minimum slab thickness must be 6 inches for embedded conduit installation. In no case must conduits be installed in the bedding material of the finish floor covering.

2. Conduit openings must be temporarily plugged to exclude water, concrete, plaster and other foreign material. For smaller conduits push pennies may be acceptable, as determined by the Commissioner.

3. Conduits run in or below any floor slab must be entirely encased in reinforced steel concrete. In no case must conduit be laid in the fill below slab.

4. Conduits embedded in concrete must be blocked and braced in place by use of adequate conduit separators to prevent displacement during the placing of concrete. The Contractor must be held responsible for proper position of conduits and must rearrange any conduit that may be displaced, when concrete is placed, at his own expense.

5. Conduits run in floor slabs or underground must be a minimum of 1 inch in size, rigid galvanized steel conduit unless noted otherwise on the Drawings.

6. All concealed conduits must be placed in walls and ceilings at the proper time, in accordance with the progress of the structural work.

7. Concrete-encased conduit runs extending through structural expansion joints must have fittings permitting longitudinal movement of the conduit ends without damaging the contained wires. The fittings must be watertight and include a grounding bond.

G. Conduits installed in dry locations requiring a flexible connection for adjustment or vibration isolation must be provided with an 18 inch minimum length of either FMC or LTFC, as required by the area conditions.

H. Flexible conduit installed in wet locations, exterior locations, air return ceilings and at motors must be liquid-tight type except for lighting in air return ceilings which must be of a type acceptable to the Bureau of Electrical Inspection, City of Chicago.

I. Flexible conduit in ½ inch trade size may be used for connections with a maximum length of 18 inches for such devices as limit switches, for which the use of ¾ inch flexible conduit may not be practical due to the manufacturer providing only threaded hubs of the ½ inch size. In the case of such installations as electric door locks, where only ½ inch provisions are available, the Contractor can install ½ inch conduit from the device to a box located as close as possible.

J. The number of 90 degree bends must be limited to four or a total of 360 degrees including all off sets, sweeps, kicks, etc. This must be between any pull points.

K. The Contractor must be aware that the conduits are sized for cables routed in exposed rigid steel conduits, as denoted on the Contract Drawings. The same cables may be partly routed in ductbanks. The ductbanks are sized on the Drawings.

L. Conduits entering motor control center conduit compartments, switchboards, switchgear, unit substations, etc. must be fitted with jumper type insulated grounding bushings, bonded together and to the structure of the enclosure by a continuous bonding wire.

M. Conduit runs entering the building from outdoors are subject to moisture accumulation due to condensation. After the wires and cables are installed, the end of the conduit continuing into the warmer area must be packed with a non-setting sealing compound.

N. All communication, telephone, data and computer conduits must have a minimum separation of 12 inches from any AC power and control conduits.

O. The Contractor must orient outlet boxes for duplex receptacles or multiple gang switches for horizontal mounting.

P. An outlet box must be provided at each location requiring one

1. Outlet box locations as shown on the Drawings must be considered as approximate only, unless noted otherwise on the Drawings.

2. Exact locations must be determined from the Drawings and/or from field instructions and coordination with the work of all other trades.

3. Boxes must be installed true and plumb, so that the covers or plates must be level, and at uniform elevations for the type of wiring devices contained.

4. Boxes for toggle switches and pilot lights at doorways must be located at the strike side of the door.

5. Fixtures which weigh more than 5 pounds must be supported independently of the box.

Q. There must be no more openings made in any box than are required for the conduits entering same. Depths of boxes must be as to allow for easy wire pulling and proper installation of wiring devices.

R. All boxes must be supported independent of the conduit system. The boxes must be supported from the building structure. Conduits must not be supported from the boxes.

S. Switches and receptacles must be ganged in a common box only when directed or indicated on the Drawings.

T. All ceiling outlets must have adequate supports and must be equipped with adequate devices to carry and mount the light fixtures. They must not be supported from the ceiling structure.

U. Conduit connections to NEMA 12 equipment must be made up with sealing locknuts. Conduit connections to NEMA 4 and NEMA 4X equipment must be made with Myer's type hubs. In no case must the Contractor terminate conduit to a NEMA 4 or 4X component by providing knock-outs and locknuts.

3.03 CONDUIT CONNECTIONS TO EQUIPMENT:

A. The conduit system must terminate at the terminal box or at the conduit connection points of electric motors, devices and equipment. Terminations of conduit at such locations will permit direct wire connections to the motors, electrical devices or other equipment.

B. Conduit connections must be made with rigid conduit if the equipment is fixed and not subject to adjustment, mechanical movement or vibration. A union type fitting must be provided when GRS or IMC is terminated at each enclosure or piece of equipment which contains a threaded termination for the conduit. This may be a threaded hub or through a fitting such as a Myers type hub. Conduit terminations using double locknuts do not require union type fitting.

3.04 PULL BOX INSTALLATION:

A. Pull boxes must be installed where shown and where necessary to insure that the installed cable will not be damaged.

B. The Contractor must add pull boxes where needed even through not shown on the Drawings.

C. Junction boxes and pull boxes of the proper size and shape must be provided. Where suitable, standard outlet boxes must be used as junction boxes and pull boxes.

D. Pull boxes and junction boxes must be supported from the building structure and must not be supported by the conduit. Pull/junction box supports must comply with the applicable requirements for supports as contained in these Specifications.

3.05 WIRING INSTALLATION:

A. All cable and wire must be installed in conduit.

B. No splices will be permitted between terminals, except at approved junction or terminal box points. Cable and wire runs must be looped through pull boxes without cutting and splicing where possible. Boxes must be sized to allow cable and wire installation without splices.

C. All hardware, such as cable stanchions, racks, insulators, brackets, structural supports, wall inserts, cable and junction boxes, bolts, connectors, clamps, fittings and other accessories for the installation of wires and cables in buildings, manholes and outdoors must be furnished and installed complete to provide a satisfactory operating installation.

D. All wiring systems must be "pullable" and use of "BX" is prohibited.

E. Branch Wiring

1. Branch circuit wiring for lighting and other single phase applications must be sized for a voltage drop in accordance with the City of Chicago Electrical Code.

2. The maximum voltage drop for each circuit must be 3 percent for power and 1 percent for lighting circuits.

3. The Contractor must use multi-wire circuits utilizing separate neutrals and must follow the color coding established. The Contractor must size the wire in accordance with the following:

a. Under no circumstances must any switch break a neutral conductor.

b. Where farthest wiring device or light is no more than 75 feet from the panel, No. 12 AWG wire must be used between all wiring devices and for home runs.

c. Where the farthest wiring device or light is more than 75 feet from the panel, the Contractor will submit voltage drop calculation to the Commissioner, prior to sizing the wire. These calculations must show the wire size to be installed by the Contractor.

d. The minimum wire size must be No. 10 AWG between the panel and the first wiring device or fixture when located more than 75 feet from the panel, with a minimum No. 12 AWG wire being used between all other wiring devices or fixtures.

e. In office areas, each circuit must have its own neutral. Networking of circuits is not permissible in these areas.

This does not apply to lighting circuits with the exception of fixtures which employ electronic ballasts.

F. Wiring systems in plenum spaces must be installed in accordance with the Chicago Electrical Code and the Chicago Fire Code.

G. Feeders must be installed with the sizes as indicated on the Drawings and must be connected as required for the proper operation of the equipment they serve.

H. Building utility motors must be provided under other sections of the Specifications.

1. The Contractor must make all connections necessary to leave motor driven equipment in satisfactory operating condition.

2. The Contractor must provide power branch circuit wiring for all motors and starting equipment.

3. The Contractor must verify the actual motor sizes to be installed, and the actual locations, and provide wiring and equipment of proper sizes as required.

4. At the time when each motor is first operated, the Contractor must check the motor terminal voltages and the amperes in each motor lead to ascertain that, under normal load conditions, the currents do not exceed the nameplate rating on the motor.

5. If the ampere reading in any leads exceeds the nameplate rating of the motor, or if the motor terminal voltages vary more than 5 percent from the nameplate rating of the motor, the Contractor must disconnect the motor and request further instructions from the Commissioner.

I. Proper termination of conduits and wires at motors, control panels or other equipment items must be provided.

J. In the event that conduit and wire sizes increase beyond the motor or equipment manufacturer's normal provisions for conduit and wire terminations, due to voltage-drop or other considerations in motor branch-circuit designs, the Contractor must provide auxiliary termination facilities, with adequate boxes, lugs, terminals, knock-outs, etc., as may be required.

K. Equipment having safety devices such as limit switches, overload relays, high-low water cut-outs, high-low pressure switches, solenoids, pilot devices, flow switches, freeze protection thermostats, etc., must be so

wired that they must always be in the control circuits of selector switches regardless of switch position.

L. The only devices that may be shunted out in the manual position of a selector switch are remote pushbutton stations, clocks, timers and room thermostats and ductstats of the non-limit type.

3.06 SPLICES AND TERMINATIONS - 600-VOLT CABLE:

A. All splices and terminations must be carefully taped and covered using material recommended by the cable manufacturers, to provide insulation equal to that of the conductors.

B. All splices must be made in proper splice or junction boxes. Splices must not be made in power or control panels. Splices must not be pulled into any conduit. Splices must not be made in any fitting.

C. Shielded Cable Grounding

1. Shielded control cables must have the shields grounded at one (1) end. The shield must be insulated from ground, equal to that of the original cable instructions, at each splice.

2. Coaxial cable shields must be insulated from ground throughout the length of the cable run. The shields must be grounded at, and only at, the coaxial connector terminating in the equipment on each end of the cable run.

D. Splices

1. Splices must be performed only by experienced and qualified cable splicers regularly engaged in this type of work.

2. Shielded cables must have the ends of the shielding bonded together across splices to provide a continuous electrical path. Splice will be made with a terminal block and only when approved by the Commissioner.

3. All cable runs must be given an insulation resistance test and continuity check at the completion of each splice throughout the length of the cable run.

4. Where a cable is cut preparatory to splicing, the work must proceed without delay. When an unavoidable delay is encountered in completing a splice, the opened cable must be protected to prevent the entrance of moisture and foreign matter with a heat shrink cap.

5. The Contractor must splice control cables with the splice kits and materials manufactured for the purpose of splicing control wiring and in accordance with manufacturer's instructions. A power cable splice kit or resin must not be used to make a control cable splice, and vice versa, under any conditions.

3.07 WIRING METHODS:

A. All remote mounted devices such as control stations limit switches or pressure switches in a common circuit must have their wires brought back to the terminals on one (1) panel.

B. When multi-conductor cables are used the number of conductors to be provided in each cable to be such that at least 1 spare conductor must be available for up to 5 conductors in use, 2 spare conductors must be available for 6 to 10 conductors in use, and 20 percent must be available for more than 10 conductors in use. The spare conductors are only required between major electrical equipment.

C. Multi-conductor cable jacket must be pulled back and neatly trimmed to allow conductors to be separated, so they can be terminated to more than one (1) device. The cable must be supported in the panel where it enters the enclosure.

D. Spare conductors must have the ends taped and they must be neatly coiled and tied and left in the bottom of the enclosure. They must be marked as spare conductors.

3.08 ELECTRICAL HARDWARE INSTALLATION:

A. Locations

1. Anchor bolts, sleeves, inserts, hangers and supports required for the work must be furnished and installed by the Contractor.

2. Any expense resulting from improper location or installation must be paid for by the Contractor at no cost to the Commissioner.

3. Where conduit and equipment is to be suspended from poured concrete construction, the Contractor must provide approved concrete inserts in the form work. Expansion shells may be used on precast concrete members but not closer than three (3) inches from the edge. The Contractor must verify the acceptable depth of anchors before beginning work on any pre or post tensioned members.

B. Hangers

1. The Contractor must provide adequate supports for all conduits and equipment, either suspended from the construction above, or by means of struts to the construction below. Where metal deck pan is used for the concrete floor above, anchors must only be placed in the rib. When the weight of the support system, including the completed electrical assembly, exceeds 100 pounds per hanger the Contractor will submit his design for review to the Commissioner.

2. Hangers for support of conduit must be fabricated type, but not of the perforated iron type, and must conform to the requirements of the Contract Documents.

3. Hangers must be suitable for the weight of the material / equipment being supported. This must include any and all pulling loads, as well as the load of the conductors, which the support may be subject to.

4. Trapeze type hangers may be used where several conduits are to be installed at the same elevation.

5. The Contractor must provide straps, clamps, threaded rods, turnbuckles and anchors and all miscellaneous specialties for the attachment of hangers and supports to the structure.

6. Vertical conduits must be supported by heavy metal clamps or collars anchored in or to the construction at each floor.

C. Conduit Supports

1. Exposed conduits must be supported in an approved manner. Conduits must not be fastened to or come in contact with any mechanical system pipes, ducts or equipment of other trades, except as approved by the Commissioner. In all conduit work, acceptable hangers, racks or a combination thereof must be used as supports.

2. Conduit trapeze supports must be located at intervals not exceeding 5 feet. Single conduits must be supported as required by the Chicago Electrical Code.

3. Conduits must be securely fastened to each trapeze with U-bolts, straps or clamps.

4. Whenever possible conduits must be supported from the building structural steel. Beam clamps must be used to attach to the steel.

When the conduit supports must be attached to the structural concrete proper anchors must be installed. Anchors must not be closer than 3 inches from the edge of the concrete. The use of anchors containing lead, plastic or wood is strictly prohibited.

D. Sleeves

1. The Contractor must provide sleeves in fire rated walls and floors, and when penetrating CMU walls.

2. Wall sleeves must be minimum 18-gauge galvanized sheet metal, as approved by Code, of sufficient length to finish flush with finished surfaces at both ends of the sleeves.

3. Sleeves must be not less than 1 inch larger than outside diameter of the conduit.

4. Floor sleeves must be galvanized steel pipe, as approved by Code, 3 inches above floor, and must be watertight.

5. Where conduit passes through floors or exterior walls, the Contractor must caulk sleeves with an appropriate system to insure the complete sealing of the opening to prevent passage of water, dirt or air and to insure the fire rating of the structure penetrated.

6. Sleeves must be set true to line plumb and position and must be so maintained during construction. Where sleeves are provided in poured concrete, the Contractor must inspect same during and after concrete is poured to insure proper position and to correct any deviation at the Contractors expense.

3.09 PAINTING:

A. Prime Coat

1. Shop fabricated and factory built equipment without a primer must be galvanized or protected by plating. Before delivery to the site, the equipment must be cleaned and given one (1) shop coat of zinc-chromate primer.

2. Any portions of the shop coat damaged in delivery or during construction must be recoated.

3. Nameplates, labels, tags, stainless steel or chromium-plated items such as motor shafts, levers, handles, trim strips, etc. must not be painted.

B. Finish Coat

1. Conduit and equipment must be left cleaned and primed, ready for finish painting provided under the Painting Section of the Specifications.

2. All equipment, panelboards, switchboards, etc. must be factory finished in baked enamel or lacquer, or as specified. Standard finishes must be as approved. All scratches must be neatly touched-up by the Contractor.

3. All metal work installed by this Contractor exposed to weather and not factory finished must be painted with one coat of rust inhibitive primer and two coats of oil based paint of color selected by the Commissioner.

3.10 PATCHING:

A. The Contractor must provide all cutting and patching of building materials required for the installation of the work herein specified:

1. No structural members must be cut without the approval of the Commissioner.

2. Roof deck is considered a structural member.

3. Approved cutting must be done with concrete saws or core drills.

B. Patching must be provided by mechanics of the particular trade involved and done in a neat and workmanlike manner.

C. Slots, chases, openings and recesses through floors, walls, ceilings and roofs must be cut by the Contractor. The Contractor must see that they are properly located.

D. Slots, chases, openings and recesses in the structure must be cut by a qualified Contractor. The Contractor must patch and repair as required. Where patching or repair becomes excessive at a location, as determined by the Commissioner, the Contractor must use skilled craftsmen of the appropriate trade to make the repairs or patching.

3.11 CLEANING:

A. Open ends of conduit and equipment must be properly capped or plugged to keep dirt and other foreign manner from entering.

B. Each length of conduit must remain capped until the conduit connections are required.

C. Trenches must be kept free from water. Conduits for ductbanks must not be laid when conditions of the trench are unsuitable for such work, or the weather must prevent quality work.

D. When work is not in progress, open ends of conduit and fittings must be securely closed so that no water, earth or other substance must enter.

E. When so directed by the Commissioner all material being removed must become the property of the Contractor, must be removed from the Airport and must be legally disposed of off City property by the Contractor.

F. The Contractor must be responsible to keep the areas where work is occurring broom clean at all times.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT:

A. Basic materials and methods associated with the electrical installation will not be measured separately for payment.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT:

A. No individual payment for this section. All work in this section is to be included on an individual basis to those items requiring the various work items delineated in this specification.

END OF SECTION 16100

ELECTRICAL IDENTIFICATION
SECTION 16195

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Work under this section is subject to the requirements of the Contract Documents.

B. Furnish and install Electrical Identification as shown on the Drawings and as specified herein, including but not limited to the following:

1. Conduit markers

2. Wire / Cable Markers.

3. Warning Tape.

4. Danger Signs.

5. Equipment Identification.

C. For the purposes of this Specification the term "Cable" must apply to any type of conductor mentioned in the Contract Documents.

1.02 RELATED WORK:

A. As specified in the following divisions:

1. DIVISION 16 - ELECTRICAL

1.03 REFERENCES:

A. See Specification Section 16010.

1.04 SUBMITTALS:

A. The Contractor must submit data to the Commissioner prior to purchasing and installation. The data must include but not be limited to the following:

1. Catalog cuts and major electrical equipment manufacturers' Drawings must include, but is not limited to, relays, meters, current and potential transformers, disconnect switches, fuses, contractors, lighting and more.

2. Complete rating data for all equipment must be provided.

3. Instruction books, operation and maintenance manuals with spare parts must be provided.

B. Submit samples of Conduit markers, cable markers and Phenolic Tags.

C. Submit a nameplate log which must clearly indicate the exact wording for each nameplate.

D. Shop Drawings - See Specification Section 16010.

1.05 QUALITY CONTROL:

A. See Specification Section 16010.

1.06 DELIVERY STORAGE AND HANDLING:

A. See Specification Section 16010.

1.07 WARRANTIES AND GUARANTEES:

A. See Specification Section 16010.

1.08 EXTRA MATERIALS AND SPARE PARTS:

A. None required

1.09 SPECIAL REQUIREMENTS:

A. Field Measurements - Before proceeding with the fabrication of the Work, the Contractor must verify all dimensions and take such measurements as are required for proper fabrication and erection of the Work.

B. Coordination - Coordinate Work of this section with related Work specified in the other divisions/sections of the Contract Documents.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Products of one of the following Manufacturers will be acceptable (for each type marker):

1. Alarm Supply Co., Inc.

2. Brady, W.H. Co.

3. Calpico Inc.

4. Cole-Flex Corp.

5. Direct Safety Co.

6. George-Ingraham Corp.

7. Griffolyn Company

8. Ideal Industries, Inc.

9. LEM Products, Inc.

10. Markal Company

11. National Band and Tag Co.

12. Panduit Corp.

13. Garfoplast.

2.02 UNDERGROUND CABLE MARKERS:

A. Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than one (1) type is specified for an application, selection is installer's option, but provide only one selection for each application.

B. Cable markers for all underground cables must be vinyl tags, with the lettering etched through the outer layer. Tags must have the lettering engraved through the outer layer exposing the second layer. The edges of each tag must be beveled. Markers must be held in place with Nylon, self-locking cable ties. Each marker must be provided with a hole at each end of the marker for the purposes of attaching the marker to the cable.

1. The cable markers must be white vinyl with black letters. Letters must be a minimum of 3/8 inch in height.

C. Cable identification must be the circuit number and the panel designation it is powered from. Where the cable originates from a piece of equipment, which is not a panel, the marking must be the item being fed and the source, i.e. " EF-1 MCC-1 ".

2.03 UNDERGROUND CONDUIT MARKERS:

A. Manufacturer's standard permanent, bright-red, continuous-printed plastic tape, intended for direct-burial service, not less than 6 inches wide x 4 mils thick. Provide tape with printing which most accurately indicates type of buried electrical service. Tape must be of the Aluminum Foil Polyethylene Laminate type which must be detectable when buried.

2.04 INTERIOR CABLE MARKERS:

A. Cable markers must be installed on both ends of all conductors. Self-adhesive, self-laminating, or heat shrink tubing or plastic bead type must be used. All markers must be mechanically printed. Cable markers must be rated for the environment in which they are placed. Acceptable manufacturers will be Brady, 3M, Panduit or Garfoplast.

B. Circuit identification must be per the Contract Drawings. Should the Drawings not specify the circuit identification the following system must be used:

1. For branch circuit wiring from receptacle/lighting panels the circuit identification must be the panel number and the circuit number.

2. For circuiting from distribution panels the circuit identification must be the panel number and the circuit number.

3. For power conductors from MCC's the identification must be the MCC designation, the item being supplied and the phase designation. Control wiring must be per the wiring diagrams.

C. Conductor color coding must be done using tape as specified elsewhere in the Contract Documents. Provide color coding for all conductors which do not come with factory applied colors.

2.05 CONDUIT MARKERS:

A. Conduit tags must be either stainless steel, grade 316 minimum, or brass. Tags must have the identification either stamped in or embossed in the material. Tags must be fastened to the conduit with either stainless steel wire or with nylon, self-locking cable ties. For interior, dry locations nylon tags which are mechanically printed may be used.

B. Conduit tags for underground use must be as described above. Where it is not practical to attach the tag to the conduit, i.e., in handholes and manholes, the tags must be fastened to the structure at the point where the conduit enters the structure. The Contractor may use a single large plate type marker for this purpose. The marker must accurately depict the

conduits and their identification. The identification must be attached using anchors as described in other parts of the Contract Documents.

2.06 WARNING/DANGER SIGNS:

A. Provide manufacturer's standard "DANGER" signs of rigid Polyethylene; of standard, red, black and white graphics; 14" x 10" size except where 10" x 7" is the largest size which can be applied where needed, and except where larger size is needed for adequate vision, with recognized standard explanation wording, e.g., HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH, etc.

B. Provide "Warning" signs, as required, of rigid Polyethylene, colors as required by OSHA.

C. Signs must be attached with Stainless Steel screws. Warning/Danger signs must not be of the adhesive type for attachment to doors or walls.

2.07 EQUIPMENT IDENTIFICATION:

A. After finish painting is completed, the Contractor must provide white with black core laminated phenolic nameplates with 1/4 inch minimum lettering etched through the outer covering. Inscription must be made with all upper case letters and must be the same inscriptions as shown on the Drawings or as directed by the Commissioner.

1. All major electrical equipment must be so identified, including motor starters, disconnect switches, panels, switches, etc.

2. Disconnect switches serving feeders and overcurrent protective devices mounted in a switchboard must be so identified.

3. Embossed self-adhering plastic tape labels will not be accepted.

4. Use stainless steel screws, except where contact-type permanent adhesive may be required when screws cannot or should not penetrate substrate.

5. The Contractor must take care when attaching the identification so that the NEMA rating of the equipment is not violated.

2.08 LETTERING AND GRAPHICS:

A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer

or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

B. Identification markings on signs and markers must not be done with pens, pencils, crayons, magic markers, paint, dymo-labels, etc.

C. Identification on small boxes, i.e., 4 inch square and 4-11/16 inch boxes may be done with a permanent marker in neat and legible block printing. Black markers must be used for this purpose. The Contractor must identify the circuits contained and the panel(s) of origin.

2.09 TERMINAL IDENTIFICATION:

A. Terminal strips must be identified by using markers supplied by the terminal manufacturer. Whenever possible they must be mechanically printed. When this is not possible the strips must be marked in neat and legible block lettering using a permanent marking system acceptable to the terminal strip manufacturer. The terminal marking must be the wire number attached to that terminal.

2.10 PULL BOX IDENTIFICATION:

A. Identification markers for pull boxes, junction boxes, etc. must be of the polyester film type, self adhesive and pre-printed. The marker must contain the highest voltage level contained within that box. The marker must be yellow with black letters and the lettering must be visible from the floor.

B. The box must have a phenolic nameplate, white with black letters, affixed to the box with stainless steel screws with the box identification. Each box must have an identifying designation that must be shown on the Drawings.

2.11 CABLE TIES:

A. Cable ties must be fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18 inch minimum width, 50 lb. minimum tensile strength, and suitable for a temperature range from minus 50 degrees F to 350 degrees F. Provide ties in specified colors when used for color coding.

B. Acceptable manufacturers will be Thomas & Betts Co., Brady Co. and Panduit.

2.12 WIRE IDENTIFICATION IN EQUIPMENT:

A. The wire identification for manufactured equipment must match the wire identification shown on the manufacturers wiring diagrams. All wires must be identified. The manufacturer must use product as specified in the Contract Documents.

B. For custom built equipment the wire identification must match the wire identification shown on the assemblers approved Shop Drawings. All wires must be identified.

C. In no case must a wire number change designations as a result of termination at a terminal.

D. Where multi-conductor cables are used the cable must be identified as well as each conductor contained within that cable.

PART 3 - EXECUTION

3.01 APPLICATION AND INSTALLATION:

A. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, requirements of Chicago Electrical Code and the Contract Documents.

1. Where identification is to be applied to surfaces which require a specific finish, install identification after completion of the finish. The Contractor must take all precautions to avoid damaging the finish. Any damage must be repaired in a manner acceptable to the Commissioner.

2. Comply with governing regulations and requests of governing authorities for identification of electrical work.

B. The Contractor must provide a typewritten directory of circuits in lighting and power panels. The Contractor must clearly indicate the purpose of each circuit, e.g. lighting, receptacles, water cooler, etc. and must indicate the location of the supplied equipment.

3.02 CONDUIT, WIRE, CABLE AND BUS IDENTIFICATION:

A. When not shown on the Contract Drawings the Contractor must indicate on his/her field marked set of Drawings, as required by the Contract Documents, the conduit identification.

B. Each cable must be labeled at all terminals and at all accessible points in equipment, panelboards, manholes, handholes and pull boxes, etc. Labels must be as specified herein.

C. All wires and feeder cables must be labeled in all junction boxes pull boxes, control panels, motor control centers, panelboards, switchboards, etc. All conductors must be tagged in cabinets at the time wires are pulled in and tested and markers must not be removed for any reason.

D. Markers approved by the Commissioner must be attached to all cables where entering or leaving from conduit runs. The cable designation and circuit use must appear on the tag.

E. Apply colored, pressure sensitive tape in half-lapped turns for a distance of 2 inches from the cable marker and in all boxes. Provide color coding at all splices and taps to each side of the splice or tap. Apply the last two laps of tape with no tension to prevent possible unwinding. Do not obliterate cable tag with the tape.

F. All conduit runs must be identified by means of non-corrosive metal tag with stamped identification thereon, as shown on Contractor's installation Drawings and attached at all conduit terminations, including junction boxes. For interior work a nylon tag, mechanically printed may be used in lieu of metal.

G. Conduit identification tags must be fastened to the conduit near the point of termination where conduits enter motor control centers, switchboards, switchgear, terminal cabinets, outlet boxes, junction boxes, pull boxes and other items. The tag must be held in place by a nylon, self-locking cable tie.

H. Conduits in miscellaneous pull boxes in runs where the system identity cannot be clearly seen must have identifying tags indicating the name of the system. Such tags must be installed as described above. Miscellaneous systems must include, but not be limited to, telephones, lighting, etc.

I. Conduits terminating at lighting fixtures, wall switches, telephones, terminal cabinets, lighting panelboards, receptacle outlets and similar items need not be tagged where their system identification is obvious, except as noted above for clarity.

J. Exterior installed conduits, except branch lighting circuit conduits, must be tagged at the ends and in intermediate boxes, chambers, manholes, handholes and other enclosures in accordance with the same inscriptions as shown on the Drawings.

K. Tags must be fastened as specified except that where this method is not practicable they must be fastened to the adjacent masonry by means of expansion bolts.

L. Phase identification letters must be 1 inch high in readily visible locations, and must be stamped into the main bus bars of switchboards and panelboards.

M. For conduits in duct banks and embedded in structural slabs, etc. the conduit identification must be installed at the point where the conduit exits the slab.

3.03 OPERATIONAL IDENTIFICATION AND WARNING:

A. Wherever reasonably required to ensure safe and efficient operation and maintenance of electrical systems, and electrically connected mechanical systems and general systems and equipment, including prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for intended purposes.

B. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated, either by the Contract Documents or as directed by the Commissioner, and at locations subsequently identified by installer of electrical work as constituting similar dangers for persons in or about the facility.

1. Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.

2. Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, damage to or loss of property.

3.04 EQUIPMENT/SYSTEM IDENTIFICATION:

A. Install engraved plastic-laminate signs on each unit of electrical equipment; including central or master unit of each electrical system including communication/control/ signal systems, unless unit is specified with its own self-explanatory identification or signal system. Provide text

matching terminology and numbering from the Contract Documents and Shop Drawings. Provide signs for:

1. Regulator.

B. Install signs at locations indicated or, where not otherwise indicated, at the location which provides the best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use a permanent adhesive where fasteners should not or cannot penetrate substrate.

C. Provide Identification on all pull, junction, splice or terminal boxes. Identification must consist of the voltage contained within the enclosure and the enclosure identification.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT:

A. Electrical identification associated with the electrical installation will not be measured separately for payment.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT:

A. No individual payment for this section. All work in this section is to be included on an incidental basis to those items requiring the various work items delineated in this specification.

END OF SECTION 16195

TESTING
SECTION 16950

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Work under this section is subject to the requirements of the Contract Documents.

B. Furnish and provide all work, materials, instruments and accessories necessary to provide, but is not limited to, the following:

1. Testing of electrical systems.

1.02 RELATED WORK:

A. As specified in the following divisions:

1.03 REFERENCES:

A. See Specification Section 16010.

1.04 SUBMITTALS:

A. The Contractor must submit data to the Commissioner prior to purchasing and installation. The data must include but not be limited to the following:

1. All test reports as witnessed and signed by the Commissioner.

2. All certified test reports as specified elsewhere.

1.05 QUALITY CONTROL:

A. See Specification Section 16010.

1.06 DELIVERY STORAGE AND HANDLING:

A. See Specification Section 16010.

PART 2 - PRODUCTS

2.01 TESTING:

A. The following tests are required, but must not be limited to, this list. All tests will be witnessed by the Commissioner.

1. Proper phase rotation.

2. Short circuits.

3. Improper grounds.

4. Power and control electrical circuits for circuit continuity and functional tests.

5. Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems must be in accordance with NETA ATS.

B. The Contractor must furnish all meters, instruments, cable/wire connections, etc. for all tests.

C. The Contractor must check all transformers, power panels, feeders, power and control cables and connections and motors to assure correct phase sequence and rotation. Phase sequence must be A-B-C as follows:

1. Top to bottom, left to right, and front to rear when facing protective or disconnecting mechanism.

2. Phasing must be done using distinctive colors for the various phases as indicated in the Contract Documents.

D. After wires and cables are in place and connected to devices and equipment, the system must be tested for short circuits, improper grounds and other faults. If a fault condition occurs the trouble must be corrected and the system must be retested.

E. Phase conductors, if shorted, grounded or at fault must be replaced and retested.

F. A voltage test must be made at each lighting panel, distribution panel, receptacle panel and at the last power consuming device in the circuit to check the voltage drop. This test must be done under the full load of the circuit being tested. If a voltage drop exceeds 1 percent for lighting and 3 percent for power the Contractor must correct the condition by locating the high resistance splice or connection and must then retest the system.

G. Any wiring device, electrical apparatus or lighting fixture grounded or shorted on any "live" part must be removed and the trouble rectified by replacing the defective parts or materials. Test device prior to performing work on the device. If a device is found to be not up to the performance standards, Commissioner will provide directions to remedy the issue via Field Order.

H. Upon completion of the electrical work the Contractor must place the entire installation in operation, test for proper function and show systems and equipment to be free from all defects. Motors and driven equipment must not run until properly lubricated. Pumps must not be run until water or process fluid supply is connected and turned on. Test and record maximum load amperage and terminal voltage when coupled and uncoupled for each motor.

I. The Commissioner will conduct from time to time such tests as may be required to any part of the equipment to determine if it is installed in accordance with the Contract Documents. The Contractor will extend to the Commissioner all facilities to this end and must furnish skilled or unskilled help required. All tests will be witnessed by the Commissioner and three copies of the verified test report must be given to the Commissioner promptly upon completion of the test.

J. The Contractor must provide assistance to the various equipment manufacturer's field personnel as required in the testing and adjusting of the electrical power and control equipment. Cooperation of the Contractor must be such that a minimum of time is required for equipment testing.

K. A log must be maintained by the Contractor of all tests. This log must be certified before completion of the job, both as to test values and date of test. All major equipment such as switchgear, motor control centers and motors must be initially energized in the presence of the Commissioner.

L. Any faults in the work performed by the Contractor or in materials or equipment furnished by the Contractor must be corrected or replaced promptly by the Contractor at his/her own expense. Any faults in materials or equipment furnished by the Contractor which are the result of careless, incompetent or improper handling or installation by the Contractor must be corrected or replaced, as directed by the Commissioner, at the Contractors expense.

M. All tests must be made by the Contractor at the Contractors' expense and certification of the tests will be submitted to the Commissioner. If any failures occur during the tests the Contractor must replace the faulty equipment of materials and retest.

2.02 WIRE AND CABLE TESTING (600 VOLTS):

A. The 600 volt insulated wire and cables must be factory tested prior to shipping in accordance with IECA Standards for the insulation specified.

B. The following 600 volt wires and cables must be tested after installation but before final connections are made up:

1. All feeders to panelboards.

2. All conductors #6 and larger.

C. For the above listed wires and cables the Contractor must megger test them at 1000 volts. The minimum acceptable reading must be 250 Megohms. The megger test must not be done until any and all splicing is completed.

PART 3 - EXECUTION

3.01 TEST EQUIPMENT:

A. All test equipment must be in good operating condition and must have been calibrated within 6 months of date of usage. At the time of testing the Contractor must present a copy of the certification of calibration to the Commissioner.

B. All test must be done with the proper equipment for the type of test being performed. When necessary the Contractor must obtain the services of a testing company to perform those tests which the Contractor either does not have trained personnel or proper testing equipment.

C. All megger tests must be recorded on Form 16950. When an outside testing company is used the test report form will be submitted to the Commissioner for review and acceptance.

D. All test reports must be signed and dated.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT:

A. Testing will not be measured separately for payment.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT:

A. No individual payment for this section. All work in this section is to be included on an incidental basis to those items requiring the various work items delineated in this specification.

END OF SECTION 16950

CONNECT CHICAGO ALLIANCE

FORM 16950

SINGLE AND MULTIPLE CONDUCTOR POWER CABLE MEGGER TEST, 600V AND LESS WIRING-FEEDER CIRCUITS

Testing must be performed before connecting the cables to the terminals at either end. Continuity of each conductor must be checked at this time.

Each conductor must be checked with a 1000 volt megger to ground, with all other conductors in the cable and shield, grounded. The minimum acceptable resistance will be 250 megohms for each conductor to ground.

Date:		Project Name:	
Feeder Number:		Location:	
From:		To:	
Cable Size:		Cable Length:	
Number of Conductors:		Insulation Type:	
Manufacturer:		Line Voltage:	
Temperature:		Humidity:	
Megger Type:		Serial Number:	
Test Voltage:		Date of Calibration:	

Remarks: _____

If Applicable, All Shields Must Be Properly Grounded.

Cable No.	MEGOHMS Phase A	MEGOHMS Phase B	MEGOHMS Phase C	MEGOHMS Neutral

Test Performed By: _____
Signature/Name/Company Date

Test Witnessed By: _____
Signature/Name/Company Date

PIPE FOR STORM DRAINS
SECTION D-701

PART 1 DESCRIPTION

1.01 GENERAL

A. This item must consist of the construction of storm drains and sewers and pipe reducers in accordance with these specifications and in conformity with the lines and grades shown on the Drawings. The work under this Section is subject to the requirements of the Contract Documents.

1.02 RELATED WORK

A. Related Work specified elsewhere includes:

1. Section P-152 – Excavation and Embankment
2. Section P-157 – Trench Backfilling
3. Section P-610 – Structural Portland Cement Concrete
4. Section X-100 – Site Demolition

1.03 REFERENCES

A. ASTM C 76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ASTM C 144 – Standard Specification for Aggregate for Masonry M

C. ASTM C150 – Standard Specification for Portland Cement.

D. ASTM C425 – Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.

E. ASTM C 443 – Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

F. ASTM C 700 – Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.

G. ASTM A746 – Standard Specification for Ductile Iron Gravity Sewer Pipe.

H. ASTM C 923 – Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

I. ASTM D 2137 – Standard Test Method for Rubber Property – Brittleness Point of Flexible Polymers and Coated Fabric

J. ASTM C 206 – Standard Specification for Finishing Hydrated Lime

K. ANSI Standard A21.51 (AWWA C1 51) – Ductile Iron Pipe Centrifugally cast

L. ANSI A-21.4 – Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings

M. Illinois Department of Transportation, "Standard Specifications for Road and Bridge Construction" (SSRBC), latest edition.

N. Standard Specifications for Water and Sewer Main Construction in Illinois, July 2014

PART 2 MATERIALS

2.01 GENERAL

A. The pipe must be the type and class called for on the Drawings and must be in accordance with the following requirements as applicable.

B. All pipes must be subject to field inspection by the Commissioner. Any section of pipe that is damaged by handling or is defective as determined by the Commissioner will be definitively marked and must be removed from the construction site and returned to the manufacturing plant.

2.02 PIPE

A. Ductile iron pipe must conform to the requirements of ANSI Standard A21.51 (AWWA Cl 51) and the cement lining conform to ANSI A-21.4.

B. For pipe sizes 21 inches or smaller, use Extra Strength Vitrified Clay Pipe – ASTM C700 or as specified on the plans.

C. For pipe sizes 24 inches or larger, use Reinforced Concrete Pipe – ASTM C76, or as specified on the plans.

1. The Contractor must design and submit details pertaining to the pipe sizes and pipe classifications that are not adequately detailed

in ASTM C76 to the Commissioner for acceptance. RCP must be Class as specified on the plans, and circular with circular reinforcement wall type B or C, and Type 1 cement plus fly ash.

D. Corrugated Metal Pipe must conform to the requirements of AASHTO M36 and the following:

1. The precoated steel sheets used to fabricate the Precoated Galvanized Corrugated Steel Pipe shall be according to AASHTO M246, Grade 250 / 250.

2. The precoated pipe shall be according to AASHTO M245. The sawed or cut ends of corrugated pipe shall be coated according to the methods described in the Repair of Damaged Coatings in AASHTO M245.

3. Precoating for the bands will not be required.

4. When the smooth sleeve-type coupler is used, the gasket material on the coupler shall be polyisoprene or equal with a durometer hardness of 45 ± 5 (ASTM D2240, Shore A).

2.03 CONCRETE

A. Concrete for pipe cradles must conform to the requirements of Section P-610 – Structural Portland Cement Concrete.

2.04 GASKETS

A. Gaskets for rigid pipe must conform to the requirements of ASTM C443. Gaskets must be resistant to with oil, fuel JP8, propylene glycol, urea and potassium acetate. A swelling test based on Methods 6001 and 6211 of Federal Standard 601 must be used to determine acceptability. When the latter method is used with No. 3 oil for 70 hours at 212 degrees F., the swelling must not exceed 100% by volume. Gaskets must meet the low temperature brittleness requirement of ASTM D2137 Standard Test Method for Rubber Property – Brittleness Point of Flexible Polymers and Coated Fabric.

2.05 MORTAR

A. Mortar for pipe to pipe wyes and connections to other drainage structures must consist of one part portland cement and two parts sand. The portland cement must conform to the requirements of ASTM C150, Type

I. The sand must conform to the requirements of ASTM C144. Hydrated lime meeting the requirements of ASTM C206 may be added to the mixture of sand and cement in an amount equal to 15 percent of the weight of sand used.

2.06 COMPRESSION JOINTS

A. Material for compression joints for the vitrified clay pipe must meet the requirements of ASTM C425.

2.07 BEDDING MATERIAL

A. Bedding material must conform to the requirements of Section P-157 - Trench Backfilling.

PART 3 CONSTRUCTION METHODS

3.01 EQUIPMENT

A. All equipment necessary and required for the proper construction of storm drains must be on the Project, in first-class working condition, and approved by the Commissioner before construction is permitted to start.

B. The Contractor must provide appropriate hoisting equipment to handle the pipe while unloading and placing it in the final position without damage to the pipe.

C. The Contractor must provide vibratory means to obtain the required compaction of the aggregate pipe bedding and backfill as specified in Section P-157 – Trench Backfilling.

3.02 PROTECTION OF ADJACENT STRUCTURES

A. In the event that systematic ground losses during pipe jacking cause or threaten to cause structures (including pavements and utilities) to settle or move in excess of allowable limits, as indicated by settlement monitoring, cease tunnel excavation and modify equipment and methods of excavation to reduce ground movements to within allowable limits.

3.03 EXCAVATION

A. The width of the pipe trench must be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe but must not be less than the external diameter of the pipe plus 6 inches on each side. The trench walls must be approximately vertical except where safety considerations require benching of the trench walls.

B. Where rock, hardpan, or other unyielding material is encountered, it must be removed below the foundation grade for a depth of at least 4 inches. The excavation below grade must be backfilled with bedding stone in accordance with Section P-157 – Trench Backfilling and compacted in layers not over 6 inches in uncompacted depth to form a uniform but yielding foundation.

C. Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil must be removed and replaced with approved stabilization stone in accordance with Section P-157 for the full trench width. The Commissioner must determine the depth of removal necessary. The granular material must be compacted to provide adequate support for the pipe in accordance with Section P-157.

D. The excavation for pipes that are placed in embankment fill must not be made until the embankment has been completed to a height above the top of the pipe as shown on the Plans.

E. The description of compaction equipment and soil classifications, including contaminated materials, and their disposal are contained in Section P-152 – Excavation and Embankment. Excavation must not be measured for direct payment. The cost of this work must be included in the Contract unit price for each kind and size of pipe.

F. The Contractor must construct 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 must not be removed in one operation but must be done in successive stages to prevent overloading of the pipe during backfilling operations. The cost of bracing, sheathing, or shoring, and the removal of same, must be included in the unit price for the pipe.

3.04 BEDDING

A. The pipe bedding must conform to the details as shown on the Drawings and in accordance with Section P-157 - Trench Backfilling.

3.05 LAYING PIPE

A. The Contractor must provide the necessary lines and supports to insure installation of the pipe to line and grade. The Contractor's facilities for lowering the pipe into the trench must be such that neither the pipe nor the trench must be damaged or disturbed.

B. The Commissioner and Contractor QC must inspect all pipe before it is laid and reject any section that is damaged by handling or is defective to a degree which must materially affect the function and service of the pipe.

C. The pipe laying must begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe must be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes must be placed facing upgrade.

D. Paved or partially lined pipe must be placed so that the longitudinal center line of the paved segment coincides with the flow line.

E. Elliptical and elliptically reinforced pipes must be placed with the manufacturer's top of pipe mark within five degrees of a vertical plane through the longitudinal axis of the pipe.

F. Pipe must not be laid on frozen ground. The Contractor must provide for the temporary diversion of flows in order to permit the installation of the pipe under dry conditions.

3.06 JOINING PIPE

A. Joints must be made to form a flexible watertight seal. Gaskets must be installed according to the manufacturer's requirements. The method of joining pipe sections must be such that the ends are fully entered and the inner surfaces are reasonably flush and even.

3.07 CONNECTIONS TO STRUCTURES AND PIPES

A. Where the Plans show connections or collars to existing or proposed pipe or structures, these connections must be watertight and made so that a

smooth uniform flow line must be obtained throughout the drainage system.

B. All branch sewer connections must meet the structural jointing and water-tightness requirements for the mainline pipe to which they are made. Break-in-connections will not be allowed. Connections of pipe 18 inches in diameter or smaller to RCP may be made using cast-in or cored-in flexible couplings meeting ASTM C923, or pre-cast wye or tee fittings, as approved by the Commissioner. Connections of pipe larger than 18 inches in diameter to RCP must be made with precast wye or tee fittings as approved by the Commissioner. Connections to Corrugated Metal Pipe (CMP) must be made with CMP fittings, as shown on the plans.

3.08 BACKFILLING

A. Pipes must be inspected before any backfill is placed; any pipes found to be out of alignment, unduly settled, or damaged must be removed and re-laid or replaced at the Contractor's expense. Trenches must be backfilled in accordance with Section P-157 - Trench Backfilling.

3.09 CLEANING AND RESTORATION OF SITE

A. After the backfill is completed, the Contractor must dispose of all surplus material, and rubbish from the site. Excess dirt and excavated material will be embanked within the project limits, or as directed by the Commissioner, in accordance with Section P-152 and must be considered incidental to the storm drain items. The Contractor must restore disturbed landscape areas to their original condition. Where the original condition is grass, topsoil and sod or permanent seeding must be used for restoration as shown on the Drawings. All costs for restoration must be included in the Contract. Any future settlement of trenches must be restored as the Contractor's expense.

B. After all the work is completed, the Contractor must remove all tools and other equipment, leaving the entire site free, clear and in good condition.

3.10 INSPECTION

A. Prior to final acceptance of the drainage system, the Commissioner, accompanied by the Contractor, must make a thorough inspection by an appropriate method of the entire installation. Defects in material or workmanship or obstruction to the flow in the pipe system must be corrected by the Contractor without additional compensation as directed by the Commissioner.

B. For pipes smaller than 72 inches in diameter, an internal television inspection must be performed by the Contractor following the completion of the installation and backfill compaction testing showing a complete, clean installation. Any debris or deficiencies encountered must be cleaned or repaired, to the satisfaction of the Commissioner, and the segment(s) must then be re-televised showing a complete, clean installation. The television camera used must be high-resolution color, must be equipped with a revolving head, and must be equipped with a footage counter which records on the video recording. Video recordings in DVD format must be made of the internal inspection and submitted to the Commissioner. The costs associated with televising must be considered incidental and no additional payment will be made for this work.

C. For pipes 72 inches and larger in diameter, a visual inspection must be performed by the Contractor following the completion of installation and backfill compaction testing. The Contractor must obtain the services of an independent inspection company qualified to perform the visual inspection. The Contractor must obtain the approval of the Commissioner before employing the inspection company. The costs of the inspection will be considered incidental to the pipe installation and no additional payment will be made for this work.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. The length of pipe will be measured in lineal feet of pipe in place, completed, and accepted. It will 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 several classes, types, sizes, and pipe jacking will be measured separately. All fittings, including tees, elbows and wyes, will be included in the footage as typical pipe sections in the pipeline being measured.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

A. Payment will be made at the Contract unit price per lineal foot for each kind of pipe of the type, class and size designated. The price will be full compensation for furnishing all materials and for all preparation, excavation, disposal of excavation (unclassified or unclassified, special), pavement sawcutting, storm sewer pipe connection to existing or

proposed manhole, connection to existing or proposed storm sewer pipe, catch basin or pipe, prefabricated tees and wyes bedding and trench backfill to subgrade, installation of these materials, backfilling and compaction, capping and bulk heading ends of pipe, concrete collars, maintenance and monitoring of drainage system during interim conditions; and for all labor, equipment, tools, and all work necessary to complete the item.

1. All drainage pipe indicated on the plans to be temporary will be paid the same as permanent pipe. Removal of temporary pipe will be paid in accordance with Section X-100 – Site Demolition.

B. Payment must be made under the following items:

ITEM NO.	DESCRIPTION	UOM
D-701-01	REINFORCED CONCRETE PIPE, 12" DIAMETER, CLASS V	LF
D-701-02	REINFORCED CONCRETE PIPE, 18" DIAMETER, CLASS III	LF

END OF SECTION D-701

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PIPE UNDERDRAINS FOR AIRPORTS
SECTION D-705

PART 1 DESCRIPTION

1.01 GENERAL

A. This item consists of the construction of pipe underdrains in accordance with these Specifications and in reasonably close conformity with the lines and grades shown on the Plans. The work under this Section is subject to the requirements of the Contract Documents.

1.02 RELATED WORK

A. Related Work specified elsewhere includes:

1. Section P-152 – Excavation and Embankment
2. Section P-629 – Geotextile Fabric

1.03 REFERENCES

A. ASTM C 136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

B. ASTM C 144 – Standard Specification for Aggregate for Masonry Mortar

C. ASTM C 150 – Standard Specification for Portland Cement

D. ASTM C 425 – Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.

E. ASTM C 700 – Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.

F. ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

G. ASTM F 477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

H. ASTM F 758 – Standard Specification for Smooth Wall PVC Underdrain Systems for Highway, Airport, and Similar Drainage.

I. AASHTO Section 30 – Thermoplastic Pipe

PART 2 MATERIALS

2.01 PIPES

A. Materials must meet the requirements shown on the Plans or specified below.

1. Smooth-Wall Perforated and Non- Perforated PVC Pipe, Sch 40 ASTM F 758

2. Smooth-Wall Non-Perforated PVC Pipe, Sch 80 ASTM F 758

2.02 FILTER SOCK FOR PERFORATED PVC UNDERDRAIN PIPE

A. Filter sock must be installed and slipped over the entire length of the perforated PVC underdrain pipe. The sock must be a seamless, knitted polyester fabric to prevent sediments from clogging the pipe perforations. Acceptable products are Northtown Drain – Sleeve (Northtown Company), Drain-Sleeve (Cariff Corporation, Inc.) and Layfield Fiber Sock (Layfield Geosynthetics & Ind. Fabrics, Ltd.).

2.03 MORTAR

A. Mortar must consist of one part Portland cement and two parts sand. The Portland cement must conform to the requirements of ASTM C 150, Type I. The sand must conform to the requirements of ASTM C 144.

2.04 COMPRESSION JOINTS

A. Material for compression joints for the vitrified clay pipe must meet the requirements of ASTM C 425.

2.05 ELASTOMERIC SEALS

A. Elastomeric seals must conform to the requirements of ASTM F477. Materials must be compatible with oil, jet fuel JP8, propylene glycol, urea, and potassium acetate.

2.06 POROUS BACKFILL

A. Porous backfill must be free of clay, humus, or other objectionable matter, and must conform to the gradation in Table 1 when tested in accordance with ASTM C 136.

TABLE -1 GRADATION OF POROUS BACKFILL		
Sieve Designation (Square Openings)	**Percentage By Weight Passing Sieves (CA-7)**	**Percentage By Weight Passing Sieves (CA-11)**
1 ½ inch (37.5 mm)	100	
1 inch (25.0 mm)	95 ± 5	100
¾ inch (19 mm)		92 ± 8
½ inch (12.5 mm)	45 ± 15	45 ± 15
No. 4 (4.75 mm)	5 ± 5	6 ± 6
No. 16 (1.18 mm)		3 ± 3

2.07 GEOTEXTILE FABRIC

A. Geotextile fabric to be used for perforated pipe underdrains must be the same as specified in Section P-629 – Geotextile Fabric of the Specifications.

PART 3 CONSTRUCTION METHODS

3.01 EQUIPMENT

A. All equipment necessary and required for the proper construction of pipe underdrains must be on the Project, in first-class working condition, and approved by the Commissioner before construction is permitted to start.

3.02 EXCAVATION

A. The width of the pipe trench must be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but must not be less than the external diameter of the pipe plus 6 inches on each side. The trench walls must be approximately vertical.

B. Where rock, hardpan, or other unyielding material is encountered, it must be removed below the foundation grade for a depth of at least 4 inches per requirements in Section P-152 Excavation and Embankment. The excavation below grade must be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 6 inches in uncompacted depth to form a uniform but yielding foundation.

C. Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil must be removed and replaced per requirements in Section P-152 Excavation and Embankment, with approved granular material for the full trench width. The Commissioner will determine the depth of removal necessary. The granular material must be compacted to provide adequate support for the pipe.

D. Excavated material not required or acceptable for backfill must be disposed of by the Contractor as directed by the Commissioner. The excavation will not be carried below the required depth; when this is done, the trench must be backfilled at the Contractor's expense with material approved by the Commissioner and compacted to the density of the surrounding earth material.

E. The bed for the pipe must be so shaped that at least the lower quarter of the pipe must be in continuous contact with the bottom of the trench. Spaces for the pipe bell must be excavated accurately to size to clear the bell so that the barrel supports the entire weight of the pipe.

F. The Contractor must 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 must 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 must 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, will be included in the unit price bid per foot for the pipe.

3.03 LAYING AND INSTALLING PIPE

A. The laying of the pipe in the finished trench must be started at the lowest point and laid upgrade. When bell and spigot pipe is used, the bells must be laid upgrade. If tongue and groove pipe is used, the groove end must be laid upgrade. Holes in perforated pipe must be placed down, unless otherwise shown on the Plans. The pipe must be firmly and accurately set to line and grade so that the invert must be smooth and uniform. Pipe must not be laid on frozen ground.

B. Pipe which is not true in alignment, or which shows any settlement after laying, must be taken up and relaid without extra compensation.

C. PVC pipe must be installed in accordance with the requirements of ASTM D 2321 or AASHTO Standard Specification for Highway Bridges Section 30.

D. Unless otherwise indicated on the Drawings, pipe perforations must be arranged as described in the table below.

1. Underdrain pipe along taxiway and runway shoulders: Rows of perforations must be arranged in one (1) or two (2) equal groups at equal distance from the bottom on each side of the vertical centerline of the pipe. The lowermost rows of perforations must be separated by an arc of about 90 degrees; the uppermost rows, by an arc of about 160 degrees.

2. Underdrain outlet pipe connecting to infield catch basins and manholes: Rows of perforations must be arranged in one (1) or two (2) equal groups at equal distance from the top on each side of the vertical centerline of the pipe. The uppermost rows of perforations must be separated by an arc of about 90 degrees; the lowermost rows, by an arc of about 160 degrees.

On both the inside and outside of the pipe, perforations must be free of cuttings or frayed edges, and any materials that would reduce the effective opening. All perforated PVC underdrain pipes must be wrapped over their entire length with filter sock. Install filter sock per manufacturer's recommendations. The pipe must be laid accurately to line and grade.

Nominal Pipe Size	Perforation	Arrangement
8" (Underdrain)	Hole Size: Center-to-Center: Rows of Holes: Orientation:	3/8" 3-1/4" +/-1/4" 4, 2@ 90º, 2@ 160º +/-3º Bottom
8" (Underdrain Outlet)	Hole Size: Center-to-Center: Rows of Holes: Orientation:	3/8" 3-1/4" +/-1/4" 4, 2@ 90º, 2@ 160º +/-3º Top

E. All Types of Pipe. The upgrade end of pipelines, not terminating in a structure, must be plugged or capped as approved by the Commissioner.

F. Unless otherwise shown on the Plans, a 4-inch bed of granular backfill material must be spread in the bottom of the trench throughout the entire length under all perforated pipe underdrains.

G. Pipe outlets for the underdrains must be constructed when required or shown on the Plans. The pipe must be laid with tight-fitting joints. Porous backfill is not required around or over pipe outlets for underdrains. All connections to other drainage pipes or structures must be made as required and in a satisfactory manner. If connections are not made to other pipes or structures, the outlets must be protected and constructed as shown on the Plans.

3.04 MORTAR

A. The mortar must be of the desired consistency for making connections to other pipes or to structures only. Mortar that is not used within 45 minutes after water has been added must be discarded. Retempering of mortar will not be permitted.

3.05 BACKFILLING

A. Granular Material. The placement of granular backfill in the trench and about the pipe must be as shown on the Plans. Special care must be taken in placing the backfill. The granular backfill must not contain a damaging amount of foreign matter, nor must earth from the sides of the trench or from the windrow be allowed to filter into the backfill. The backfill must 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 must be done in a manner to avoid injurious top or side pressure on the pipe or damage to the filter fabric. The granular backfill must be made to the elevation of the trench, as shown on the Plans.

B. When perforated pipe is specified, granular backfill material must be placed along the full length of the pipe. The position of the granular material must be as shown on the details in the Plans.

C. When porous backfill is to be placed in paved or adjacent areas prior to the completion of grading or subgrade operations, the backfill material must be placed immediately after laying the pipe. The depth of this granular backfill must be not less than 12 inches, measured from the top of the underdrain. During subsequent construction operations, this minimum backfill of 12 inches of depth must not be disturbed until such time as the underdrains are to be completed. When the underdrains are to be completed, the unsuitable material must be removed until the porous backfill is exposed. That part of the porous backfill which

contains objectionable material must be removed and replaced with suitable material. The cost of removing and replacing any such unsuitable material must be borne by the Contractor.

D. 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 must 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 must 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 must be removed and replaced. The subbase material must be placed to provide clean contact between the subbase material and the underdrain granular backfill material for the full width of the underdrain trench.

3.06 CONNECTIONS

A. When the Plans call for connections to existing or proposed pipe or structures, these connections must be watertight and made so that a smooth uniform flow line will be obtained throughout the drainage system.

3.07 CLEANING AND RESTORATION OF SITE

A. After the backfill is completed, the Contractor must dispose of all surplus material, and rubbish off of air property. Excess dirt and excavated material must be sorted and embanked within the project embankment limits, or as directed by the Commissioner, in accordance with Specification Section P-152 – Excavation and Embankment, and must be considered incidental to the work. The Contractor must restore all disturbed landscape areas to their original condition. Where the original condition is grass, topsoil and sod or permanent seeding must be used for restoration as shown on the Drawings. All costs of restoration must be included in the Contract unit price. Any future settlement of trenches must be restored at the Contractor's expense.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. The length of pipe to be paid for must be the number of linear feet of pipe underdrains in place, completed, and approved; 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. All fittings and filter socks must be included in the footage as typical pipe sections in the pipeline being measured.

B. The quantity of granular backfill and geotextile fabric will not be measured separately for payment but will be included in the Contract unit price for the pipe.

C. Cap existing underdrain will not be measured separately for payment.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

A. Payment will be made at the Contract unit price per linear foot for pipe underdrains of the type, class, and size designated. The price will be full compensation for furnishing all materials and for all preparation, excavation, backfilling, and installation of these materials, connection to existing drainage structures and pipes, and for all labor, equipment, tools, and all work necessary to complete the item. No separate payment will be made for connecting new underdrain pipes to new or existing manholes, inspection holes, storm sewers or underdrains.

B. Cap existing underdrain is incidental to the new underdrain pay items.

C. Payment will be made under the following items:

ITEM NO.	DESCRIPTION	UOM
D-705-01	UNDERDRAIN PIPE, 8" PVC, SCH 40, PERFORATED	LF

END OF SECTION D-705

DRAINAGE STRUCTURES AND DRAINAGE STRUCTURE ADJUSTMENTS
SECTION D-751

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item must consist of the construction and adjustment of manholes, catch basins, and inspection holes in accordance with these Specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the Drawings or required by the Commissioner. The work under this Section is subject to the requirements of the Contract Documents.

1.01 RELATED WORK

A. Related work specified elsewhere includes:

1. Section D-701 – Pipe for Storm Drains
2. Section D-705 – Pipe Underdrains for Airports
3. Section P-152 – Excavation and Embankment
4. Section P-154 – Frost Protection Course
5. Section P-157 – Trench Backfilling
6. Section P-405 (WMA) – Warm Mix Asphalt Pavement Concrete Pavements
7. Section P-610 – Structural Portland Cement Concrete

1.02 REFERENCES

A. Illinois Department of Transportation, “Standard Specifications for Road and Bridge Construction”, (SSRBC), latest edition.

B. References to ASTM Specifications are to the designated Specifications of the American Society for Testing and Materials, latest edition.

C. FAA Advisory Circular 150/5320-6 – Airport Pavement Design and Evaluation, latest edition.

PART 2 - MATERIALS

2.01 CONCRETE

A. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames must conform to the requirements of Section P-610 Structural Portland Cement Concrete.

2.02 PRECAST CONCRETE PIPE MANHOLE RINGS

A. Precast concrete pipe manhole rings must conform to the requirements of ASTM C 478. Precast concrete pipe section risers must conform to ASTM C-76, Class V. Unless otherwise specified, the risers and offset cone sections must have an inside diameter of not less than 36 inches nor more than 48 inches.

2.03 FRAMES, COVERS, AND GRATES

A. The castings must conform to one of the following requirements as appropriate:

1. Gray iron castings must meet the requirements of ASTM A 48, Class 308 and 358.

B. Each frame and cover or grate unit must be provided with fastening members to prevent it from being dislodged by traffic but which must allow easy removal for access to the structure.

C. Frames, covers and grates located airside or subject to aircraft loading must be rated for a minimum 100,000 pound live load. Castings must be thoroughly cleaned. After fabrication, structural steel units must be galvanized to meet the requirements of ASTM A 123.

D. Frames and covers for adjusted structures must be new, unless specified otherwise on the Drawings and Specifications.

E. Acceptable manufactures are:

1. Neenah Foundry Company

2. East Jordan Iron Works, Inc.

3. Campbell Foundry

F. Frame and grates/lids shall be as specified on the plans or approved equals. Typical drainage covers are Neenah R-3492 for lids and Neenah R-3475-3 for open grates.

2.04 STEPS

A. The steps or ladder bars must be aluminum. The steps must be the size, length, and shape shown on the Drawings. Portions in contact with concrete or mortar should be painted.

2.05 STEEL REINFORCEMENT

A. Reinforcing bars and dowels must conform to the requirements of ASTM A 615, Grade 60, and be epoxy-coated in accordance with Section 508 of the SSRBC.

2.06 NON-SHRINK GROUT

A. Non-shrink grout must conform to the requirements of Section 1024 of IDOT's SSRBC (latest edition) and meet the approval of the Commissioner.

2.07 EPOXY CONCRETE ADHESIVE

A. The epoxy concrete adhesive must conform to the requirements of Section 1025.01 of IDOT's Standard Specifications for Road and Bridge Construction (latest edition) and meet the approval of the Commissioner.

PART 3 - CONSTRUCTION METHODS

3.01 UNCLASSIFIED EXCAVATION

A. The Contractor must do all excavation for structures and structure footings to the lines and grades or elevations, shown on the Drawings, or as staked by the Commissioner. The excavation must 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 Drawings, must be considered as approximately only; and the Commissioner 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 must be removed. All rock or other hard foundation material must be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the Commissioner.

C. All seams or crevices must be cleaned out and grouted. All loose and disintegrated rock and thin strata must be removed. When concrete is to rest on a surface other than rock, special care must be taken not to disturb the bottom of the excavation, and excavation to final grade must not be made until just before the concrete or reinforcing is to be placed.

D. The Contractor must 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 must be included in the unit price bid for the structure.

E. Unless otherwise provided, bracing, sheathing, or shoring involved in the construction of this item must be removed by the Contractor after the completion of the structure. Removal must be effected in a manner which will not disturb or mar finishing masonry. The cost of removal must be included in the unit price bid for the structure.

F. After each excavation is completed, the Contractor must notify the Commissioner to that effect; and concrete or reinforcing steel must be placed after the Commissioner has approved the depth of the excavation and the character of the foundation material.

G. The Contractor must verify the required minimum allowable bearing on the subgrade beneath the concrete structures. Contractor QC to verify to 3 feet minimum, or to depth as directed by the Commissioner. The cost of verifying the required bearing will be considered included and incidental to the price of the structure.

H. Where suitable bearing condition is not encountered at subgrade indicated for footings, foundations and manholes, the Commissioner may direct additional excavation and backfill with stabilization stone per Section P-157 as necessary.

3.02 CONCRETE STRUCTURES

A. All structures for manholes and catch basins located within the Runway and Taxiway Safety Areas (RSA, TSA) must be designed to support aircraft loading. All other structures must be design for HS-20 loading.

B. Concrete structures must be built on prepared foundations, conforming to the dimensions and form indicated on the Drawings. The construction must conform to the requirements specified in Section P-610. Any reinforcement required must be placed as indicated on the Drawings and must be approved by the Commissioner before the concrete is placed.

C. All invert channels must be constructed and shaped accurately so as to be smooth, uniform and cause minimum resistance to flowing water. The interior bottom must be sloped downward toward the outlet.

3.03 PRECAST CONCRETE PIPE STRUCTURES

A. Precast concrete pipe structures must be constructed on prepared or previously placed slab foundations and must conform to the dimensions and locations shown on the Drawings. All precast concrete pipe sections necessary to build a completed structure must be furnished. The different sections must fit together readily, and all jointing and connections must be cemented with mortar or watertight gasket/cement material as specified. The top of the upper precast concrete pipe member must be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision must be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. Penetrations for pipe connections must be sized to accommodate the type of sealing mechanism specified. The flow lines must be smooth, uniform, and cause minimum resistance to flow. The metal steps which are embedded or built into the side walls must be aligned and placed as shown in the Drawings. When a metal ladder replaces the steps, it must be securely fastened into position.

3.04 INLET AND OUTLET PIPES

A. Inlet and outlet pipes must extend through the walls of the structures for a sufficient distance beyond the outside surface to allow for connections but must be cut off flush with the wall on the inside surface, unless otherwise directed. For concrete or brick structures, the mortar must be placed around these pipes so as to form a tight, neat connection.

3.05 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES, AND FITTINGS

A. All castings, frames, and fittings must be placed in the positions indicated on the Drawings or as directed by the Commissioner, and must 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 must be in place and position before the concrete or mortar is placed. The unit must not be disturbed until the mortar or concrete has set.

B. When frames or fittings are to be placed upon previously constructed masonry, the bearing surface or masonry must be brought true to line and grade and must 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 must be set in mortar beds and anchored to the masonry as

indicated on the Drawings or as directed and approved by the Commissioner. All units must set firm and secure.

C. 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 must be placed and fastened down.

3.06 INSTALLATION OF STEPS

A. The steps must be installed as indicated on the Drawings or as directed by the Commissioner. When the steps are to be set in concrete, they must be placed and secured in position before the concrete is poured. The steps must not be disturbed or used until the concrete or mortar has hardened for at least 7 days. After this period has elapsed, the steps must be cleaned and painted.

B. When steps are required with precast concrete pipe structures, they must 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.

C. In lieu of steps, prefabricated ladders may be installed. In the case of brick or concrete structures, the ladder must be held in place by grouting the supports in drilled holes.

3.07 ADJUSTMENT OF STRUCTURES

A. Manholes and catch basins, requiring vertical adjustment must be brought to proposed grade by either adding or removing concrete adjustment rings as required, or constructed in accordance with details in the plans. Mortar must be placed between each layer of adjusting rings and must be composed of one-part masonry cement to three parts sand, by volume. Frames must be set firm, secure, true to line and to the correct elevations.

B. When precast concrete adjusting rings are used to adjust frames to proposed or new elevation, no more than four rings may be used. Total adjustment must be no more than 12 inches. Adjusting rings must be rated to support aircraft loading.

C. Adjustments in excess of one foot must have new precast riser sections installed. Should special riser sections be required the materials used must be as specified in Section P-610. All required riser sections must be considered included in the adjustment of structures.

D. Existing frames and covers located airside or subject to aircraft loading must be replaced with new heavy frames and covers capable of supporting 100,000 lbs. loads. This work must be considered included in the adjustment of structures.

E. The Contractor must identify sunken or damaged existing subdrain inspection holes to have their existing frames and grates adjusted to the proposed pavement elevations as directed by the Commissioner. The adjustment or repair must include the breakout of the existing structure to a depth of at least 12 inches below the existing grade. Drilling and grouting reinforcing bars, application of an epoxy concrete adhesive, setting new frames and covers and extending the inspection hole as indicated on the Contract Drawings to the proper elevation and the placement of Portland cement concrete to the dimensions of the existing structure and to the proper elevation.

F. Any areas around inspection holes that have been disturbed or removed during the construction of the inspection hole adjustments or repairs must be restored with bituminous concrete meeting the materials and methods requirements of Sections P-405 and P-401, to match the proposed pavement design. This restoration work must not be measured and paid for separately. This work is to be included in the price for inspection hole adjustment or repair.

3.08 BACKFILLING

A. After a structure has been completed, the area around it must be filled with approved material, in horizontal layers not to exceed 8 inches in loose depth, and compacted to the density required in Item P-152. Each layer must be deposited all around the structure to approximately the same elevation. The top of the fill must meet the elevation shown on the Drawings or as directed by the Commissioner.

B. Backfilling must not be placed against any structure until permission is given by the Commissioner. In the case of concrete, such permissions must not be given until the concrete has been in place 7 days, or until tests made by the Contractor's QC organization and tested by the Contractor's approved laboratory, subject to the verification by the QA laboratory working under supervision of the Commissioner 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 must not be measured for direct payment. Performance of this work must be considered as a subsidiary obligation of the Contractor covered under the Contract unit price for the structure involved.

D. Structures in pavements must be backfilled with Trench Backfill unless otherwise indicated on the Drawings. See Specification Section P-157 for Trench Backfill gradation.

3.09 CLEANING AND RESTORATION OF SITE

A. After the backfill is completed, the Contractor must dispose of all surplus material, dirt, and rubbish off the Airport. The Contractor must restore all disturbed areas to their original condition. Where the original condition is grass, topsoil and sod or permanent seeding must be used for restoration, as shown on the Drawings. All costs of restoration will be included in the Contract unit price.

B. After all work is completed, the Contractor must remove all tools and equipment, leaving the entire site free, clear, and in good condition.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Catch basins, manholes, junction chambers, flared end sections and the adjustment/reconstruction of manholes and catch basins will be measured per each for payment.

B. Allowance for Inspection Hole Adjustment or Repair will compensate the Contractor for the costs associated with performing work, as directed by the Commissioner and not otherwise shown, related to the adjustment or repair of existing inspections holes as provided in Section 3.07, and will include all materials, tools, and other required appurtenances to complete the work, as specified.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. The accepted quantities for the construction of drainage structures will be paid for at the Contract unit price per each, complete and in place. This price will be full compensation for furnishing all materials and for all preparation, excavation, stabilization stone, backfilling and placing of the materials, concrete, reinforcing steel, engineering, pavement coring, furnishing and installation of frames and covers, hardwares, and connections to pipes and other structures as may be required to complete the item as shown on the Drawings; and for all labor equipment, tools and all work necessary to complete the structure.

B. Allowance for Inspection Hole or Repair: Any work under this allowance must have prior approval by the Commissioner. The work will be paid

for as shown in Article X, “Changes in the Work,” of Part 2, General Conditions. Upon completion of the Project, any remaining balance in this Allowance will not be paid to the Contractor, but will be returned to the City in the form of an appropriate credit.

C. Payment will be made under the following items:

ITEM NO.	DESCRIPTION	UOM
D-751-01	UNDERDRAIN INSPECTION HOLE, AIRCRAFT LOADING	EA
D-751-02	ALLOWANCE FOR INSPECTION HOLE ADJUSTMENT OR REPAIR	AL
D-751-03	CATCH BASIN, 4-FOOT DIAMETER, TYPE 2 OPEN LID, NON-AIRCRAFT LOADING	EA
D-751-04	MANHOLE, IDOT STANDARD TYPE A, 7-FOOT DIAMETER, NON-AIRCRAFT RATED	EA

END OF SECTION D-751

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MARKER LIGHT BASES, LIGHTING FIXTURES, AND GUIDANCE SIGNS
SECTION L-100

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item consists of furnishing all labor, equipment and material, and performing all operations in accordance with the latest FAA standards, Advisory Circulars, and Engineering Briefs to install and connect or taxiway centerline lights, taxiway edge lights, and runway status lights (RWSL) , and light bases at the locations shown on the Drawings. The work under this Section is subject to the requirements of the Contract Documents. CDA will furnish the new replacement Signs, Taxiway edge lights, Taxiway center lights fixtures, L-868, L-867 Light bases, flange rings, ALSF/RWSL Snowplow rings, and extension rings to be installed by the contractor. The contractor must furnish and install the remaining items including, isolation transformers, spacer rings, bolts, L-823 connector and accessories to have a complete and operation unit.

B. Where shown on the Drawings, the scope of this item includes, but is not limited to, the following:

1. Core out, remove existing in-pavement Taxiway Centerline light base, fixture and accessories and replace with new L-868 base, L-852(A or B) (L) LED fixtures, isolation transformer, L-823 connector kit, flange ring with dam, extension ring, spacer ring and accessories to have a complete and operational unit as shown on the drawings and as specified in this Specification.

2. Furnish and install Taxiway edge light and Type 1 marker foundation and accessories with new Type 1 Marker foundation with handhole, L-861T (L) LED omni-directional blue lens Elevated Taxiway Edge fixture, isolation transformer, L-823 connector kit, and accessories and reconnect to the existing circuit to have a complete and operational unit as shown on the drawings and as specified in this Specification.

3. Remove existing in-pavement Runway Status Light (RWSL) fixture, snow plow ring, extension ring and provide cover to facilitate the milling and paving operation. Reinstall the original RWSL light fixture with new snow plow ring, extension and spacer rings on the existing base can in the original orientation, reconnect and restore

to the original operating condition with lens colors as noted in the drawings, complete with accessories as shown on the drawings and as specified in this Specification.

4. Remove existing in-pavement ALSF Light center-bar with 5-Steady-Burning (no flasher) fixtures and extension ring and provide cover to facilitate the milling and paving operation. Reinstall the original ALSF Steady-burning light fixtures with new snow plowing rings, extension and spacer rings on the existing base cans in the original orientation, reconnect and restore to the original operating condition with lens colors as noted in the drawings, complete with accessories as shown on the drawings and as specified in this Specification.

5. Remove existing in-pavement ALSF Light sidebar with 3-Steady-Burning fixtures and extension ring and provide cover to facilitate the milling and paving operation. Reinstall the original ALSF Steady-burning light fixtures with new snow plowing rings, extension and spacer rings on the existing base cans in the original orientation, reconnect and restore to the original operating condition with lens colors as noted in the drawings, complete with accessories as shown on the drawings and as specified in this Specification.

6. Remove existing Taxiway edge light fixture, accessories and Type 1 marker foundation. Restore disturbed area per X-100 specification, to match surrounding shoulder pavement and to Part 139 requirements. Properly and legally dispose of offsite any/all used transformers removed from within the Project Area. Salvaged materials must be delivered to a location on Airport property and as directed by the Commissioner

7. Painting the exterior top of all new Taxiway Type 1 marker bases installed within the Project Area or as shown on the Drawings.

8. Constructing, furnishing, installing, and making operational new guidance signs with new or existing bases/foundations with L-858Y/R/L/B - LED (L) airfield guidance signs complete with accessories as shown on the Drawings and as specified in this Specification. New and temporary base/foundation installation includes the removal of temporary signs and foundations and the restoration of any disturbed or graded areas to meet Part 139 requirements. CDA will furnish the signs, sign panels, L-867 light base and base cover. Contractor must furnish all remaining items shown in the Contract Documents.

9. Removing existing and temporary guidance signs and bases designated on the Drawings including foundation, conduit, transformers, miscellaneous hardware, and restoration of any disturbed or graded areas to meet Part 139 requirements. Salvage and deliver to the Commissioner existing signs removed from within the Project area shown on the Drawings or as directed by the Commissioner. Properly and legally dispose of offsite any/all used transformers removed from within the Project Area. Salvaged materials must be delivered to a location on Airport property and as directed by the Commissioner

1.02 RELATED WORK

A. Related Specification Sections include the following:

1. Section X-100 Site Demolition

PART 2 - EQUIPMENT AND MATERIALS

2.01 GENERAL

A. Airport lighting equipment and materials covered by Federal Aviation Administration (FAA) equipment Specifications must have the prior approval of the Office of Airport Safety and Standards, Attention: AAS-200, FAA, 800 Independence Avenue SW, Washington, DC 20591, and will be listed in the latest issue of FAA Advisory Circular (AC) 150/5345-53 (latest revision), "Airport Lighting Equipment Certification Program, including Appendices 1 to 7, with current Addendum for Appendices 1, 3 & 4. Light sources other than incandescent and xenon technologies subject to certification under AC 150/5345-53 (latest revision) and other documents, will be subject to the additional requirements of Engineering Brief No. 67 (latest revision) Light Sources Other Than Incandescent and Xenon for Airport and Obstruction Lighting Fixtures. Materials covered by other reference Specifications will be subject to acceptance through manufacturer's certification of compliance with the applicable Specifications, determined by a Third-Party Certifier when so requested by the Commissioner.

B. The certified equipment list and address list of certified airport lighting equipment manufacturers are available on the Internet at the FAA Office of the Associate Administrator for Airports (ARP) home page. The direct Internet FAA home page is www.faa.gov.

C. This equipment must have series circuit lamps. Elevated fixture height must be 24 inches except for L-862 HIRL fixtures installed on 200' wide runways where the fixture height must be 30 inches.

D. For 200 feet wide runways only, the elevated runway edge lights with L-862(L) HIRL fixtures must be supplied with 2 inch heavy duty frangible couplings (that must resist a moment of 350-450 ft. lbs. and separate cleanly before reaching 500 ft. lbs.) and a matching L-867 fixture base plate with 2 inch threaded opening. Coupling fixture stem inside diameter to be 1.2 inches. Frangible coupling and its installation must conform to AC 150/5345-66 (latest revision). Frangible coupling to be manufactured by Crouse Hinds, ADB Airfield Solutions, or Airport Lighting Company in aviation yellow.

2.02 LIGHTING FIXTURES

A. The high intensity, runway light fixtures and the medium intensity runway and taxiway light fixtures must conform to the requirements of AC 150/5340-30 (latest revision), "Design Installation Details for Airport Visual Aids, "and AC 150/5345-46 (latest revision), "Specification for Runway and Taxiway Light Fixtures".

B. All lights must be supplied with all parts and appurtenances required for installation and to be made operational including, but not limited to: fixtures, light bases, extension rings, dam rings, snow plow rings, shims, ground rods, transformers, snow plow rings for in-pavement fixtures, arctic kits for LED lights, cable, and grounding.

C. Use FAA Specification L-852A/B/(L) LED for in-pavement taxiway centerline lights. These lights must have Uni-directional lenses with colors shown on the Drawings, two LED lamps, 6.6 amp 12" LED fixture with flange ring, with arctic kit, by manufacturers listed in the latest FAA AC 150/5345-53 (latest revision) Appendix 3 Addendum.

D. Use FAA Specification L-861T(L) LED for elevated taxiway medium intensity edge lights. These lights must have blue lenses, 7 watt LED, 6.6 amp ADB LED (model L-861T (L) / ETES – L) with arctic kit, by manufacturers listed in the latest FAA AC 150/5345-53 (latest revision) Appendix 3 Addendum.

E. The wattage for the LED fixture refers to the lamp only. The arctic kit option will add to the total power requirement for the LED fixture and required isolation transformer selection.

F. For all elevated runway and taxiway light fixtures, the light base plate must be provided with a frangible fitting and electrical disconnect at the

base can per the CCA Standard Drawings; meeting the requirements of the FAA AC 150/5345-46 (latest revision), Specification for Runway and Taxiway Light Fixtures; AC 150/5345-47 (latest revision), Specification for Series to Series Isolation Transformers for Airport Lighting Systems and; AC 150/5345-26 (latest revision), FAA Specification for L-823 Plug and Receptacle, Cable Connectors.

G. All light fixtures must be bonded to the light base internal ground lug via a #6 AWG standard copper wire rated for 600 volts with green XHHW-2 insulation, or a braided ground strap for RWSL lights, of equivalent current rating in accordance with AC150/5340-30 (latest edition). The ground wire or strap length must be sufficient to allow the removal of the light fixture from the light base for maintenance. Refer to the light manufacturer's instruction for proper methods of attaching the bonding wire.

2.03 ISOLATION TRANSFORMERS

A. The isolation transformers for runway and taxiway lighting and signs must conform to the requirements of AC 150/5345-47 (latest revision), "Specification for Series to Series Isolation Transformers for Airport Lighting Systems," as manufactured by Integro, LLC., ADB Airfield Solutions, LLC, or Thomas and Betts, Ltd.

B. The installation of the isolation transformers must conform to the applicable requirements of the FAA Specifications and as shown on the Drawings.

2.04 SIGNS

A. The guidance signs must be as specified in AC 150/5340-18 (latest revision) "Standards for Airport Sign Systems" and AC 150/5345-44 (latest revision), "Specification for Taxiway and Runway Signs". The guidance signs for this Project must be FAA Specification L-858 (with LED Lighting System), Size 2, up to a maximum of four modules. For a sign array, requiring more than 4 modules, the extra module(s) must be installed separately adjacent to the 4 modules and must be powered from a separate isolation transformer installed at the other end of the foundation slab as shown on the Drawings. Connect the two isolation transformer base cans with a concrete encased 2" PVC Sch 40 conduit for the power cabling.

B. The Airport signs must be mounted according to the manufacturer's directions and as shown in the Drawings. The signs must be provided with frangible fittings and electrical disconnect at the base plate per the Drawings, meeting the requirements of FAA AC 150/5345-44 (latest

revision), Specification for Taxiway and Runway Signs; AC 150/5345-47 (latest revision), Specification for Series to Series Isolation Transformers for Airport Lighting Systems; and AC 150/5345-26 (latest revision) FAA Specification for L-823 Plug and Receptacle, Cable Connectors. Signs must be provided with non-corrosive tethers.

C. Signs must be wired to edge light circuits indicated on the Drawings.

D. All sign lamps to be LED.

E. Guidance Signs

1. Airfield guidance signs must be Lumacurve by Standard Signs, Inc.

2. All guidance signs must have LED lighting system.

F. In a sign array consisting of multiple individual signs, AC 150/5345-44 requires that there be no above ground electrical connection between signs in an array. For this arrangement, an additional, separate base can must be installed with 2" interconnecting PVC duct, base plate and sign cord disconnect, to provide underground wiring required.

G. All signage placards must be one (1) module in size with all attachment hardware necessary for connection to adjacent placards.

H. The Contractor must install a spare 2" RGS conduit from the base can and stub this conduit with cap above the sign concrete pad at the center of sign module (typical).

2.05 LIGHT BASE

A. Light bases must conform to the requirements of AC 150/5345-42 (latest revision), "Specification for Airport Light Bases, Transformer Housings, Junction Boxes, and Accessories", except that they must be Class 1A, metallic 12-inch or 16-inch diameter, Type L-867 or L-868 as shown on the Drawings and must be listed in AC 150/5345-53 (latest revision) addendum. All light bases must be provided with factory installed ground lugs, one external lug for grounding and one internal lug for light fixture bonding. The 16-inch base cans for use by and in the jurisdiction of the FAA must be verified with FAA if they will be stainless steel Class 1 B, which is preferred by the FAA for its facilities.

B. Installation of spacers; extension ring; flange with dam, snow plow, or mud rings; and other base can accessories must conform strictly to the requirements of AC 150/5345-42 (latest edition) or as indicated on the Drawings. The base can must be set precisely to the proper grade, level,

and orientation to minimize the use of excessive number of spacers and shims or long bolts.

C. Acceptable manufacturers for light bases and accessories are Jacquith Industries, Inc., Olson Industries, Inc., Airport Lighting Equipment, and other certified manufacturers listed in the current AC 150/5345-53 (latest revision) addendum.

2.06 BOLTS FOR BASE CAN AND ACCESSORIES

A. Fluoropolymer ceramic-metallic coated SAE Grade 2 bolts must be used to secure light fixtures to stainless steel L-868 and L-867 light bases with 2-part locking washers in accordance with FAA Engineering Brief No. 83 "In-Pavement Light Fixture Bolts" issued June 28, 2010. The color of the outer coating of the Grade 5 bolts must be orange or hot pink as determined by the Commissioner. Fluoropolymer ceramic-metallic coated bolts do not require the use of anti-seize compounds.

B. SAE Grade 5 carbon steel bolts with anti-seize compound must be used to secure light fixtures to galvanized steel L-868 and L-867 light bases with 2 part locking washers as approved by the commissioner.

C. Installation and torquing of the bolts must be in conformance with the FAA Engineering Brief No. 83 and must follow the recommended industry best practices for installing and torquing bolts.

D. The torque values for each bolt installed in the final condition must be recorded and submitted to the FAA and Commissioner in the Turnover Binder.

2.07 CONCRETE

A. Concrete required for the construction of bases and other work under this item must conform to the requirements of Sections L-120 or P-610, as noted in the plans.

2.08 GROUND RODS

A. Ground rods must be Type 304 stainless steel, 10 feet long and ¾ inch diameter unless otherwise shown on the Contract Drawings. All new or replaced lights must be installed with new ground rods.

2.09 PAINT

A. The paint must meet the requirements of Federal Specification TT-P-1952. The paint must be yellow without reflective media.

2.10 IDENTIFICATION NUMBERS FOR EDGE LIGHTS AND GUIDANCE SIGNS

A. Identification numbers for each light will be as directed by the Commissioner and will be provided to the Contractor during construction.

B. Identification numbers for edge lights and guidance signs must be permanently engraved or cut in a phenolic or nonmetallic disc or plate not less than two (2) inches in diameter or square. The disc or plate must be fastened to the base cover by the regular hold down bolts or by at least two metal screws of rust-proof material. Plate must not be fastened to fixture cover.

2.11 EPOXY CONCRETE BONDING ADHESIVE

A. The epoxy concrete bonding adhesive between old and new concrete must conform to ASTM C881, Type IV, Grade 1, Class A, B, or C and must meet the approval of the Commissioner. The class supplied must be governed by the range of temperature for which the material is to be used.

2.12 ANTI-SEIZE COMPOUND

A. Where required, anti-seize compounds must meet the requirements of MIL-A-907E, have a temperature range from at least -65 degrees F to +180 degrees F, be compatible with the various metals being united, and not affected by deicing agents. The light fixture manufacturer must furnish the proper torque values in their installation manual with the type of anti-seize compound that must be used.

B. Anti-seize compound must not be used on fluoropolymer ceramic-metallic coated bolts.

2.13 POLYMER PATCHING MORTAR

A. Patching mortar installed around in-pavement light fixtures must be a three component, 100% solids, multi-purpose, high strength, non-shrink, waterproof, non-conductive, and semi-flexible polymer patching mortar for longer lasting patches with excellent workability. The system must combine a high quality polymer resin and curing agent with an engineered blend of added aggregates.

B. Acceptable products are SSI Flexpatch by Silicone Specialties, Inc. (www.ssicm.com) and equivalent products conforming to 2.13 A above and meeting the approval of the Commissioner. Application and installation of the product must be in accordance with the manufacturer's procedures and instructions.

2.14 DRAIN PIPES FOR LIGHT BASE CANS AND MARKER LIGHT BASES

A. PVC drain pipes must be Schedule 80 complying with ASTM D1785. The conduit must be manufactured from PVC compound that meet the applicable requirements of ASTM D1784. Standard fittings and cement must be obtained from the same conduit manufactures.

B. Acceptable PVC pipe manufacturers are Carlon, J-M, National Pipe, or Georgia Pipe.

2.15 STEEL REINFORCEMENT

A. Steel reinforcement, tie bars and dowels must meet the requirements of Section P-610.

PART 3 - CONSTRUCTION

3.01 GENERAL

A. The work being performed under this item of these Specifications must conform to the Chicago Electrical Code and the National Electrical Code. The electrical systems must be complete with all necessary accessories for the required results with the greatest assurance of protection to life and property.

B. The Plans indicate the extent and general arrangement of the electrical work. If any departures from the Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore will be submitted in writing as soon as practicable to the Commissioner for approval. No such departures will be made without the prior written approval from the Commissioner.

3.02 UNCLASSIFIED EXCAVATION

A. Unclassified excavation must be in accordance with these Specifications.

B. The Contractor must excavate for the light bases and the structure to the lines and grades or elevation, shown on the Drawings, or as directed by the Commissioner. The excavation must be of sufficient size to permit the placing of the full width and length for the structure. The elevations of the bottoms of structures, as shown on the Plans, must be considered as approximate only; and the Commissioner may order in writing changes in dimensions or elevations of structure necessary to secure a satisfactory foundation.

C. Boulders, logs, or any other objectionable material encountered in excavation must be removed and must be disposed off the Airport property. These removals will be considered included in the unit price for the lighting structure pay items of this Specification. When concrete is to rest on a surface other than rock, special care must be taken not to disturb the bottom of the excavation, and excavation to final grade must not be made until just before the concrete or reinforcing is to be placed.

D. The Contractor must do all bracing, sheathing, or shoring necessary to implement and protect the excavation, pavement, and the structures as required for safety or conformance to governing laws. The cost of bracing, sheathing, or shoring must be included in the unit price for the lighting structure pay item.

E. Unless otherwise provided, bracing, sheathing, or shoring involved in the construction of this item will be removed by the Contractor after the completion of the structure. Removal must be performed in a manner which will not disturb, or mar finished masonry. The cost of removal will be included in the unit price for the lighting structure pay item. The Contractor must place concrete and reinforcing steel only after the Commissioner has approved the depth of the excavation and the character of the foundation material.

3.03 CONCRETE STRUCTURES

A. Concrete structures must be built on prepared foundations, conforming to the dimensions and form indicated on the Drawings. The construction must conform to the requirements specified in Section P-610 or L-120 as shown on the plans. Any reinforcement required must be placed as indicated on the Plans and must receive approval by the Commissioner before the concrete is placed.

3.04 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES AND FITTINGS

A. Castings, frames and fittings must be placed in the position indicated on the Drawings or as directed by the Commissioner and must be set true to line and to correct elevation. If frames or fittings are to be set in concrete or cement mortar, anchors or bolts must be in place and position before the concrete or mortar is placed. The unit must be brought true to line and grade and must be set in mortar beds and anchored to the masonry as indicated on the Drawings or as directed and approved by the Commissioner. All units must set firm and secure.

B. 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 must be placed and fastened down.

3.05 BACKFILLING

A. After the structure has been completed, the area around it will be backfilled in accordance with this Specification. Backfilling must not be placed against any structure until permission is given by the Commissioner. In the case of concrete, such permission will not be given until the concrete has been in place a minimum of seven (7) days or until tests made by the Contractor's QC organization and tested by the Contractor's approved laboratory, subject to verification by the laboratory under supervision of the Commissioner establish that the concrete has attained sufficient strength to provide a factor of safety against damage in withstanding any pressure created by the backfill or the methods used in placing it.

B. All trenches and excavations must be backfilled within a reasonable time after the structures are installed, unless other protection of the structures is directed. The backfill material must be as specified herein. Backfill materials and compaction procedures must be acceptable to the Commissioner. In all backfilling, any compressible or destructible rubbish and refuse must be removed from the excavated space before backfilling is started.

C. Fine aggregate for backfill must be brought up evenly on each side of the structure. If the excavation is to be under pavement, or within 2 feet of the proposed, future or existing pavement edge, then placement and compaction of the fine aggregate backfill must continue until the top of subgrade is reached. If the excavation is not under, or adjacent to, existing, proposed or future pavement, then acceptable fill must be placed and compacted to top of subgrade.

D. Fine aggregate for backfill must consist of natural sand or washed crushed limestone having a FA-6 gradation conforming to Section 1003 of the Standard Specifications for Road and Bridge Construction, Illinois Department of Transportation. Acceptable fill for backfill is defined as suitable unclassified excavation material that is non-organic, non-decayable and non-rubble material having a maximum dry density of not less than 98 pounds per cubic foot. It will contain no rock, stones, or broken concrete greater than 3 inches in the largest dimension. The material must be easily compactable to the required density and approved by the Commissioner.

E. If the backfill is fine aggregate backfill, it must be placed in uniform layers not greater than 8 inches in loose thickness and thoroughly compacted in place with suitable vibratory equipment to not less than 95% of the maximum density as determined by ASTM D-1557. Each lift of Acceptable Fill must be within +/-2% of optimum moisture content before

the succeeding lift is placed. If the backfill is acceptable fill it must be placed in uniform layers not greater than 12 inches in loose thickness and each layer compacted to 85% of maximum density as determined by ASTM D 1557.

F. Finish grading must be performed to blend into the existing ground surfaces. All finished grading surfaces must be left smooth and free to drain. Finish grades must meet the requirements of CFR Part 139. Finish grading must not be measured and paid for separately. This work is to be included in the unit price for the related work.

G. Any depression which may develop from settlement in backfilled areas within 1 year after the work is fully completed and accepted must be the responsibility of the Contractor. The Contractor must provide as needed, at his own expense, additional backfill material, pavement, base replacement, permanent pavement repairs or replacement and must perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as acceptable to the Commissioner.

H. Backfill compaction must be tested and monitored by the Contractor. All material and backfill operations may be subjected to testing by the Commissioner with the assistance of the Contractor.

I. Backfill will not be measured for direct payment. Performance of this work will be considered as a subsidiary obligation of the Contractor covered under the Contract unit price for the structure involved.

J. The suitability of compacting equipment must be acceptable to the Commissioner. Tamping rollers (generally referred to as Sheepsfoot Rollers) will be considered the proper type of equipment for compaction of cohesive soils and vibratory/mechanical tamping equipment will be applicable for compacting granular soils. In all cases, the adequacy of the equipment will be determined by the Commissioner.

K. Any excavations adjacent to existing structures that have disturbed or removed existing pavement during the construction or adjustments of structures, conduit or ductbank must be restored with bituminous concrete meeting the materials and methods requirements of Sections P-401, and P-405, to match the proposed pavement design adjacent to light or sign construction. This restoration work must not be measured and paid for separately. This work is to be included in the unit price for the related work.

L. Backfill placed around ALSF and RWSL light fixtures must conform to the requirements in FAA Specification FAA-GL-918D.

3.06 NIGHT WORK

A. Work performed at night as directed in the plans must be constructed in accordance with Section N-100 and the additional restrictions and requirements noted in the plans and specifications. The work must be completed, tested, and operational to the satisfaction of the Commissioner, and meet the requirements for reopening runway and taxiway pavement as described in Section N-100.

3.07 CLEANING AND RESTORATION OF THE SITE

A. After the backfill is completed, the Contractor must dispose of all surplus material, soil, and rubbish off of air property. Surplus soil may be deposited in embankments, shoulders, or as ordered by the Commissioner. The Contractor must restore all disturbed areas to their original condition. The restoration must include any necessary topsoiling, fertilizing, liming, seeding, and mulching. All such work must be performed in accordance with turfing Specifications. The Contractor must be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

B. After all work is completed, the Contractor must remove all tools and equipment, leaving the entire site free, clear, and in good condition, meeting the requirements of CFR Part 139.

3.08 OTHER ELECTRICAL WORK

A. All other electrical work required under this item of these Specification must be installed in accordance with the Chicago Electrical Code and the National Electrical Code.

3.09 REMOVAL OF EXISTING STRUCTURES

A. If shown on the Drawings, remove certain light bases in the existing electrical system as indicated. Dispose of or deliver salvaged light bases to the Commissioner as directed by the Commissioner.

3.10 PAINTING

A. The exposed surface of Type 1 marker light bases must be painted with two (2) coats of aviation yellow paint. The painting must be performed only when the existing surface is dry and clean, when the atmospheric temperature is above 40 degrees F, and when the weather forecast is for dry weather.

3.11 LIGHTING FIXTURES

A. The installation of lighting units must be as directed by the manufacturer. After each light unit is completely installed, the void between and around the top of the light fixture flange ring and the pavement must be filled with a polymer patching mortar.

B. The Contractor must survey the location of each existing lights to be adjusted and/or replaced and record the type, direction of the fixture and provide the information to the Commissioner prior to starting electrical work

3.12 APPLICATION OF EPOXY CONCRETE BONDING ADHESIVE

A. Where shown on the Drawings the epoxy concrete bonding adhesive must be uniformly applied to coat the entire surface of the concrete remaining in place prior to placement of the new concrete.

3.13 NEW BASES

A. The light and sign bases must be installed where indicated on the Contract Drawings.

B. The installation of the light and sign base units must be in accordance with the manufacturer's installation instructions and the FAA installation requirements and as directed by the Commissioner.

C. The light and sign bases must be installed as detailed on the Drawings.

3.14 DRAIN PIPES AND HUBS FOR LIGHT BASE CANS AND MARKER LIGHTS BASES:

A. The drain pipes and hubs must be installed where indicated on the Contract Drawings.

B. The drain pipes and hubs must be installed as detailed on the Drawings.

3.15 TESTING

A. The Contractor must accomplish operational testing of the lighting fixtures and circuits after cable testing described in Specification Section L-108, paragraph 3.10 and 3.11 to ensure compliance with the Contract documents. The Commissioner will witness all testing. The Contractor must furnish all meters, instruments, cable connections, equipment or apparatus necessary for performing and recording the results of all tests.

B. Upon completion of the electrical work and cable testing, the Contractor must energize each of the affected circuits under this Contract, and:

1. Demonstrate that each lighting fixture and guidance sign is operational and is connected to the designated circuit.

2. Test the power and control of electrical circuits for continuity and function from both the control tower and the airfield lighting vault.

3. Show and verify in writing that the systems and equipment are free from all defects.

C. Any wiring device, electrical apparatus, or lighting fixture grounded or shorted on any integral "live" part, must be removed and the trouble rectified by replacing the defective parts or materials.

D. Tests must be coordinated with the field schedule and field conditions. Before testing, all necessary precautions must be taken to ensure the safety of personnel and equipment. All enclosures for conductors and equipment must be properly grounded.

E. The Commissioner will conduct from time to time such tests as may be required to any part of the equipment to determine if it is installed in accordance with these Specifications. The Contractor must extend to the Commissioner all facilities to this end and must furnish the skilled or unskilled help required. Three copies of the verified test results must be given to the Commissioner promptly upon completion of a test.

F. The Contractor must provide assistance to the various Equipment Manufacturers' field engineers as required in the testing and adjusting of the electrical power and control equipment. Cooperation of the Contractor must be such that a minimum of time is required for equipment testing.

G. A log must be maintained for all tests. This log must be certified before completion of the job, both as to test value and date of test.

H. Any faults in the work performed by the Contractor or in materials or equipment furnished by the Contractor must be corrected or replaced promptly by the Contractor at his own expense. Any faults in materials or equipment furnished by the Contractor which are the result of careless, incompetent or improper workmanship must be repaired and the work retested.

3.16 DOCUMENTATION

A. FAA Facility As-Built Documentation is required for formal acceptance of the ALSF and the Runway Status Light System by the FAA and CDA. The Documentation must be complied and submitted to the Commissioner to be forwarded to the FAA for review and acceptance.

B. The Documentation must contain, at a minimum, the following items as applicable:

1. FAA Form 4650-12 (Material Requisition / Issue / Receipt Form), including costs.

2. Approved Submittals (electronic copy only).

3. Redline Drawings. These shall include the latest field change redlines from construction.

4. Cable Tests- ensure that the cable tests are a) from the factory b) on the reel and c) after install.

5. Operations & Maintenance Manuals.

6. Attic Stock Chain of Custody Forms.

7. Non ACM certification. Certification of non-asbestos containing material provided on this project.

8. MSDS sheets.

9. Warranties.

10. Torque documentation (calibration of equipment used and required/set values for screws, bolts, and nuts.)

C. The Documentation must be presented in 3 rings binders, labeled with the material enclosed therein. Three (3) copies of the Documentation are required for each Facility; one original, two printed copies and one electronic copy on CD(s) in PDF format. The Contractor must coordinate with the Commissioner and the FAA prior to preparation of the Documentation to ascertain the precise requirement for each.

PART 4 - METHOD OF MEASUREMENT

4.01 MARKER LIGHT BASES AND FIXTURES

A. Removal and Replacement of existing in-pavement Taxiway centerline light, complete will be measured as each. The quantity of the remove and replace of the existing centerline light to be paid for will be the number complete, connected, tested, ready for operation, and accepted. This item includes removing and replacing existing in-pavement Taxiway Centerline light base, fixture and accessories with new L-868 base, L-852A/B (L) LED fixtures, isolation transformer, L-823 connector kit, flange ring with dam, extension ring, spacer ring and accessories to have a complete and operational unit as shown on the drawings and as specified in this Specification.

Removal and Reinstallation of existing in-pavement Runway Status Light (RWSL), complete will be measured as each. The quantity of the remove and reinstall of the existing Runway Status Light to be paid for will be the number complete, connected, tested, ready for operation, and accepted. This item includes removing existing in-pavement Runway Status Light fixture, snow plow rings and extension ring and provide cover to facilitate the milling and paving operation. Reinstall the original RWSL light fixture with new snow plow, extension and spacer rings on the existing base can in the original orientation, reconnect and restore to the original operating condition with lens colors as noted in the drawings, complete with accessories as shown on the drawings and as specified in this Specification.

B. Removal and reinstallation of existing in-pavement ALSF Light center-bar with 5-Steady-Burning (no flasher) light fixtures will be measured as each. The quantity for removing and reinstalling the ALSF light bar fixtures complete, connected, tested, ready for operation, and accepted. This item includes removing the ALSF light fixtures and extension rings and providing covers to facilitate the milling and paving operation. Reinstalling the original ALSF Steady-burning and flasher light fixtures with new snow plowing rings, extension and spacer rings on the existing base cans in the original orientation, reconnect and restore to the original operating condition with lens colors as noted in the drawings, complete with accessories as shown on the drawings and as specified in this Specification.

C. Removal and reinstallation of existing in-pavement ALSF Light center-bar with 3-Steady-Burning light fixtures will be measured as each. The quantity for removing and reinstalling the ALSF light bar fixtures complete, connected, tested, ready for operation, and accepted. This item

includes removing the ALSF light fixtures and extension rings and providing covers to facilitate the milling and paving operation. Reinstalling the original ALSF Steady-burning and flasher light fixtures with new snow plowing rings, extension and spacer rings on the existing base cans in the original orientation, reconnect and restore to the original operating condition with lens colors as noted in the drawings, complete with accessories.

D. Removal of existing Taxiway edge light and Type 1 Marker foundation, complete will be measured as each. The quantity of the remove Taxiway edge light and Type 1 Marker be paid for will be the number complete and accepted. This item includes removing existing Taxiway elevated edge fixture and Type 1 Marker foundation. Salvage and deliver the light fixture to CDA.

E. Taxiway edge light, Type 1 Marker base will be measured as each. This item includes furnishing and installing new Taxiway edge light in Type 1 marker with handhole, L-861T (L) LED omni-directional blue lens Elevated Taxiway Edge fixture, isolation transformer, L-823 connector kit, and accessories and reconnect to the existing circuit to have a complete and operational unit as shown on the drawings and as specified in this Specification.

4.02 GUIDANCE SIGNS AND BASES:

A. New L-858 Guidance Sign on Existing Base or with New Base, 1 thru 7 Module, Size 3, Complete: The quantity of guidance signs and new bases to be paid for will be the number of each type guidance sign complete, connected, tested, ready for operations, and accepted. This Item consists of a concrete foundation, L-867 light base(s); a one, two, three, or four Module, Size 3 sign furnished by the CDA; transformer, ground rod, and required hardware. No separate measurement will be made for excavation, drain pipe, ground rods, transformers, or any miscellaneous hardware, but will be considered included in the unit price for the guidance sign and base.

B. Remove Guidance Sign with Base, Complete: The quantity of these signs and bases to be paid for will be the number of existing guidance signs and transformers removed from its existing location and relocated to another shown on the Drawings. This item includes removal and disposition of the existing base and conduit to the nearest light base with the resulting hole and surrounding disturbed areas backfilled and finished surface areas restored in accordance with the Project Specifications and as directed by the Commissioner.

C. Commissioning of the new sign and decommissioning of the existing sign must take place during the same work shift such that continuity of directional information is not interrupted.

D. Temporary guidance signs as described herein, and as detailed in the plans, will not be measured for payment.

4.03 DRAIN PIPES FOR LIGHT BASE CANS AND MARKER LIGHT BASES

A. The drain pipe or hub and French drain as applicable per details shown on the Drawings will not be measured separately, but shall be included in the line item unit price per each for marker light base, lighting fixture, and guidance sign in place, completed, and accepted.

PART 5 - BASIS OF PAYMENT

5.01 BASES AND FIXTURES

A. Payment will be made at the Contract unit price for each new taxiway edge light in Type 1 marker and replaced taxiway centerline light complete with light base with light fixtures, all installed in place by the Contractor and accepted by the Commissioner. The price will be full compensation for furnishing all materials; for all preparation, assembly and installation; and for labor, equipment, tools, accessories, light bases, and all work necessary to complete these units as required by these Specifications, and/or as shown on the Drawings.

B. Payment will be made at the Contract unit price for each adjusted or replaced taxiway centerline, RWSL and ALSF light fixtures, all installed in place by the Contractor and accepted by the Commissioner and FAA. The price will be full compensation for furnishing all materials; for all preparation, assembly and installation; and for labor, equipment, tools, accessories, light bases, light adjustments, and all work necessary to complete these units as required by these Specifications, and/or as shown on the Drawings.

5.02 GUIDANCE SIGNS AND BASES

A. Payment will be made at the Contract unit price for each complete Remove Guidance Signs and Bases, Complete, and New Guidance Sign with New Base or Existing Base, 1 thru 7 Module, installed in place by the Contractor and accepted by the Commissioner. The prices will be full compensation for furnishing all materials (unless otherwise provided by the CDA); for all preparation, assembly and installation; and for labor, equipment, tools, accessories for light bases, and all work necessary to

complete these units as required by these Specifications, and/or as shown on the Drawings.

B. Temporary guidance signs as described herein, and as detailed in the plans, shall be considered incidental to the contract, and no additional payment will be made.

5.03 DRAIN PIPES FOR LIGHT BASE CANS AND MARKER LIGHT BASES

A. Payment for the furnishing and installation of drain pipes or hubs and French drains (materials and preparation, excavation, installation of drain pipe including clip-on drain covers and screens, backfilling; and for all labor, equipment, tools, and all work necessary to complete the item) will not be made separately, but will be included as included in the Contract unit price per each marker light base, lighting fixture, and guidance sign.

5.04 PAY ITEMS

A. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
L-100-01	REMOVE EXISTING TAXIWAY IN-PAVEMENT CENTERLINE BASE, LIGHT FIXTURE, ISOLATION TRANSFORMER AND EXTENSION RING AND BACKFILL THE CAN. FURNISH AND INSTALL NEW L-868 BASE CAN, L-850(A or B)(L) LIGHT FIXTURE, ISOLATION TRANSFORMER, L-823 CONNECTOR, FLANGE, EXTENSION AND SPACER RINGS AT THE SAME LOCATION.	EA
L-100-02	REMOVE EXISTING IN-PAVEMENT RUNWAY STATUS LIGHT (RWSL) FIXTURE, SNOW PLOW RING, EXTENSION RING AND PROVIDE TEMPORARY COVER. REINSTALL ORIGINAL RWSL FIXTURE WITH NEW SNOW PLOW RING, FLANGE EXTENSION RING AND SPACER RINGS.	EA

L-100-03	REMOVE EXISTING IN-PAVEMENT ALSF LIGHT CENTER BAR (5-STEADY-BURNING) FIXTURES, SNOW PLOW RING, EXTENSION RING, AND PROVIDE COVER. REINSTALL ORIGINAL ALSF STEADY-BURNING LIGHT FIXTURES WITH NEW SNOW PLOW RING, FLANGE, EXTENSION AND SPACER RINGS.	EA
L-100-04	REMOVE EXISTING IN-PAVEMENT ALSF LIGHT SIDE BAR (3-STEADY-BURNING) FIXTURES, SNOW PLOW RING, EXTENSION RING, AND PROVIDE COVER, REINSTALL ORIGINAL ALSF STEADY-BURNING LIGHT FIXTURES WITH NEW SNOW PLOW RING, FLANGE, EXTENSION AND SPACER RINGS.	EA
L-100-05	REMOVE EXISTING TAXIWAY TYPE 1 MARKER EDGE LIGHT AND FOUNDATION, COMPLETE. SALVAGE LIGHT FIXTURE AND ISOLATION TRANSFORMER AND DELIVER TO CDA.	EA
L-100-06	PROPOSED L-861(T), LED TAXIWAY ELEVATED EDGE LIGHT, OMNI-DIRECTIONAL BLUE, IN TYPE 1 MARKER LIGHT BASE WITH HANDHOLE	EA
L-100-07	INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN WITH NEW BASE, 7-MODULE(S), SIZE 3, STYLE 2, MODE 2, CLASS 2, COMPLETE	EA
L-100-08	INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN WITH NEW BASE, 1-MODULE(S), SIZE 3, STYLE 3, MODE 2, CLASS 2, COMPLETE	EA
L-100-09	INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN WITH NEW BASE, 2-MODULE(S), SIZE 3, STYLE 2, MODE 2, CLASS 2, COMPLETE	EA

L-100-10	INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN WITH NEW BASE, 3-MODULE(S), SIZE 3, STYLE 2, MODE 2, CLASS 2, COMPLETE	EA
L-100-11	INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN WITH NEW BASE, 3-MODULE(S), SIZE 3, STYLE 3, MODE 2, CLASS 2, COMPLETE	EA
L-100-12	INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN WITH NEW BASE, 4-MODULE(S), SIZE 3, STYLE 2, MODE 2, CLASS 2, COMPLETE	EA
L-100-13	INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN WITH NEW BASE, 4-MODULE(S), SIZE 3, STYLE 3, MODE 2, CLASS 2, COMPLETE	EA
L-100-14	INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN WITH NEW BASE, 5-MODULE(S), SIZE 3, STYLE 2, MODE 2, CLASS 2, COMPLETE	EA
L-100-15	REMOVE EXISTING SIGN AND INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN ON EXISTING BASE, 7-MODULE(S), SIZE 3, STYLE 2, MODE 2, CLASS 2, COMPLETE	EA
L-100-16	INSTALL CDA FURNISHED L-858 (L), LED AIRFIELD SIGN ON EXISTING BASE, 2-MODULE(S), SIZE 3, STYLE 2, MODE 2, CLASS 2, COMPLETE	EA
L-100-17	INSTALL CDA FURNISHED 'NOISE ABATEMENT' SIGN WITH NEW BASE, COMPLETE	EA
L-100-18	REMOVE GUIDANCE SIGN AND BASE, COMPLETE	EA

END OF SECTION L-100

INSTALLATION OF UNDERGROUND CABLE FOR AIRPORTS SECTION L-108

PART 1 - DESCRIPTION

1.01 GENERAL

A. The work consists of furnishing and installing underground cable in accordance with these Specifications at the locations shown in the Drawings. This item includes the installation of airfield lighting and power cables, airfield lighting equipment grounding cable and airfield lighting counterpoise wire. It includes cable connections, splicing, tagging, cable marking, and testing of the installation and all work necessary to place the cable in operating condition as a completed unit to the satisfaction of the Commissioner. This item also includes removal of existing wire and cable as shown on the Drawings and providing temporary and permanent wiring to keep existing circuits in service during construction. This item does not include the installation of the duct or conduit. The work under this Section is subject to the requirements of the Contract Documents.

PART 2 - EQUIPMENT AND MATERIALS

2.01 GENERAL

A. Airport underground cables covered by Federal Aviation Administration (FAA) Specifications must have the prior approval of the FAA, and are described in Advisory Circular (AC) 150/5345-7 (latest revision), "Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits" and must be listed in the latest issue of FAA Advisory Circular (AC) 150/5345-53 "Airport Lighting Equipment Certification Program", Appendix 3 and 4 Addendum.

B. All other equipment and materials covered by other referenced Specifications will be subject to acceptance through manufacturer's certification of compliance with the applicable Specification, when requested by the Commissioner.

C. All materials and equipment used to construct this item must be submitted to the Commissioner for approval prior to ordering the materials and equipment. Submittals consisting of marked catalog sheets or shop drawings must be provided. Submittal data must be presented in a clear, precise, and thorough manner. Manufacturer's certifications will not relieve the Contractor of his responsibility to provide materials in accordance with these Specifications and acceptable to the

Commissioner. Materials supplied and/or installed that do not materially comply with these Specifications must be removed, when directed by the Commissioner, and replaced with materials that comply with these Specifications, at the sole cost of the Contractor.

D. All equipment and materials furnished and installed under this Section must be guaranteed against defects in materials and workmanship for a period of at least 12 months from final acceptance by the Commissioner. The defective materials and/or equipment must be repaired or replaced, at the Commissioner's discretion, with no additional cost to the City. The Contractor must be responsible to maintain the required insulation resistance with isolation transformers connected in new circuits and new segments of existing circuits through the end of the Contract warranty period.

2.02 SERIES AIRFIELD LIGHTING CABLE, COUNTERPOISE, GUARD WIRE, AND GROUNDING CONDUCTORS

A. Runway and taxiway series lighting cables must be 5,000 volt (5KV) cross-linked polyethylene insulated and must conform to the requirements of AC 150/5345-7 (latest revision), L-824 Type C, 5KV , size 6 AWG copper, 7 strand, single conductor cable and as indicated in the Contract Drawings. Cables must have a conductor stress relief shield, in accordance with Section 3 of the Insulated Cable Engineers Association Inc, ICEA S-96-659/NEMA WC71 as referenced in AC 150/5345-7 (latest revision). Acceptable manufacturer of this type of cable are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum.

B. All CED electrical ductbanks must be provided with lightning protection, either with counterpoise conductor or guard wire conductor, depending on the cables installed in the ductbank. Ductbanks containing FAA copper cables must be provided with guard wire, all other ductbanks must be provided with counterpoise only.

C. Airfield lighting counterpoise conductors installed underground must be soft drawn bare copper, size 6 AWG, solid, and must conform to the requirements of AC 150/5340-30 (latest revision), Chapter 12, Equipment and Material. Acceptable manufacturers of this type of wire are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum.

D. Equipment grounding conductors installed within airfield lighting bases/ fixtures, grounding conductors installed underground in conduit or ductbank must be soft drawn copper, size 6 AWG, 7 strand, with a 45 mil minimum coating of Type XHHW green insulation for airfield lighting and shall conform to the requirements of AC 150/5340-30 (latest revision), Chapter 12, Equipment and Material, or braided ground strap, as shown in the plans. Acceptable manufacturers of this type of wire are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum. Acceptable manufacturers of the ground strap are Burndy, or Storm Power Components, or other manufacturers approved by FAA.

E. Equipment grounding conductors installed within manholes must be soft drawn copper, utilizing a grounding bus of 4/0 AWG bare stranded copper and size 2 AWG pigtails bare copper to bond all metal hardware within the structure. The equipment grounding conductor must be bonded to ¾" diameter, 10'-0" long stainless steel ground rod installed in each manhole. The Equipment Grounding System must conform to the requirements of AC 150/5370-10 (latest revision). Acceptable manufacturers of this type of wire are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum. Ground bus, ground pigtails, and ground rods are included in the unit price of the L-115 electrical manhole pay items.

F. Equipment grounding conductors installed within handholes must be soft drawn copper, utilizing a ground bus of 4/0 AWG stranded copper with 45 mil minimum coating of Type XHHW green insulation and size 2 AWG pigtails with a 45 mil minimum coating of Type XHHW green insulation to bond all metal hardware within the structure. The equipment grounding conductor must be bonded to ¾" diameter, 10'-0" long stainless steel ground rod installed in each handhole. The Equipment Grounding System must conform to the requirements of AC 150/5370-10 (latest revision). Acceptable manufacturers of this type of wire are Draka Cableteq USA; Prysmian Power Cables and Systems USA, LLC; South Wire Company; and Coleman Cable, Inc.; or other manufacturers approved by FAA and listed in the current AC150/5345-53 Appendix 3 Addendum. Ground bus, ground pigtails, and ground rods are included in the unit price of the L-115 electrical handhole pay items.

G. Samples and reports on the results of shop tests for all wire and cables and descriptive literature for cable connectors, splices and terminations must be submitted for review by the Commissioner prior to installation.

H. The following wires and cables must be tested after installation but before final connections are made up: Service feeders, distribution feeders, branch circuit wiring and control wiring.

2.03 GROUND RODS

A. Ground rods must be Type 304 solid stainless steel, ¾" diameter x 10'-0" long.

2.04 CABLE CONNECTIONS

A. Cable connectors for series airfield lighting cables must be factory-molded or field attached plug-in connectors in accordance with the following. When the Plans or the proposal permit a choice of connection, the Contractor must indicate in the bid the type of connection that will be furnished.

1. The Field-Attached Plug-in Splice: Figure 3 of AC 150/5345-26 (latest revision), "Specification for L-823 Plug and Receptacle, Cable Connectors," employing connector kits, is approved for field attachment to single conductor cables.

2. The Factory-Molded Plug-in Splice: Specification for L-823 Connectors, Factory-Molded to individual conductors, is approved.

B. Series circuit cable connectors for the connection of two single conductor wires to the secondary connector on the airfield lighting isolation transformer leads must be in accordance with FAA Specification L-823, Figure 2, of AC 150/5345-26 (latest revision).

C. Provide FAA approved electrical tape (Scotch Electrical Tape No. 88, 1 ½" wide; and Scotch 130C, 2" wide, as manufactured by Minnesota Mining and Company, or approved equivalent) and 16" of approved heat shrink tubing over all primary cable splices in manholes, handholes and all light bases.

D. Acceptable manufacturers of cable connectors are Amerace Ltd., Crouse-Hinds Molded products and Integro, LCC, and other manufacturers approved by FAA and listed in the current revision of FAA AC 150/5345-53C, Appendix 3.

2.05 SHRINKABLE CABLE CONNECTOR KITS

1. Heat shrink tubing is to be designated for FAA Type L-823 plug and receptacle cable connectors. The heat shrink tubing is to be thick wall polyolefin, 16" full length, with a minimum shrink ratio of 3:1, designed for use with a heat gun or propane torch, and

suitable for indoor or outdoor applications. Taping of connectors will not be permitted in lieu of heat shrink tubing. Connectors must be taped with a few turns of FAA approved vinyl tape prior to the installation of heat shrink tubing. Heat shrink tubing kits are to be installed in manholes, handholes and light bases. The secondary L-823 connectors from isolation transformers to airfield lighting/signage matching connectors must not have heat shrink tubing applied. These connectors are designed to be secured to the fixture and sign cover plates to provide an electrical disconnect at the frangible connector location, by break away action of the L-823 connectors.

PART 3 - CONSTRUCTION METHODS

3.01 GENERAL

A. The Contractor must install the specified cable at the approximate locations indicated in the Drawings.

B. The work performed under this Section of these Specifications must conform to the requirements of the Chicago Electrical Code and the National Electric Code. The electrical systems must be complete with all necessary accessories to make them fully operational with the greatest assurance of protection to life and property.

C. The Plans indicate the extent and general arrangement of the electrical work. If any departures from the Plans are deemed necessary by the Contractor, details of such departures and the reasons therefore must be submitted in writing as soon as practicable to the Commissioner for approval. No such departures must be made without the prior written approval of the Commissioner.

D. Cable connections between lights will be permitted only at the light locations for connecting the underground cable to the primary leads of the individual isolation transformers. The Contractor must 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 Commissioner or shown in the Drawings.

E. In addition to connectors being installed at individual isolation transformers, L-823 cable connectors for maintenance and test points must be installed at locations shown on the Drawings. Cable circuit identification markers must be installed on both sides of the L-823 connectors installed or at least once in each access point where L-823 connectors are not installed.

F. Provide not less three feet of cable slack on each side of all connections, isolation transformers, light units, and at points where cable is connected to field equipment. Where provisions must be made for testing or for future above grade connections, provide enough slack to allow the cable to be extended at least one foot vertically above the top of the access structure. This requirement also applies where primary cable passes through empty base cans, junction and access structures to allow for future connections, or as designated by the Commissioner.

3.02 INSTALLATION IN CONDUIT

A. 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 must be in accordance with the Chicago Electric Code.

B. The Contractor must make no connections or joints of any kind in cables installed in conduits or ducts.

C. The conduit must be installed as a separate item in accordance with Section L-110, "Installation of Airport Underground Electrical Duct." The Contractor must run a mandrel through duct banks or conduit prior to installation of cable to insure that the conduit is open, continuous, and clear of debris. The Contractor must swab out all conduits/ducts and clean base can, manhole, etc., interiors immediately prior to pulling cable. Once cleaned and swabbed, the base cans and all accessible points of entry to the duct/conduit system must be kept closed except when installing cables. Cleaning of ducts, base cans, manholes, etc. is incidental to the pay item being cleaned. All raceway systems left open, after initial cleaning, for any reason, must be recleaned at the Contractor's expense. All accessible points must be kept closed when not installing cable. The Contractor must verify existing ducts proposed for use in this project as clear and open. The Contractor must notify the Commissioner of any blockage in the existing ducts. The cable must 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 must be sealed with moisture-seal tape before pulling into the conduit, and it must be left sealed until connections are made. Where more than one cable is to be installed in a conduit or duct under the same Contract, all cable must be pulled in the conduit or duct at the same time. The pulling of a cable through ducts or conduits may be accomplished by hand winch or power winch with the use of cable grips or pulling eyes. Installation of cable in ducts must be carried out by the use of nylon or polypropylene pull lines. Flat steel tapes or steel cables must not be used. Pulling tensions must be governed by recommended standard practices for straight pulls or bends and must not exceed manufacturer's

recommendation. The Contractor must submit pulling tension values to the Commissioner prior to any cable installation. If required by the Commissioner, pulling tension values for cable pulls must be monitored by a dynamometer in the presence of the Commissioner. Cable pull tensions must be recorded by the Contractor and reviewed by the Commissioner. Cables exceeding the maximum allowable pulling tension values must be removed and replaced by the Contractor at Contractor's expense. A lubricant recommended for the type of cable being installed must be used where pulling lubricant is required. All cable must be installed directly from reels. Dragging the cable over the ground and across base can or manhole edges is not permitted. When cable must be coiled, lay cable out on a canvas tarp or utilize other appropriate means to prevent abrasion to the cable jacket.

D. Cable installation, handling, and storage must be per manufacturer's recommendations. During cold weather, particular attention must be paid to the manufacturer's minimum installation temperature. At the Contractor's option, the Contractor may submit a plan, for review by the Commissioner, for heated storage of the cable and maintenance of an acceptable cable temperature during installation when temperatures are below the manufacturer's minimum cable installation temperature.

3.03 SPLICING

A. For 5KV series circuit airfield lighting, the connections of the type required in the Plans must be made by experienced personnel regularly engaged in this type of work and must be completed in accordance with the following:

1. Field-attached or Plug-in Splices. (5KV Splices) These must be assembled in accordance with the National Electrical Code and manufacturer's recommendations. These splices must be made with compression type connectors or lugs plugging directly into mating connectors. In all cases the joint where the connectors come together must be cleaned, taped and encased with heat shrink tubing. Indenter type compression fittings are not acceptable. Provide tape and heat shrink tubing over all cable splices in manholes, handholes, and light bases.

2. For splicing cables with L-823 plug and receptacle cable connectors, see Paragraphs 2.04A, 2.04B, and 2.05 above.

3. Every splice must be housed in a light base, handhole, or manhole. In a light base, leave at least 6 feet of slack cable on each side of the splice. In a handhole or manhole, the cable must

make one loop around the handhole or manhole and the splice must be located near the center of the loop.

B. For power cable splicing above 600 Volt, splices and terminations will not be permitted except in junction boxes, manholes and handholes. These must be assembled in accordance with the National Electrical Code and manufacturer's recommendations. Splices and terminations must be made with compression type connectors and lugs for medium voltage use. Splices must only be made where necessary when pulling tensions exceed manufacturer's recommendations. Lugs will only be allowed in above ground enclosures or junction boxes. Lugs must be 2-hole, color keyed only and installed with tools as required by the lug manufacturer. Lug bolting and solderless lug terminations must be per manufacturer's recommendation for medium voltage.

3.04 COUNTERPOISE OR GUARD WIRE INSTALLATION FOR LIGHTNING PROTECTION.

A. Counterpoise or guard wire must be installed for lightning protection of the underground cables. Counterpoise or guard wire must be installed in the same trench for the entire length of buried cable, conduits and duct banks that are installed to contain airfield lighting cables and/or FAA copper conductors. In trenches counterpoise or guard wire must be installed continuously a minimum of 4 inches above the cable, conduit or duct bank; 10 inches above conduit for RWSL; or as shown on the Drawings if greater. Additionally, counterpoise or guard wire must 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 or guard wire must not be installed in conduit. Refer to paragraph 2.02B as to where counterpoise wire or guard wire is required. The counterpoise wire must be exothermically welded to ground rods spaced a maximum of 500 feet apart around the entire circuit.

B. For in-pavement runway touchdown zone lights, runway centerline lights and taxiway centerline lights installed in rigid pavement the counterpoise connections are made to the exterior ground lug on fixture bases and bonded to the rebar cage around the fixture base. The counterpoise wire must also be exothermically welded to ground rods installed as shown on the Drawings, but not more than 500 feet (150 m) apart around the entire circuit.

C. The distance between ground rods must vary by 10-20% throughout the length of installation to prevent resonance.

3.05 SAFETY (EQUIPMENT) GROUND

A. A separate safety (equipment) ground system must be provided in addition to the counterpoise wire. The requirements for safety ground must conform to the FAA Advisory Circular AC 150/5340-30 (latest revision), Chapter 12, Paragraph 12.6 “Safety (Equipment) Ground” and as shown in the Drawings. The equipment ground must not run in conduit between fixture bases.

1. A ground rod must be installed at and securely attached with a size 6 AWG bare jumper to each airfield in-pavement light fixture base can.

2. For each electrical manhole, bond all metal surfaces to the 4/0 AWG bare stranded copper ground bus utilizing size 2 AWG pigtail bare copper cables.

3. For each Type 1 marker base handhole, bond all metal surfaces to the ground rod in the handhole using size 6 AWG green insulated wire.

4. Each ground rod must be tested prior to backfilling. Provide test results to the FAA and Commissioner in the turnover binder.

3.06 COUNTERPOISE INSTALLATION ABOVE MULTIPLE CONDUITS AND DUCT BANKS

A. Counterpoise or guard wires must be installed above multiple conduits/duct banks for airfield lighting or FAA copper cables, to provide a complete cone of protection over the cables. When multiple conduits and/or duct banks are installed in the same trench, the number and location of counterpoise or guard wires above the conduits must be adequate to provide a complete cone of protection measured 22 ½ degrees each side of vertical. For ductbank of extra width, multiple counterpoise or guard wires may be required.

B. Where duct banks pass under pavement to be constructed in the Project, the counterpoise or guard wire must be placed above the duct bank.

3.07 COUNTERPOISE INSTALLATION AT EXISTING DUCT BANKS

A. Where new ductbank is to connect to an existing ductbank and counterpoise/guard wire system, the new counterpoise or guard wiring must be terminated at ground rods at the end of the existing duct bank. The new counterpoise or guard wire must be bonded to the existing

counterpoise or guard wire system in accordance with these Specifications.

3.08 EXOTHERMIC BONDING FOR COUNTERPOISE AND GROUNDING CONDUCTORS

A. Bonding of counterpoise or guard wire must be by the exothermic welding process. Only personnel experienced in and regularly engaged in this type of work must make these connections.

B. Contractor must demonstrate to the satisfaction of the Commissioner, the welding kits, materials and procedures to be used for welded connections prior to any installations in the field. The installations must comply with the manufacturer's recommendations and the following:

1. All slag must be removed from welds.

2. For welds at light fixture base cans, all coated surface areas and "melt" areas, both inside and outside of base cans, damaged by exothermic bond process must be restored by coating with a compound conforming to the base can manufacturer's recommendations.

3. All buried stainless steel, copper, and weld materials at weld connections must be thoroughly coated with 6 mil of 3M “Scotchkote”, or approved equivalent, or coated with coal tar bitumastic material to prevent surface exposure to corrosive soil or moisture.

3.09 INTERFERENCE WITH AIRPORT OPERATION

A. The normal operating functions of the Drawings will be continued and the work in some areas will be permitted only at specified times and during suitable weather conditions. The installation of equipment and the opening of vital circuits must be done only for minimum intervals at such times and with such restrictions as approved and agreed upon by the Commissioner and may be required during non-regular working hours. The installation of temporary wiring may also be required to permit operations and work in certain areas and will be required to maintain operation of all lighting.

3.10 TESTING REQUIREMENTS

A. The Contractor must furnish all necessary equipment and appliances for testing the underground cable circuits after installation. The Contractor

must test and demonstrate in the presence of and to the satisfaction of the Commissioner the following:

1. That all lighting power and control circuits are continuous and free from short circuits. This task includes a megger test at the respective Airfield Lighting Vault.

2. That all circuits are free from unspecified grounds.

3. That the insulation resistance to ground of all nongrounded series circuits and all nongrounded conductors of multiple circuits is not less than 100 megohms at the Airfield Lighting Vault.

4. That all circuits are properly connected in accordance with applicable wiring diagrams.

5. That all circuits are operable. Tests must 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 at each intensity.

6. That for airfield ground testing other than FAA installations, the impedance to ground of each ground rod does not exceed 10 ohms prior to establishing connections to other ground electrodes. The fall-of-potential ground impedance test must be utilized, as described by ANSI/IEEE Standard 81, to verify this requirement.

7. All tests and measurements must be documented in writing for future reference. A log must be maintained for all tests. This log must be certified before completion of the work both as to test value and date of test. The log and all test results must be submitted to the Commissioner.

8. All cables must be factory-tested and certified before shipping. The test reports must be submitted and approved by the Commissioner before shipping.

9. Tests must be coordinated with the field schedule and field conditions.

10. Before testing, all necessary precautions must be taken to ensure the safety of personnel and equipment. All enclosures for conductors and equipment must be properly grounded.

11. Any faults in the work performed by this Contractor or in materials furnished by this Contractor must be corrected or replaced promptly by this Contractor at his own expense. Any faults in

materials furnished by the Contractor which are the result of careless, incompetent or improper workmanship must be repaired and the work retested.

12. Contractor must perform a Megger test of all circuits prior to performing any work on the applicable circuits. Contractor to provide all Megger test reports to the Commissioner for review. After construction activities on the applicable circuits (where existing cable is scheduled to be re-used in conjunction with new cable) is complete, the Contractor must re-test the circuits to ensure the circuit was returned in a manner that meets or exceeds the existing condition of the circuit.

3.11 TESTING PROCEDURES

A. After home-run cable installation operations have been completed, including splices and terminations, the individual conductors of all cables must have all test requirements listed in Section 3.10.

B. On all new airfield lighting circuits comprised of all new size 6 AWG-5 KV series circuit conductors, megger testing between fixtures will not be required provided that the 100 megohms requirement is met at the appropriate North or South Airfield Lighting Control Vault per 3.10.A.1, 2, 3.

With reference to new portions or extensions of size 6 AWG-5 KV cable that have been added to existing 5 KV cabling circuit, the megger testing must conform to Paragraph 3.11.G of this Specification and the 100 megohms requirement at the vault per Paragraph 3.10.A.1, 2, 3. Megger testing between fixtures will be required to check for improper grounds if the vault testing with adjusted values for testing based on Paragraph 3.11.G cannot be met.

C. Any cable which fails to meet any specified tests must be removed and replaced by the Contractor, without added expense to the Contract. Any splice or termination which fails must be repaired or replaced as determined by the Commissioner.

D. All new cables provided due to failures during the warranty or the above specified tests must be tested in the same manner and at the same times as the original new cables provided by this Contract.

E. The Contractor must maintain a readily available supply of replacement cables so that in the case of a cable failure no delays shall occur in the prompt replacement or repair of the faulty cable.

F. Tests must be performed in accordance with ICEA and AEIC recommended procedures. The Contractor must notify the Commissioner two weeks prior to each test that these tests can be witnessed by the Commissioner. Certified copies of all tests must be delivered to the Commissioner upon completion of all tests.

G. Whenever the new 5KV cables are spliced or otherwise connected to existing cables which are older, have a lower insulation level or have a different construction, the test voltage and time duration applied to this combination must not exceed the lower of the specified values for the different types of cable. It must be the Contractor's sole responsibility to check the conditions and to establish these test values before setting up the tests.

H. Tests must be coordinated with the field schedule and field conditions. Before testing, all necessary precautions must be taken to ensure the safety of personnel and equipment. All enclosures for conductors and equipment must be properly grounded.

3.12 IDENTIFICATION OF CONDUCTORS

A. Where conductors pass through handholes, manholes and at each side of an L-823 Connector they must be identified with phenolic engraved tags. Each conductor must be tagged at each end of each handhole, manhole, and light base. For the North Airfield (supplied from the North Airfield Lighting Control Vault) the tags must be yellow with black one-quarter inch high lettering and attached with nylon locking ties at each end of the tag. For the South Airfield (supplied from the South Airfield Lighting Control Vault) the tags must be white with black one-quarter inch high lettering and attached with nylon locking ties at each end of the tag. The cable must be thoroughly cleaned before applying the tags. At splices, conductors on each side of the splice shall be tagged. The circuit identification must be as shown on the Contract Drawings and in accordance with Airfield Circuit Identification System.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Cable and counterpoise/guard wire installed must be measured by the number of lineal feet measured in place, completed, ready for operation, and accepted as satisfactory.

B. Separate measurement must be made for each cable or counterpoise/guard wire installed. The footage of wire or cable will be

lineal measurement plus two percent for slack of wire or cable. Measurement will be from center to center of manholes, handholes and bases. Additional length for connection of isolation transformers, in handholes, etc. will be included in the appropriate items of this Contract. Connector kits, cable tagging, electrical testing, and removal of existing cable will not be paid for separately; but, will be included in the unit price for the pay item for wire and/or cable installed. Ground rods and exothermic welding for counterpoise wire and guard wire will not be measured and paid for separately, but are included in the unit price of the pay items in this Specification requiring their installation.

C. Separate measurement shall be made for replacing counterpoise wire in the areas where new saw-kerfing affects existing counterpoise wire.

D. No separate measurement shall be made for the connectors, pulling, terminating, providing splices relocating, and testing of all cables. The cost for this work shall be considered incidental to the installation of new cable on this project.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. Payment will be made at the Contract unit price for wire and cable installed by the Contractor and accepted by the Commissioner. This price includes full compensation for furnishing all materials and for all preparation and installation of these materials, and for all labor, equipment, tools, and all work necessary to complete this item.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
L-108-01	COUNTERPOISE WIRE - 1/C, SIZE 6 AWG, 600V, BARE COPPER, SOLID	LF
L-108-02	REMOVE EXISTING ELECTRICAL CABLE	LF
L-108-03	AIRFIELD LIGHTING CABLE, L-824, TYPE C, 5kV, SIZE 6 AWG, LIGHTING CIRCUIT	LF

END OF SECTION L-108

INSTALLATION OF AIRPORT UNDERGROUND ELECTRICAL DUCT
SECTION L-110

PART 1 - DESCRIPTION

1.01 GENERAL

A. The work consists of underground electrical conduit and ducts installed in accordance with this Specification at the locations and in accordance with the dimensions, designs, and details shown in the Drawings. The work includes the installation of all underground electrical ducts or underground conduits. It includes the connection of the ducts and conduit into the existing underground electrical system, including all trenching, jacking steel casing where shown on the Plans, backfilling, removal, restoration of any paved areas, connection to new or existing manholes and handholes, concrete encasement, installation of innerducts, mandreling and installation of nylon or polypropylene rope, capping and the testing of the installation as a completed duct system ready for installation of cables, to the satisfaction of the Commissioner. The work under this Section is subject to the requirements of the Contract Documents.

1.02 RELATED WORK

A. Section L-120 – Concrete for Electrical Applications

B. Section P-157 – Trench Backfilling

C. Section P-610 – Structural Portland Cement Concrete

PART 2 - EQUIPMENT AND MATERIALS

2.01 GENERAL

A. Equipment and materials covered by referenced Specifications must be subject to acceptance through manufacturer's certification of compliance with the applicable Specification when so requested by the Commissioner.

2.02 POLYVINYLCHLORIDE (PVC) CONDUIT

A. Non-metallic conduit must be PVC Schedule 40 or Schedule 80 concrete encased as indicated on the Drawings.

B. PVC conduit, including elbows and couplings, must meet the requirements of NEMA standards TC2 (latest edition), UL Standard 651, Federal Specifications WC-1094A, and must be UL rated and listed for use with 90 degrees C-rated conductors in compliance with Article 352 of the NEC.

C. The conduit must be manufactured from PVC compound that meets the applicable requirements of ASTM No. D 1784.

D. PVC conduit fittings must meet with the requirements of NEMA Standard TC3 (latest edition), UL Standard 514 supplement, and Federal Specifications WC-1094A.

E. Standard PVC fittings and PVC cement adhesive must be compatible with the conduits and must be obtained from the same conduit manufacturers.

F. Acceptable PVC conduit manufacturers are National Pipe, Carlon (Lamson and Sessions), Cantex, and IPEX.

2.03 PVC-COATED GALVANIZED RIGID STEEL (GRS) CONDUIT

A. A Polyvinyl Chloride (PVC) coating nominal thickness 0.04 inches (40 mil), will be bonded to the exterior of the conduit. The bond between the coating and the conduit must be greater than the tensile strength of the plastic.

B. Fittings must be coated in the same manner as the conduit. Fittings must have a PVC sealing sleeve extending from the ends. The sleeve length must be approximately equal to the outside diameter of the conduit or 1-1/2 inches, whichever is smaller.

C. The PVC coated galvanized rigid conduit must be U.L. listed /labeled. The Manufacturer must submit certified test results from a recognized independent testing company validating that their product meets or exceeds the requirements of ASTM D870-02 Testing Water Resistance of PVC Coating Using Water Immersion and ASTM D2247-02 Testing Water Resistance of PVC Coating in 100% Relative Humidity, to signify compliance to the adhesion performance standards.

D. A urethane chemical coating must be uniformly and consistently applied to the interior of the conduit and fittings. The internal coating must be applied at a minimum thickness of 2 mils.

E. Provide solvent cement and patching compound as recommended by the manufacturer for sealing joints and repairing gouges and cuts.

F. Provide PVC coating cement and patching compound as recommended by the PVC coated conduit and fitting manufacturer.

G. PVC coated conduit and fittings must be 1 inch trade size or larger.

H. Galvanized rigid steel conduit heavy wall must be milled steel, hot-dip galvanized conduit, complying with ANSI C80.1 and Federal Specification WWC-581 and must be U.L. listed.

I. Elbows, bends, and fittings must be made of full weight materials and must comply with the above and threaded the same as conduit.

J. Threads for conduit, couplings and fittings must be full depth and clean cut. Field cut threads must be coated with Coppercoat or in accordance with manufacturer's instruction.

2.04 CONCRETE

A. Concrete used to form duct banks with conduit must be as specified in Section P-610 Structural Portland Cement Concrete. Reinforcing bars where required will be as shown on the Drawings and in accordance with P-610.

B. Concrete used for backfilling saw kerfs in pavement shall be in accordance with Section L-120, unless otherwise noted.

PART 3 - CONSTRUCTION METHODS

3.01 GENERAL

A. The Contractor must install underground duct banks at the locations and grades as indicated in the Drawings. Conduits must be of the size, material, and type indicated in the Plans or Specifications. Where no size is indicated in the Drawings or Specifications, the conduits must not be less than 3 inches inside diameter. All duct banks must be laid to pitch toward structures for drainage as shown on the Drawings. Pockets or traps where moisture may accumulate are not acceptable unless pre-existing underground field conditions prohibit ductbank pitch to structure.

B. The Contractor must mandrel each conduit. After completion of construction, each conduit must first be thoroughly cleaned before being mandrelled. Cleaning can be accomplished by drawing a wire duct brush, a flexible mandrel or power water rodding/jetting through each conduit to make sure that no foreign materials are left in the conduits after construction. When cleaning is completed, each conduit must be mandrelled with a non-flexible, durable, wood or metal conduit mandrel

made specifically for this purpose. The diameter of the mandrel must not be more than ¼ inch smaller in diameter of the bore of the conduit and the length of the mandrel must be at least 1 inch longer than the diameter of the bore.

C. Conduit installed must be provided with a nylon or polypropylene rope for pulling the permanent wiring. Sufficient length must be left in handholes and secured to prevent it from slipping back into the conduit.

D. Conduit must be securely fastened in place during construction and progress of the work and must be plugged to prevent seepage or grout, water, or dirt. Conduits must be placed on supports/spacers designed and manufactured for this specific purpose. When not being worked, conduits must be capped using metal or plastic caps designed for this purpose. The use of materials such as rags, paper, plastic bags or tape is forbidden. Any duct bank having a defective joint must not be installed.

E. Conduit must be encased in concrete, with a 3 inch minimum concrete envelope poured around all conduit.

F. Where turf is well established and the sod can be removed, it must be carefully stripped and properly stored and replaced after backfilling in accordance with Section 3.06, as directed by the Commissioner.

G. Trenches for conduit and ducts may be excavated manually or with mechanical trenching equipment. Walls of trenches must be essentially vertical so that a minimum of base material or soil is disturbed.

H. Dozers, wheel loaders, or motor graders must not be used to excavate the trench. The Contractor must ascertain the type of soil or rock to be excavated before bidding. All excavation material will be unclassified. Work shall be performed in accordance with Section 3.07-Unclassified Excavation.

I. Conduit must be provided with slip couplings where it crosses through or under transverse construction joints in Portland cement concrete pavement.

J. Conduit must be provided with approved expansion and deflection couplings where it crosses through expansion joints.

K. Galvanized Rigid Steel Conduit must be provided with grounding bushings to insure continuity of ground for the underground electrical system. The grounding bushings must be threaded onto the conduit.

L. The Contractor must connect into the electrical duct bank system at the location indicated on the Plans by core drilling into structures, by connecting to existing conduit or ducts, or as directed by the Commissioner.

3.02 CONDUIT ENCASED IN CONCRETE

A. Unless otherwise shown in the Plans, concrete-encased conduit must be installed so that the top of the concrete envelope is not less than 30 inches below the finished subgrade where installed under runways, taxiways, aprons, or roads, and not less than 30 inches below finished grade where installed in unpaved areas. Ducts under paved areas must extend at least 5 feet beyond the edges of the pavement or 5 feet beyond any underdrains which may be installed alongside the paved area. Trenches for concrete encased conduit must be opened the complete length before concrete is laid, so that if any obstructions are encountered, proper provisions can be made to avoid them. Concrete for the duct must be placed to form a single unit, not incrementally. The concrete cover thickness must be a minimum of three inches on all sides. Where two or more conduits are encased in concrete, the Contractor must space them not less than 2 inches apart (measured from outside wall to outside wall) using spacers applicable to the type of conduit. End bells or end couplings must be installed flush with the end of the concrete encasement where required.

B. Electrical Ductbank (CED) Warning Tape

1. Unless the Electrical Ductbank is being jacked in place, or the Plans indicated otherwise, a 6 inch wide red plastic warning tape must be placed 12 inches below grade directly over the entire length of a proposed Electrical Ductbank.

2. The plastic warning must be colorfast and chemically inert. Clips for bonding tears and completing end-of-roll splices must be provided and installed per manufacturers' recommendations.

3.03 REPAIR

A. It is the Contractor's responsibility to locate existing utilities within the work area prior to excavation. Where existing active conduit, ductbank cross proposed installations, the Contractor' shall insure that these conduit, ductbank are adequately protected. Where crossings are unavoidable, no splices will be allowed in the existing cables, except as specified on the plans. Installation of new conduit, ductbank where such crossings must occur shall proceed as follows in paragraphs below.

B. Existing conduit, ductbank shall be located manually. Unearthed conduit, ductbank shall be inspected to assure absolutely no damage has occurred.

C. Trenching, etc., in conduit, ductbank areas shall then proceed with approval of the Commissioner, with care taken to minimize possible damage or disruption of exiting cable, conduit, ductbank including careful backfilling in area of cable, conduit, and ductbank.

D. In the event that any previously identified cable, conduit, and ductbank are damaged during the course of construction, the Contractor shall be responsible for the complete repair.

3.04 DUCTBANK END DELINEATION

A. In locations where ductbank ends; but, will be extended at a later date, the ductbank ends will be bulkheaded or stubbed and capped below grade. The ends of these ductbanks must be surveyed by the Contractor for their exact locations based on O'Hare Survey Control Monuments (easting and northing of each corner referred to the IL State Plane Coordinates NAD 1983 and the vertical elevation of the top of each corner referred to NAVD 1988). This survey information must be provided and indicted by the Contractor on the As-built Drawings for reference.

3.05 BACKFILLING

A. After concrete-encased conduits have been properly installed and the concrete has set, the trench must be backfilled in accordance with Specification P-157, Trench Backfilling.

B. Trenches must not be excessively wet and must not contain pools of water during backfilling operations.

C. Excess excavated material must be removed and disposed of in accordance with instructions issued by the Commissioner.

D. Material to be used in backfilling under and adjacent to the paved areas must conform to the requirements of Trench Backfill, but the cost of furnishing and placing such backfill must be included in the Contract unit price for the items listed under installation of underground electrical duct.

3.06 RESTORATION

A. Where sod has been removed, it must be replaced as soon as possible after the backfilling is completed. All areas disturbed by the trenching, storing of soil, cable laying, pay construction, and other work must be

restored to its original condition. The restoration must include any necessary topsoiling, fertilizing, liming, or seeding. All such work must be performed in accordance with turfing Specifications. The Contractor must be held responsible for maintaining all disturbed surfaces and replacements until final acceptance.

3.07 UNCLASSIFIED EXCAVATION

A. Provide all excavation for duct bank to the lines and grades for elevations, shown on the Drawings or as stated by the Commissioner. The excavation is to be of sufficient size to permit the placing of the full width and length of the duct bank shown. Suitable excavated material is to be stockpiled where directed by the Commissioner. All other material excavated must be hauled off Airport property. The elevations, as shown on the Drawings, are to be considered as approximate only, and the Commissioner may order, in writing, changes in dimensions or elevations necessary to secure a satisfactory installation.

B. Boulders, logs, or other objectionable materials encountered in excavation are to be removed. All rock or other hard foundation material is to be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the Commissioner. All seams or crevices are to be cleaned out and grouted. All loose and disintegrated rock and thin strata must be removed. When concrete is to rest on a surface other than rock, special care is to be taken not to disturb the bottom of the excavation, and excavation to final grade is not to be made until just before the concrete or reinforcing is to be placed.

C. Provide all bracing, sheathing or shoring necessary to implement and protect the excavation and the duct bank, as well as protect existing adjacent structures located above or below grade as required, as required for safety or conformance to governing codes. The cost of bracing, sheathing or shoring is incidental to the items of Work to which bracing, sheathing and shoring pertains.

D. Unless otherwise provided, bracing, sheathing, or shoring involved in the construction of this item is to be removed by the Contractor after the completion of the structure. Removal is to be performed in a manner which will not disturb or mar finish masonry. The cost of removal is to be included in the unit price bid for the structure. The Contractor is to notify the Commissioner that the excavation is complete and concrete or reinforcing steel is to be placed after the Commissioner has approved the depth of the excavation and the character of the foundation material.

PART 4 - METHOD OF MEASUREMENT

A. Underground duct bank will be measured by the linear feet of duct bank installed, measured in place, completed, and accepted. Measurement will be made from the outer edge to the outer edge of manholes, handholes or connecting structures. Separate measurement will be made for the various types and sizes. No separate measurement will be made for concrete, conduit, ductbank warning tape and conduit mechanical seals, excavation, backfilling, miscellaneous materials or connections to the existing underground ductbank system including removal of standard duct banks and appurtenances within limits of the ductbank trench and layout, and clearing of existing underground ductbank necessary for the installation of new cable.

B. Temporary conduit is not shown on Contract Drawings but will be installed as required by actual field conditions and phasing requirements to maintain operation of airfield circuits during construction as directed by the Commissioner.

1. Temporary conduit shall not be measured for payment but shall be considered incidental to the Project.

PART 5 - BASIS OF PAYMENT

A. Payment will be made at the Contract unit price for each type and size of duct bank completed by the Contractor and accepted by the Commissioner. This price includes full compensation for furnishing all materials; for all preparation, assembly, and installation of these materials; for all trenching and backfilling necessary; for all restoration of disturbed areas; for clearing existing underground ductbank for new cable installations, ductbank warning tape and conduit mechanical seals; restoration of pavement, and for all labor, equipment, tools, and all work necessary to complete this item as required by these Specifications and as detailed on the Contract Drawings.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
L-110-01	2" PVC COATED GALVANIZED RIGID STEEL CONDUIT,SAW KERFED IN FULL STRENGTH PAVEMENT	LF
L-110-02	2-WAY - 3" PVC CONCRETE ENCASED DUCTBANK	LF

L-110-03	6-WAY, 4” HDPE, DIRECTIONALLY BORED DUCTBANK	LF
L-110-04	6-WAY, 4” PVC CONCRETE ENCASED DUCTBANK	LF
L-110-05	REMOVE EXISTING ELECTRICAL DUCTBANK	LF
L-110-06	1-WAY - 2" PVC CONCRETE ENCASED DUCTBANK	LF

END OF SECTION L-110

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ELECTRICAL MANHOLES AND HANDHOLES
SECTION L-115

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item consists of the furnishing of all labor, equipment, and material, and of performing all operations in connection with the adjustment of existing electrical manholes and handholes. The work under this section is subject to the requirements of the Contract documents.

PART 2 - EQUIPMENT AND MATERIALS

2.01 GENERAL

A. Airport equipment and materials covered by Federal Aviation Administration (FAA) specifications are to have the prior approval of the Office of Airport Safety and Standards, Attention: AAS-200, FAA, Washington, D.C. 20591, and are to be listed by FAA's Advisory Circular No. 150/5345-53 (latest edition), "Airport Lighting Equipment Certification Program."

B. All other Airport equipment and materials covered by other referenced specifications will be subject to acceptance through manufacturer's certification of compliance with the applicable specifications, when so requested by the Commissioner.

2.02 REINFORCING STEEL

A. Reinforcing steel is to comply with Section P-610 of these specifications.

B. All existing reinforcing steel exposed during the adjustment of electrical manholes is to be reincorporated into the adjusted structure. Care must be taken not to damage the existing reinforcing steel during concrete removal. The exposed reinforcing steel is to be cleaned of all concrete. Any reinforcing steel rusted, damaged or deemed not retainable by the Commissioner is to be replaced with bars of the same size and length meeting the requirements of ASTM A615 Grade 60.

2.03 CONCRETE

A. Cast-in-place concrete required for the construction of manholes and handholes, and for the adjustment of manholes and handholes is to

comply with all the requirements of Section P-610, Structural Portland Cement Concrete.

2.04 GROUND RODS

A. Ground rods are to be ¾ inch diameter type 304 stainless steel, 10-feet long minimum.

2.05 FRAMES AND COVER

A. New frames and covers are to be installed on all electrical manholes and handholes, except where the Drawings indicate otherwise.

B. The castings must conform to one of the following requirements:

1. Gray iron castings: ASTM A48, Class 30B and 35B

2. Malleable iron castings: ASTM A47

3. Steel castings: ASTM A27

4. Structural steel for grates and frames: ASTM A283, Grade D

5. Ductile iron castings are to meet the requirements of ASTM A536

6. Austempered ductile iron castings: ASTM A897

C. All castings or structural steel units are to conform to the dimensions and requirements shown on the Drawings and are to be designed to support the loading specified.

D. Each frame and cover unit is to be provided with stainless steel locking bolts to prevent it from being dislodged but which will allow easy removal for access to the structure.

E. Each cover must be provided with a latch device that is integral to the cover casting. The latch must be of a spring catch or quarter turn design that is operable with a tool supplied with the casting. Tool quantity to be supplied with the order as indicated on the drawings. The latching device must secure the cover in a closed position when the hold down stainless steel locking bolts (item 'D' above) are being removed or reinstalled. The cover must be secured by both bolts and latches.

F. The frames of all electrical and communications manholes and handholes are to be grounded as shown on the Drawings.

G. All frames and covers installed within the Aircraft Operation Area (AOA) will be aircraft rated for 100,000 lbs. Spring assist frame to be cast into roof or riser section of structure.

H. Airside Electrical Handhole/Manhole Frame and Cover Schedule

Structure Use	Cover Size and Type	Cover Legend	Notes
ComEd Manholes	Per ComEd Standards (Drawings and Specifications) For new ComEd manholes - Use 38" dia. frame for 32" dia. cover For retrofit installation - Use 42" x 46" frame for 36" dia. cover	Per ComEd Standards (Drawings and Specifications)	Must meet CDA/CCA Aircraft loading requirements within the AOA. Refer to Section CE-100 and CE-101
Common Electrical Duct (CED) Handholes Design Standard Detail Nos. 6-06-03R through 6-06-05R.	30" x 30" Opening spring assist, hinged w/bolt down, ductile iron lid		Must meet CDA/CCA Aircraft loading of 100,000 lbs within the AOA.
		Common Installations: 600V-7500V R/W AIRFIELD LIGHTING or 600V-7500V T/W AIRFIELD LIGHTING or COMMUNICATIONS	
		Less Common Installations: 0V-600V ELECTRIC or	Low voltage for FAA PAPI feed, hot boxes, pump, security or other similar function High voltage for FAA

Structure Use	Cover Size and Type	Cover Legend	Notes
		600V-7500V ELECTRIC	Secondary or City Electric
		<u>Use Only Upon Approval from CDA/CCA for Limited Cases:</u> 600V-7500V AIRFIELD LIGHTING	
Common Electrical (CED) Manholes Design Standard Detail Nos. 6-06-09R through 6-06-22	30" x 30" Opening spring assist, hinged w/bolt down, ductile iron lid		Must meet CDA/CCA Aircraft loading of 100,000 lbs within the AOA.
		<u>Common Installations:</u> 600V-7500V R/W AIRFIELD LIGHTING or 600V-7500V T/W AIRFIELD LIGHTING or COMMUNICATIONS	
		<u>Less Common Installations:</u> 0V-600V ELECTRIC or 600V-7500V ELECTRIC	Low voltage for FAA PAPI feed, hot boxes, pump, security or other similar function High voltage for FAA Secondary or City Electric
		<u>Use Only Upon Approval from CDA/CCA for Limited Cases:</u> 600V-7500V AIRFIELD LIGHTING	

Structure Use	Cover Size and Type	Cover Legend	Notes
FAA Handholes FAA Standard Details Example – GL-D-5693-10-6	Per FAA Standards (Drawings and specifications)	Per FAA Standards (Drawings and specifications) (See FAA-C-1391b) "FAA Communications" legend on lids are exclusive to FAA NAVAID, FAA Communications, and ALSF sites only. For locations outside FAA facilities/sites and all other locations, the legend on lids must be per CED requirements.	Handhole type, Cover Size and Legend to be Coordinated with the FAA
Type 1 Marker Light Bases	18" x 18" Opening w/bolt down, ductile iron lid	AIRFIELD LIGHTING	Must meet CDA/CCA Aircraft loading of 100,000 lbs within the AOA.

A. Acceptable manufactures include:

1. Neenah Foundry Company
2. East Jordan Iron Works, Inc.
3. Campbell Foundry

2.02 NON-METALLIC CABLE SUPPORT RACKS

A. Manhole and handhole cable racks must be heavy duty, molded, acceptable agency listed, standard yellow fiberglass reinforced nylon with adjustable arms. Length of rack arm must be 14 inches for CED manholes and 6 inches for handholes, respectively. Install cable racks as shown on the Drawings. Secure all cable to the rack arm with separate nylon tie wrap. Acceptable manufacturers of non-metallic cable support racks are Underground Devices, Inc., Northbrook, IL and StrutTech/Axium Composites, Inc., Redmond, WA. Acceptance is subject to manufacturer's certification of compliance with applicable specifications. ComEd furnishes and installs its own cable support racks.

2.03 PULLING IRONS

A. Provide all pulling-in irons, hooks and all other appurtenances as indicated on the Drawings and as required for a complete operational manhole or handhole. Pulling-irons to be manufactured with 7/8-inch diameter hot-dipped galvanized steel.

2.04 EPOXY CONCRETE ADHESIVE

A. The epoxy concrete adhesive must conform to the requirements of Section 1025.01 of IDOT's Standard Specifications for Road and Bridge Construction (latest edition), and meet the approval of the Commissioner.

PART 3 - CONSTRUCTION METHODS

3.01 UNCLASSIFIED EXCAVATION

A. Provide all excavation for structures to the lines and grades for elevations, shown on the Drawings or as directed by the Commissioner. The excavation is to be of sufficient size to permit the placing of the full width and length of the structure shown. Excavated material is to be stockpiled where directed by the Commissioner. The elevations, as shown on the Drawings, are to be considered as approximate only; and the Commissioner may order, in writing, changes in dimensions or elevations necessary to secure a satisfactory installation.

B. Boulders, logs, or other objectionable materials encountered in excavation are to be removed. All rock or other hard foundation material is to be cleaned of all loose material and cut to a firm surface either level, stepped or serrated, as directed by the Commissioner. All seams or crevices are to be cleaned out and grouted. Remove all loose and disintegrated rock and thin strata. When concrete is to rest on a surface other than rock, special care is to be taken not to disturb the bottom of the excavation, and excavation to final grade is not to be made until just before the concrete or reinforcing is to be placed.

C. Provide all bracing, sheathing or shoring necessary to implement and protect the excavation and the structure, as well as protect existing adjacent structures located above or below grade as required, as required for safety or conformance to governing laws. The cost of bracing, sheathing or shoring is to be included in the unit price for the structure.

D. Unless otherwise provided, bracing, sheathing, or shoring involved in the construction of this item is to be removed by the Contractor after the completion of the structure. Removal is to be effected in a manner which will not disturb or mar finish masonry. The cost of removal is to be included in the unit price bid for the structure. The Contractor is to notify the Commissioner to the effect; and concrete or reinforcing steel is to be placed after the Commissioner has approved the depth of the excavation and the character of the foundation material.

3.02 CONCRETE STRUCTURES

A. Concrete structures are to be built on prepared foundations, conforming to the dimensions and form indicated on the Drawings. Any reinforcement required, is to be placed as indicated on the Drawings and is to be approved by the Commissioner before the concrete is poured. Precast manholes and handholes are allowed as long as they meet all requirements of this specification. Precast units to be installed plumb and true. Joints to be made watertight by use of sealant at each key joint and at roof joint.

B. The interior bottom is to be sloped downward toward the floor drain or outlet. Provide French Drain Sump or piped drain connection to manholes and handholes as shown or indicated on the Drawings.

3.03 PLACEMENT AND TREATMENT OF CASTINGS, FRAMES AND FITTINGS

A. All castings, frames and fittings are to be placed in the positions indicated on the Drawings or as directed by the Commissioner, and must 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 are to be in place and position before the concrete or mortar is placed. The unit is not to be disturbed until the mortar or concrete has set.

B. After the frames or fittings have been set in final position and the concrete or mortar has been allowed to harden for seven (7) days, the grates or covers are to be placed and fastened down.

3.04 COMMONWEALTH EDISON (ComEd) MANHOLE INSTALLATION

A. Construction and installation of ComEd utility manholes must be in accordance with the ComEd Standards. Refer to CE-100 - *Commentary on ComEd Standards for Utility Manholes, Ductbanks, and Equipment Foundations at the CDA/CCA and* CE-101 – CDA/*CCA Advisory on Shop Drawings for Commonwealth Edison (ComEd) Manholes*.

3.05 BACKFILLING

A. After a structure has been completed, the area around it is to be backfilled in horizontal layers all around the structure not to exceed 8 inches in loose depth, and compacted. The top of the fill is to meet the elevation shown on the Drawings or as directed by the Commissioner.

B. All excavations must be backfilled within a reasonable time after the structures are installed, unless other required protection of the structure is directed. Backfill materials and compaction procedures must be

acceptable to the Commissioner. In all backfilling, any compressible or destructible rubbish and refuse must be removed from the excavated space before backfilling is started, except that sheeting and bracing must be left in place or removed as the work progresses as specified or directed.

C. The backfill material must be brought up evenly on each side of the structure to proposed grade. If under pavement, or within 2 feet of the proposed, future or existing pavement edge, fine aggregate backfill must be placed and compacted until the top of subgrade is reached. If the trench is not under, or adjacent to, existing, proposed or future pavement, then acceptable fill must be placed and compacted to proposed grade.

D. Structures excavated with sloped or bench walls must be backfilled for the full width of the excavation, as herein specified.

E. The backfill material for fine aggregate must consist of natural sand or washed crushed limestone having a FA-6 gradation conforming to Section 1003 of the Standard Specifications for Road and Bridge Construction, Illinois Department of Transportation, latest edition. Acceptable fill for backfill is defined as suitable unclassified excavation material that is non-organic, non-decayable, and non-rubble material having a maximum dry density of not less than 98 pounds per cubic foot. It will contain no rocks, stones, or broken concrete greater than 3 inches in the largest dimension. The material must be easily compactable to the required density and approved by the Commissioner.

F. Finish grading must be performed in accordance with the completed contour elevations and grades shown and must be made to blend into the existing or plan ground surfaces. All finished grading surfaces must be left smooth and free to drain. Finish grades must be brought to elevations within plus or minus 0.10 foot of elevations or contours shown.

G. Fine aggregate backfill must be placed in uniform layers not greater than 8 inches in loose thickness and thoroughly compacted in place with suitable vibratory equipment to not less than 95% of the maximum density determined by ASTM D 1557. Each lift of fill must be within +/-2% of optimum moisture content before the succeeding lift is placed. If the backfill is acceptable fill it must be placed in uniform layers not greater than 12 inches in loose thickness and each layer compacted to 85% of maximum density as determined by ASTM D 1557.

H. Backfill compaction must be tested and monitored by the Contractor. All material and backfill operations may be subjected to testing by the Commissioner with the assistance of the Contractor.

I. Backfilling is not to be placed against any structure until permission is given by the Commissioner. In the case of concrete, such permission will not be given until the concrete has been in place a minimum of seven (7) days, or until tests made by the Contractor's QC organization and tested by the Contractor's approved laboratory, subject to the verification by the laboratory under supervision of the Commissioner 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.

J. The suitability of compacting equipment must be acceptable to the Commissioner. Tamping rollers (generally referred to as Sheepsfoot Rollers) will be considered the proper type of equipment for compaction of cohesive soils and vibratory/mechanical tamping equipment will be applicable for compacting granular soils. In all cases, the adequacy of the equipment will be determined by the Commissioner.

K. Any depression which may develop from settlement in backfilled areas within 1 year after the work is fully completed and accepted must be the responsibility of the Contractor. The Contractor must provide as needed, at his own expense, additional backfill material, pavement, base replacement, permanent pavement repairs on replacement and must perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as acceptable to the Commissioner.

L. Any excavations adjacent to existing structures that have been disturbed or removed existing pavement during the construction or adjustments of structures, conduit or ductbank must be restored with bituminous concrete meeting the materials and methods requirements of Sections P-405 and P-401, to match the proposed pavement design. This restoration work must not be measured and paid for separately. This work is to be included in the unit price for the related work.

3.06 HEIGHT ADJUSTMENT OF ELECTRICAL MANHOLES AND HANDHOLES

A. Where indicated on the Drawings and as directed by the Commissioner, existing manholes and handholes are to be adjusted to meet new finish grade elevations in accordance with the typical sections as detailed on the Plans. New grade elevations for existing manhole and handholes must match the proposed pavement and/or finish grade elevation at the specified location.

B. When frames or fittings are to be placed upon previously constructed manholes, handholes, and structures, the bearing surfaces are to be brought true to line and grade. The unit is to be set in mortar beds and anchored to the existing manhole or handhole as indicated on the

Drawings and as directed and the Commissioner. All units are to be set firm and secure.

C. When frames and covers on existing ComEd manhole structures are required, the existing square covers and frames must be removed and the manhole entrance rebuilt to accommodate ComEd Retrofit 42”x46” frame and ComEd 36” diameter cover.

D. Areas around electrical manholes and handholes that have been disturbed or removed during construction must be restored using bituminous concrete meeting the materials and methods requirements of Sections P-405 and P-401, to match the proposed pavement design. Restoration work will not be measured and paid for separately. This work is to be included in the unit price for electrical manhole adjustment.

3.07 APPLICATION OF EPOXY CONCRETE BONDING ADHESIVE

A. Where shown on the detail the epoxy concrete bonding adhesive is to be uniformly applied to coat the entire surface of the concrete remaining in place.

3.08 CLEANING AND RESTORATION OF SITE

A. After the backfilling is completed, the Contractor is to dispose of all surplus material, soil, and rubbish off of air property. Surplus soil may be deposited in embankments, shoulders, or as ordered by the Commissioner. The Contractor is to restore all disturbed areas to their original condition.

3.09 GROUNDING

A. All non-current-carrying metallic parts of equipment and exposed metal in electrical handholes and manholes must be securely grounded to the grounding conductor. New conductors must be installed in a neat and workmanlike manner and must be securely held in place by means of straps spaced at proper intervals. Exothermic welds must be used to make connections to grounding systems. The grounding requirement is 5 ohms.

B. A ground rod must be installed in the floor of all concrete structures so that the top of the rod extends 6 inches (154 mm) above the floor. The ground rod must be installed within 1 foot of a corner of the concrete structure. Ground rods must be installed prior to casting the bottom slab. Where the soil condition does not permit driving the ground rod into the earth without damage to the ground rod, the Contractor must drill a 4-inch diameter hole into the earth to receive the ground rod. The hole around

the ground rod must be filled throughout its length, below slab, with Portland cement grout. Ground rods must be installed in precast bottom slab of structures by drilling a hole through the bottom slab and installing the ground rod. Bottom slab penetration must be sealed watertight with Portland cement grout around the ground rod.

C. For manholes and handholes, a grounding bus of 4/0 AWG bare stranded copper must be looped around the concrete structure walls and exothermically bonded to the ground rod. The ground bus must be a minimum of 1 foot above the floor of the structure and separate from other cables. Size 2 AWG bare copper pigtails must bond the grounding bus to all metal hardware within the concrete structure. Connections to the ground bus must be by exothermic welding.

D. Grounding for ComEd manholes must be in accordance with ComEd Standard C0724.

3.10 INTERFERENCE WITH OPERATION

A. The normal operating functions of the Airport will be continued while the work under the Contract is being accomplished. Operations and work in some areas will be permitted only at specific times and suitable weather conditions. The installation of equipment and the opening of vital circuits must be done only for minimum intervals at such times and with such restrictions as accepted and agreed upon by the Commissioner and may be required during non-regular working hours. The installation of temporary wiring may also be required to permit operations and work in certain areas.

3.11 EXISTING MANHOLE CLEANING AND DEGASSING

A. Pump out any water that may have accumulated in the existing manholes that are a part of the Underground Distribution system where work is to be performed. Remove all dirt and debris from the manholes and dispose of the refuse properly.

B. Pump liquid out of manhole where the work will occur.

1. Pump all clean water to a storm sewer or vegetated swale.

2. Pick up any oil on top of water by a vacuum truck and properly dispose of per regulations.

C. Examine the adjacent manholes and pump the liquid out of them to a level below the ducts running to the manhole to be worked in. The liquid

level in the adjacent manholes is to be held below the level of these ducts during the work period.

D. Wash the walls and floor of the manhole that is to be worked in with water. Do not direct water against the cables.

E. Pump the sediment laden wash water directly into a sediment trap, into a ditch or temporary ditch that leads to a sediment trap, or into sediment containing filter bag that leads to an existing storm sewer or vegetated swale. Discharge hose must have filter fabric or filtering device per EPA requirement.

F. Gas test the manhole.

1. The first step is to gas test for explosive hydrocarbon and hydrogen sulfide.

2. If the manhole tests satisfactory for these gases, then test the manhole for the presence of benzene.

3. The level of concentrations of gas must not exceed those allowed under the Williams-Steiger Occupational Safety and Health Act of 1970. A higher concentration of gas can be tolerated for a shorter duration (in accordance with the Safety and Health Act).

G. If it is found necessary to decrease the concentration of gas to an acceptable level, fresh air is to be blown into the manhole and exhaust blowers are to be used on adjacent manholes.

H. If the concentration of gas will permit exposure for a short duration, but is too high for an extended exposure, plug the ducts to adjoining manholes, using untapped, unoiled jute packing (Oakum) or conduit seals. If necessary, blowers are to be used during the plugging operations.

1. Continue to operate the blowers until the gas concentration is acceptable. This may require overnight operation.

2. Manholes may be further cleaned by using sawdust or mulch to absorb water and oil from manhole floors. This absorptive material is to be removed when the work in the manhole is finished.

I. Removing the covers from both the manhole to be worked in and the adjacent manholes is also helpful. These covers should be left off after the manholes are pumped out and until the degassing work is completed. Provide barricades for open manholes.

J. All manholes in the work area, affected by this Contract are to be kept clean during the term of this Project.

1. The presences of liquids, fumes, litter or debris will not be tolerated.

2. The manhole cleaning and degassing requirement with appropriate and approved modifications, is to be used to obtain clean and dry manholes during the construction period.

3. Inspection of manholes to maintain the above criteria will be done periodically as directed by the Commissioner.

PART 4 - METHOD OF MEASUREMENT

4.01

A. Manhole and handhole cleaning and degassing, concrete, reinforcement, engineering design, excavation, backfilling, restoration, and appurtenant items will not be measured separately, but will be considered included in the unit price for pay item requiring the work.

B. Manholes and handhole adjustments must be measured by the number of units adjusted, measured in place, completed and accepted. There shall be no distinction made between the different types of structures that require adjustment.

PART 5 - BASIS OF PAYMENT

5.01 MANHOLE AND HANDHOLE

A. Payment will be made at the Contract unit price for adjustment made of each manhole and handhole completed and accepted by the Commissioner. This price includes full compensation for furnishing all materials; for all preparation, assembly, and installation of these materials; for all dewatering, temporary earth retention system, excavation and backfilling, for all restoration of disturbed areas and for all labor, equipment, tools, and accessories necessary to complete this item as required by these Specifications and as detailed on the Contract Drawings.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
L-115-01	6’X8’ ELECTRICAL MANHOLE, AIRCRAFT RATED	EA
L-115-02	REMOVE EXISTING ELECTRICAL MANHOLE	EA

END OF SECTION L-115

CED/FAA COMMUNICATION MH/HH AS-BUILT CHECKLIST SECTION L-118

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The scope of this As-Built Checklist covers CED and FAA High Voltage (HV), Low Voltage (LV) and Communication (COM) Manholes/Handholes (MH/HH) and infrastructures.

1. The primary purpose of butterfly mapping the CED/FAA High Voltage, Low Voltage and Communication MHs/HHs is to inspect, identify and tag all existing active HV, LV & COM cables, identify and remove all abandoned cables to allow for relocation of all active circuits and constructing new taxiway pavement in future projects. Where specified elsewhere in the contract documents, the scope of work may include the clearing and cleaning of existing ducts including removal and pulling out of abandoned cables/wires, power washing and mandrelling of existing ducts, and rehabilitation of existing ducts to provide clear paths for new innerducts and fiber optic cables.

2. The secondary purpose of the MH/HH mapping and documentation is to determine, identify, and establish the remaining conduits/ducts available for future use and to verify their clear path from structure to structure as called for on the Drawings.

B. The Contractor must prepare a CED/FAA Structure Checklist for each CED/FAA of existing High Voltage, Low Voltage and Communication structure. The Contractor is the prime responsible group to coordinate, verify, document, and maintain the as-built checklists until transmitted to CDA/CCA and FAA. Work requiring the checklist includes, but is not limited to:

1. Installation of HV, LV and COM manholes or handholes (structures).
2. Construction of duct bank entrances to such structures.
3. Installation of communication inner-ducts in such structures.
4. Installation of copper, fiber optic communication cables and tracer wire (tracer wire installed per Section L-110 – Installation of Airport Underground Electrical Duct, Paragraph 3.02B) in such structures.
5. Items 2-4 above as related to existing communication structures

that are altered.

6. The CDA/CCA structure identification and label (per CDA/CCA naming convention) must be included and used on the form with the structure location (latitude/longitude in NAD 83 format).

C. The checklist will document and record construction items related to a contract's communication scope of work. If a contract is installing only empty infrastructure then the checklist will document only those items installed (frames and lids, pulling eyes, ground bus, ground rod, cover ground pig tail, duct entrances, duct size and configuration, etc.). Any future work, by other contracts, such as innerduct installation, innerduct reaming, copper or fiber optic cable installations, tracer wire installations, cable tagging, cable coiling would produce a separate or updated CED/FAA Communication Manhole/Handhole Checklist documenting those items within the contract's communication scope of work and noting any other existing installations.

D. The manhole/handhole checklist form includes a section where the Contractor will sketch the butterfly mapping of the structure with wall faces A, B, C, and D references to true duct bank entrance compass configuration. Depending on the project scope, the mapping will record number, size, configuration of cells per wall, the number, size, location of cable designations, and cable tagging. The form utilizes a small standard duct bank illustration for each wall and requires larger separate sketches to be prepared and attached, if necessary, to clearly document the duct bank configuration for each wall of the structure. The Contractor should indicate and label existing cables to the extent that he sees them and cable tags that exist; the Contractor is not responsible for labeling any existing cables that don't have cable tags or tracing cables to determine what they are or verifying the accuracy of existing cable tags (unless the Contractors' scope of work specifically includes this additional labeling verification or coordination with FAA or CDA agencies).

E. The Contractor must investigate spare ducts within a structure to allow the new cabling to route through the structure. Depending on the system being installed, the Contractor must designate if existing spare innerducts in that system exist, and, if so, are the spare innerducts usable to achieve the systems clear path required. Where no spare ducts or innerducts exist, the Contractor must identify any cables that are tagged as abandoned that may be cleared to provide a spare duct for establishing a clear path. When a clear path has been established by cleaning and mandrelling or by cable removal operations, that duct must be left with a pull cord with tag indicating the clear path duct established. Clear path ducts must be indicated on the manhole/handhole checklist. The tag must alert that the identified duct(s) are dedicated to a specific agency

and unauthorized use by others is prohibited.

1.02 SUBMITTALS

A. Duly accomplished CED/FAA High Voltage, Low Voltage and Communication MH/HH As-built Checklist (pages 1 and 2) – Refer to attachment.

B. High Resolution Color Pictures or photographs of the manholes/handholes, as required by the Commissioner.

1.03 RELATED WORK

A. As specified in the following Sections:

1. Section L-108 – Installation of Underground Cable for Airports
2. Section L-110 – Installation of Airport Underground Electrical Duct

PART 2 MATERIALS – NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. The CED/FAA High Voltage, Low Voltage and Communication Manhole/Handhole Checklist forms must be incorporated into the project's As-built Document submittal. The documentation must also include a tabulation sheet that numbers each cell per wall; listing work per cell installed will be compiled by the CDA/CCA as new contracts and new cabling populate the CED/FAA High Voltage, Low Voltage and communication duct/structure system. As a revision block is to a drawing for recording all changes, the checklist will record and document all cabling work and structure build out within a respective CED/FAA structure. The checklist will be used as a tool to manage cable installations and plan for future use and expansions. The Contractor will be responsible for labeling and signing off as accurate, as part of the checklist, any cables, tracer wires, or other work the Contractor installed or performed as part of the construction contract.

B. As-built checklists prepared by the Contractor and verified as performed by the CM must be provided to CDA/CCA/FAA upon substantial completion of individual component/phase of work when there is a transfer of building/infrastructure occupancy, and not after the completion of the entire project. Prior to pulling fiber optic cables through a loop by the FAA or other Contractor, the MH/HH as-built checklists for that entire loop must be submitted to CDA/CCA and FAA.

C. The Contractor is required to provide redlined .pdf files prior to the Building Occupancy Date (BOD). Computer Assisted Drawing (CAD) .dgn files of pertinent as-built FAA drawings will be prepared by the CDA/CCA's Engineer of Record or other provider of Construction Phase Services within 90 days of BOD for limited segments of work associated specifically with the BOD deliverable, based upon the .pdf files.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. ALLOWANCE FOR ELECTRICAL INVESTIGATION AND MAPPING: An allowance has been established to investigate, identify, and map the HV, LV & COM cables inside electrical manhole structures with the project area. This allowance establishes a mechanism to compensate the Contractor for identifying, tagging, providing manhole checklists, removing abandoned cable, photographing and documenting all the existing undefined cables and circuits that reside in the existing ductbank and CED manhole clusters as directed and approved by the Commissioner.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

A. The cost of the electrical investigation and mapping will be paid under the allowance for Pay Item L-118-01, ALLOWANCE FOR ELECTRICAL INVESTIGATION AND MAPPING. The Contractor must receive written notice from the Commissioner and Chief Procurement Officer to proceed with the work. The Work will be paid for as shown in Article X, "Changes in the Work," of the Part 3, General Conditions. Upon completion of the Project, any remaining balance in this Allowance will be returned to the City in the form of an appropriate credit.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
L-118-01	ALLOWANCE FOR ELECTRICAL INVESTIGATION AND MAPPING	AL

L-118 CED/FAA COMMUNICATION MH/HH AS-BUILT CHECKLIST (Page 1 of 2)
(To be submitted as Electrical As-built)

Project Name: _____ **Date:** _____

OMP Project No: _____

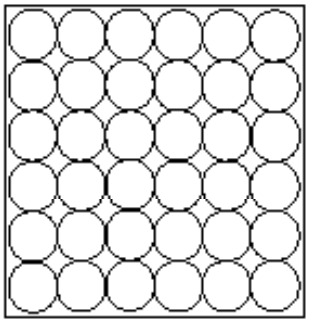
Contractor: _____

Electrical MH/HH No.: _____ **Location:** _____

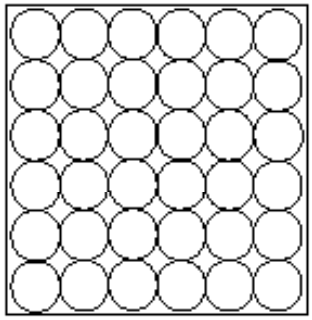
Electrical MH/HH Lid Label: _____ *(Lat./Long. In NAD 83 Format)*

***Draw innerduct location in conduit & indicate labeling. Use page 2 of 2 if necessary**

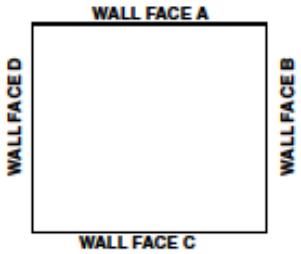
WALL FACE A



WALL FACE B

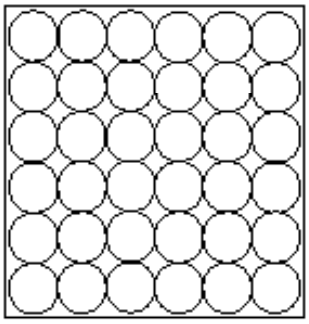


KEY PLAN OF MH/HH

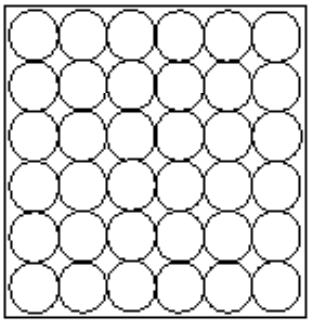


Note: Indicate in the Box, the Direction of the True North for Reference.

WALL FACE C



WALL FACE D



NOTES:

Y	N	N/A	MHs and HHs
☐	☐		Existing MH / HH
☐	☐	☐	Fiber Loop per FAA detail
☐	☐	☐	Security Fiber looped per FAA detail
☐	☐	☐	FAA FOTS Loop Tags present
☐	☐	☐	Tracer wire in place per plan
☐	☐		Uniduct for tracer wire identified in Grey
☐	☐	☐	Saddle Racks / Rack Arms installed
☐	☐	☐	Ground Rod installed
☐	☐	☐	Pulling Eyes Grounded
☐	☐	☐	Frame Grounded
☐	☐		Ground Bus installed
☐	☐	☐	Mech Seal installed in used innerduct
☐	☐	☐	Tuckpoint Conduits
☐	☐	☐	MH / HH Cleaned (New installation only)
☐	☐	☐	Pull strings installed (New MH & HH Only)
☐	☐	☐	Conduit Mandrelled
☐	☐	☐	Document cell used
☐	☐	☐	Innerduct installed / color (circle below) Yellow Grey Orange

Ductbank Legend
(to be filled in per Project)

Name of Contractor F.M.	Signature	Date
Name of OMP Inspector	Signature	Date
Name of FAA Inspector	Signature	Date

L-118 CED/FAA COMMUNICATION MH/HH AS-BUILT CHECKLIST (Page 2 of 2)
(To be submitted as Electrical As-built)

Project Name: _____ **Date:** _____

OMP Project No: _____

Contractor: _____

Electrical MH/HH No.: _____ **Location:** _____

Electrical MH/HH Lid Label: _____ (Lat./Long. In NAD 83 Format)

Wall Face A ❑ B ❑

C ❑ D ❑

(Identify Cells as A1, B1, ...K6, L6, ...)

	A	B	C	D	E	F	G	H	I	J	K	L
1	○	○	○	○	○	○	○	○	○	○	○	○
2	○	○	○	○	○	○	○	○	○	○	○	○
3	○	○	○	○	○	○	○	○	○	○	○	○
4	○	○	○	○	○	○	○	○	○	○	○	○
5	○	○	○	○	○	○	○	○	○	○	○	○
6	○	○	○	○	○	○	○	○	○	○	○	○

CELL No. _____

Contents Description: _____

CELL No. _____

Contents Description: _____

CELL No. _____

Contents Description: _____

CELL No. _____

Contents Description: _____

CELL No. _____

Contents Description: _____

CELL No. _____

Contents Description: _____

Name of Contractor F.M.	**Signature**	**Date**
Name of OMP Inspector	**Signature**	**Date**
Name of FAA Inspector	**Signature**	**Date**

END OF SECTION L-118

HIGH EARLY STRENGTH CONCRETE FOR ELECTRICAL APPLICATIONS
SECTION L-120

PART 1 - DESCRIPTION

1.01 GENERAL

A. This work to consist of furnishing and installing quick curing, high early strength concrete for placement around in-pavement lights and for backfill of saw kerfed trenches in existing pavement as shown on the Plans. The work under this Section is subject to full-time quality control surveillance. High early strength concrete must be used to backfill all saw kerfs and to backfill all in-pavement light bases that must re-open to air traffic by 6:00 a.m.

PART 2 - EQUIPMENT AND MATERIALS

2.01 AGGREGATES

A. Aggregates for high early strength concrete are to conform to the requirements of ASTM C 33. The maximum aggregate is to be 3/8 inch diameter nominal size. Aggregate volume is to be 40 percent of the total mix.

B. The coarse aggregate for concrete must meet the requirements of IDOT SSRBC Article 1004. The fine aggregate for concrete must meet the requirements of IDOT SSRBC Article 1003.

2.02 CEMENT

A. Cement is to be high early strength concrete repair material to produce high performance early and ultimate strengths without the field addition of cement accelerating admixtures.

B. The manufacturer of the cement is to provide technical assistance or direction on the design, mixing and handling of the concrete mixture.

C. Cement must conform to the requirements of ASTM C150 Type I or Type III. If for any reason, cement becomes partially set or contains lumps of caked cement, it must be rejected. Cement salvaged from discarded or used bags must not be used.

2.03 WATER

A. The water used in concrete must be free from sewage, oil, acid, strong alkalies, vegetable matter, and clay and loam, or other substances injurious to the finished product. If the water is of questionable quality, it must be tested in accordance with AASHTO T26. Water known to be of potable quality may be used without testing.

2.04 ADMIXTURES

A. The use of material added to the concrete mix must be acceptable to the Commissioner. Before acceptance of any material, the Contractor must submit the results of complete physical and chemical analyses made by an acceptable testing laboratory. Subsequent tests may be made of samples taken by the Commissioner 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 accepted.

B. Pozzolanic admixtures will not be permitted in this mix.

C. Air-entraining admixtures must meet the requirements of ASTM C260 and will be added to the mixer in the amount necessary to produce the specified air content. The air-entrainment agent and the water reducer must be compatible.

D. Water reducing, set-controlling admixtures must meet the requirements of ASTM C494, Type A, water-reducing or Type D, water-reducing and retarding. Water reducing admixtures will be added at the mixer separately from air-entrained admixtures in accordance with the manufacturer's printed instructions.

2.05 CURING MATERIALS

A. Curing material must conform to one of the following Specifications:

1. Polyethylene Sheeting for Curing Concrete – ASTM C171

2. Liquid Membrane – Forming Compounds for Curing Concrete – ASTM C309, Type 2

PART 3 - EXECUTION

3.01 SUBMITTALS

A. The mix design is to be submitted in accordance with the provisions of the General Conditions.

3.02 GENERAL

A. At least two weeks prior to any proposed usage of the high early strength cement concrete, the Contractor must provide to the Commissioner, mix designs and test data showing exact proportions of the materials to produce the specified compressive strength and actual compressive strengths obtained from the mix designs. The specified compressive strengths must not be less than 3,500 psi at 4 hours and 4,000 psi at 24 hours. Cylinders must be made in accordance with ASTM C31 and tested in accordance with ASTM C-39.

B. The mix design must be approved in writing by the Commissioner before any construction using the concrete is undertaken. The mix design must indicate the exact proportions of materials to be used.

C. The proportions of cement, fine and course aggregate are to be determined using methods outlined in ACI 211 (latest edition) or as determined by the Commissioner.

D. Water/cement ratio shall be 0.35 to 0.45. The slump is to produce a workable concrete under proper and timely vibration. The concrete must always exhibit a consistent plasticity and workability and not be prone to segregation.

E. Concrete must have an air content of 6 percent plus or minus 1.0 percent with the addition of air-entraining admixtures. Tests for air content (ASTM C 231) and temperature (ASTM C 1064) must be made by the Contractor on the first and the last load and for every 50 cubic yards of each day's placement of concrete.

F. The mix must be capable of maintaining adequate plasticity and workability to allow placement and finishing. Water reducing admixtures recommended by CTS Cement Manufacturing are acceptable for use to increase the plasticity of the concrete mix for CTS Rapid Set Cement. For other types of high early cement concrete, follow the manufacturer's recommendations for water reducing admixture.

3.03 EQUIPMENT

A. Equipment and tools necessary for handling materials and performing all parts of the work are to be approved by the Commissioner as to design, capacity, and mechanical condition. The equipment is to be at the job site before the start of construction operations for examination and approval.

B. The Contractor is to provide at a minimum one backup method of batching the concrete mix on an emergency basis, in case of failure of the primary method during a night's operation. The backup method is to be detailed in the Contractor's Work Plan.

C. Prior to start of using the high early concrete, the Contractor must calibrate the mixing equipment and conduct trial batches of the mix. The calibration of the mixing equipment and testing of trial batch cylinder specimens will be witnessed by the Commissioner's representative. The calibration must produce the specified compressive strength requirements.

3.04 MIX AND PLACEMENT PROCEDURES

A. Concrete must be mixed and placed according to the cement manufacturer's directions.

B. Portable lighting units sufficient for control and observation of the work are to be in position at the concrete placement site prior to mixing concrete each night. Comply with the requirements of Section N-100.

C. Concrete is to be mixed only in quantities which are required for immediate use and can be placed and finished prior to initial setting of the concrete.

D. The temperature of the concrete mix at the time of placement must not be less than 60 degrees F.

E. Unless authorized in writing by the Commissioner, mixing and concreting operations are to be discontinued when a descending air temperature falls below 40 degrees F and are not to be resumed until an ascending air temperature reaches 40 degrees F.

F. To compensate for cool temperatures and to enhance early concrete curing and strength gain, the Commissioner may require the water and/or aggregates to be heated to not less than 70 degrees F nor more than 150 degrees F.

3.05 SAW KERF TRENCHES AND IN-PAVEMENT LIGHT INSTALLATIONS

A. Concrete to be used in filling saw kerfed trenches with conduit is to be high early strength concrete. It is to have a 4 hour compressive strength of 3,500 psi. The Contractor is to ensure that the compressive strength requirement is met by 6:00 a.m. of the morning of placement or be subject to opening delay penalties. Testing must be done by the Contractor per Section P-610, Paragraph 610-3.03, except that two (2)

test specimens are to be tested at 4 hours or before 6:00 a.m.; two (2) test specimens at 1 day; and one (1) test specimen to be in reserve. The test specimens are to be delivered by the Contractor to the Commissioner's test laboratory no later than 5:00 a.m. prior to the runway opening. Cylinders will be tested in accordance with ASTM C39.

3.06 CURING

A. For CTS Rapid Set Cement concrete, continuous fog spray with water using approved spraying equipment after the concrete has initially set prior to runway opening (minimum one hour). The intent of this requirement is to keep the concrete cool, because Rapid Set Cement Concrete will reach high temperatures during hydration and needs water cure for proper hydration. For other high early strength cement concrete mixes, follow manufacturer's recommendation for curing and proper hydration. The Contractor must plan his / her work such that no concrete is placed after the time of day each day so that minimum strengths and cure times are met by 6:00a.m.

3.07 TESTING

A. High early strength concrete cylinders must be made by the Contractor in accordance with ASTM C 31 and tested by the Commissioner in accordance with ASTM C-39. Two (2) test specimens will be required for each age to be tested each night that placement is occurring. The Contractor will provide concrete and the preparation, initial curing, and transport of the specimen cylinders to the Commissioner designated laboratory at no additional cost to the Commissioner. A chain of custody form provided by the Commissioner must be used. The Commissioner will provide for the testing of the specimens.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. High Early Strength Concrete will not be measured separately for payment.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. High Early Strength Concrete will not be paid for separately, but will be included in the unit price for items including, but not limited to, concrete encased ducts in saw kerfs, lighting bases, and in-pavement lights.

END OF SECTION L-120

RUNWAY WEATHER INFORMATION SYSTEM
SECTION L-140

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section includes the modification of the existing Runway Weather Information System (RWIS) system for Runway 4R-22L and Taxiway Y. System will include replacing a weather pavement sensor positioned as shown on the Contract drawings. The system shall be specifically designed for monitoring and displaying pavement surface conditions, pavement temperature, freeze point temperature, chemical percent concentration, subsurface temperature, from the location(s) as shown in the contract plans. Passive in-pavement sensors shall be installed at the RWIS site(s) to monitor Road/Runway surface status conditions including dry, wet, frost, chemical wet, and snow/ice warning. The new pavement sensor shall be connected into the existing Runway Weather Information System (RWIS) system currently in use at the airport.

B. The new equipment shall be from the same manufacturer as the existing system currently installed and operational. The new equipment will be supplied by the Commissioner for the Contractor to install.

1.02 RELATED WORK

A. As specified in the following Sections:

1. Section L-108 – Installation of Underground Cable for Airports

PART 2 - EQUIPMENT AND MATERIALS

2.01 PASSIVE PAVEMENT SENSOR

A. The Contractor shall install passive pavement sensor(s) as shown on the Project Plans. The passive sensor supplied shall be a single solid-state electronic device that is installed in the Runway pavement at the locations as shown on the plans. Exact sensor placement shall be as determined by the Commissioner with guidance from the equipment supplier.

B. The sensor supplied by the Commissioner shall be constructed of materials that have thermal characteristics similar to common pavement materials. The top of the sensor shall approximate the Runway pavement color and texture. The sensor shall be gray in color for

concrete surfaces and black color for asphalt surfaces. It shall be installed with epoxy sealer so the top is flush with the surrounding Runway surface. The sensor shall be thermally passive, providing stable operation over a temperature range from -40°C to 80°C (-40°F to 176°F). Weather conditions, traffic, or ice control chemicals shall not degrade its performance. The sensor shall be supplied with 91 m (300 ft) of attached molded cable that is waterproofed and sealed as an integral part of the assembly. Each sensor shall be capable of operating at extended cable lengths up to 1524 m (5000 ft) from the RPU by splicing to direct burial sensor extension cable. The sensor shall electronically sample the following pavement parameters:

1. Surface temperature at the sensor head.

2. Dry pavement condition.

3. Wet pavement condition above 0°C (32°F).

4. Pavement status information.

C. In addition, the pavement sensors supplied by the Commissioner shall supply data for the RWIS to determine the following pavement surface conditions when sufficient water is present on the pavement, and atmospheric data from precipitation, RH, and air temperature sensors is available:

1. Water on the pavement at or below 0°C (32°F).

2. Snowy or icy pavement at or below 0°C (32°F).

3. Freezing point temperature of the water/ice-control-chemical solution present on the surface of the pavement sensor for selected ice-control-chemicals.

4. Depth of the water/ice-control-chemical solution present on the surface of the pavement sensor up to a depth of 12 mm (0.5 inches).

5. Percentage of ice particles present in the water/ice-control chemical solution resident on the surface of the pavement sensor.

2.02 CABLE & CONDUCTORS

A. Cable and conductors between the pavement sensor and the RPU must be constructed as described above and shown on the plans subject to compatibility with the existing RWIS.

B. Power conductors between the RPU and the disconnect switch mounted on the outside of the Glide Slope shelter must be sized as indicated on the plans, RHW/USE type, and constructed of soft annealed stranded copper.

C. Protection wire must be constructed in accordance with specification Section L-108, "Installation of Underground Cable for Airports" for CED ductbanks containing no FAA cable or conductors.

PART 3 - EXECUTION

3.01 GENERAL

A. The work being performed under this item of these Specifications must conform to the Chicago Electrical Code and the National Electrical Code. The electrical systems must be complete with all necessary accessories for the required results with the greatest assurance of protection to life and property.

B. The Plans may indicate the extent and general arrangement of the RPU and sensors. If any departures from the plans are deemed necessary by the Contractor, details of such departures and the reasons therefore must be submitted in writing as soon as practicable to the Commissioner for approval. No such departures must be made without the prior written approval from the Commissioner. The existing RPU may be located in CDA or FAA facilities. The Contractor must coordinate with the Commissioner and FAA for access to the appropriate facilities prior to beginning work on the existing sensor systems and facilities.

C. Connections to the existing system must be made in accordance with the details and notes shown in the plans and specifications.

3.02 RWIS EQUIPMENT INSTALLATION

A. The Contractor shall install the RWIS in accordance with the RWIS vendor's recommendations, Contract Documents and all federal, state and local codes and requirements.

B. The RWIS and cable must be painted blue in accordance with Section P-620, as directed by the Commissioner.

3.03 CABLE & CONDUCTORS

A. Cable, conductors, and protection wire must be installed in accordance with Section L-108, "Installation of Underground Cable for Airports" and as shown in the plans.

B. All conductors must be tagged in accordance with Section L-108 “Installation of Underground Cable for Airports”.

3.04 CLEANING AND RESTORATION OF THE SITE

A. After the backfill is completed, the Contractor must dispose of all surplus material, soil, and rubbish off of air property. Surplus soil may be deposited in embankments, shoulders, or as ordered by the Commissioner. The Contractor must restore all disturbed areas to their original condition.

B. After all work is completed, the Contractor must remove all tools and equipment, leaving the entire site free, clear, and in good condition.

3.05 TESTING

A. The Contractor must test the RPU as follows:

1. Test the new weather sensor and sensor cabling as required by the sensor manufacturer.

2. Calibrate the new unit with the existing RPU to ensure proper operation and communication with the existing system.

3. Verify the installation meets the manufacturers requirements.

4. All testing must be to the satisfaction of the Chicago DOA, as coordinated through the Commissioner.

B. Tests must be coordinated with the field schedule and field conditions. Before testing, all necessary precautions must be taken to ensure the safety of personnel and equipment. All enclosures for conductors and equipment must be properly grounded.

C. The Commissioner will conduct from time to time such tests as may be required to any part of the equipment to determine if it is installed in accordance with specifications. The Contractor must extend to the Commissioner all facilities to this end and must furnish skilled or unskilled help required. Three copies of the verified test results must be given to the Commissioner promptly upon completion of a test.

D. A log must be maintained for all tests. This log must be certified before completion of the job, both as to test value and date of test.

E. Any faults in the work performed by this Contractor or in materials or equipment furnished by the Contractor must be corrected or replaced promptly by the Contractor at his own expense. Any faults in materials

or equipment furnished by the Contractor which are the result of careless, incompetent or improper workmanship must be repaired and the work retested.

3.06 COMMISSIONING

A. The commissioning of the new installation shall be performed by a qualified technician from the equipment manufacturer on site after the installation is complete. The field engineer will calibrate the sensors, perform/inspect final connections to the equipment.

B. An allowance amount has been established for Runway Weather Information System Installation and Interconnection. This allowance shall include, but not be limited to, interconnection of equipment, inspection of equipment installation and cable spices, interface to existing system and system commissioning by a qualified manufacturers' representative as directed by the Commissioner.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Taxiway Weather Sensor must be measured for payment by the number of units installed, measured in place, completed, and accepted, including removal of the existing sensor and cable, disconnection from existing system, sensor cable, sawkerfing, connection to existing cable, testing, painting, and all other appurtenances required for construction of the system

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. Remove and Replace existing Taxiway Weather Sensor with New Weather Sensor and Wiring, Complete, and its related work, which will include interconnection of equipment, inspection of equipment installation and cable spices, interface to existing system and system commissioning by a qualified manufacturers' representative as directed by the Commissioner, will be paid from the Contract allowance in accordance with this Section, and must be authorized by the Commissioner prior to beginning the Work. The Contractor must receive written notice from the Commissioner and Chief Procurement Officer to proceed with the Work. The Work will be paid for as shown in Article X, "Changes in the Work," of Part 2 - General Conditions. Upon completion

of the Project, any remaining balance in this Allowance will be returned to the City in the form of an appropriate credit.

5.02 PAYMENT

A. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
L-140-01	REMOVE AND REPLACE EXISTING TAXIWAY WEATHER SENSOR WITH NEW WEATHER SENSOR AND WIRING, COMPLETE	EA

END OF SECTION L-140

MOBILIZATION AND CLOSEOUT DOCUMENTATION SECTION M-101

PART 1 DESCRIPTION

1.01 GENERAL

A. The work must consist of preparatory work and operations necessary for permits, the movement of personnel, equipment, supplies, and incidentals to the Project site; for the establishment of offices, buildings, and other facilities necessary for work on the Project; for any and all required utilities, including coordination with ComEd and provisions for ComEd secondary service to Contractor Staging/Trailer Area; and for all other administrative work or operations which must be performed, or costs incurred when beginning work on the Project. This work also consists of demobilization of equipment, trailers, supplies, clean up, and close-out of the project.

B. The Contractor must submit all documents as described in Part Two, General Conditions of the Specifications prior to the first request for partial payment for Mobilization:

1. Construction Operations Plan	Part 2, Article IV.D.1
2. Sustainability Requirements: Contractor/Subcontractor Equipment Verification Report; Local/Regional Materials Estimate; Recycled Content Estimate; Sustainable Temporary Construction Materials Pre-Construction Estimate; Construction Waste Management Plan and C&D Recycling Worksheet	Part 2, Article IV.D.2
3. Anticipated Workforce Projection Form	Part 2, Article IV.D.3
4. Procedures, Methods, Structures and Equipment	Part 2, Article IV.D.4
5. Subcontractor Agreements	Part 2, Article V.C.1
6. Source of Materials	Part 2, Article VI.E.2.a

7.	Key Personnel	Part 2, Article VII.B.1 Baseline Schedule Part 2, Articles VIII.E.2.b and E.4.a
8.	Shop Drawings, Product Data and Samples, "Index and Schedule"	Part 2, Article XI.B.4

1.02 CLOSEOUT DOCUMENTATION INCLUDES:

A. The Work must consist of preparing and obtaining approval of the closeout documentation per Part 2, Article IX.G. Contractor must submit all documents as described in Part Two, General Conditions of the Specifications and receive acceptance from the Commissioner prior to the request for payment for Closeout Documentation and includes the items below:

1. All permits – Part 2, Article III.E
2. Final Punch List Completed – Part 2, Article VIII.D
3. Record Shop Drawings – Part 2, Article XII.C
4. As-Built Contract Drawings – Part 2, Article XII.A
5. O&M Manuals – Part 2, Article XII.B
6. Contract Warranty – Part 2, Article VI.F.1
7. Manufacturers' Warranty – Part 2, Article VI.F.2
8. Contractor Demobilization Completed – Part 2, Article IX.G.3.a
9. Final Waivers – Part 2, Article IX,G.2.d
10. Final Sworn Statement and Affidavit – Part 2, Article IX.G.2.b

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Measurement will be made for Mobilization as a lump sum.

B. No separate measurement will be made for coordination with ComEd and establishing ComEd secondary service to the Contractor Staging/Trailer Areas.

C. Measurement will be made for Closeout Documentation as a lump sum.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

A. The Contractor is to include a cost for Mobilization not to exceed six percent (6.0%) of the total base bid.

B. Partial payment of the lump sum for Mobilization will be made in accordance with the following schedule:

1. The Contractor may draw 75% of the pay item as part of the first request for partial payment.
2. When 10% or more of the original Contract amount is earned, an additional 15% of the pay item will be paid.
3. When 90% or more of the revised Contract amount is earned, and the Contractor has demobilized, the remaining balance of the pay item will be paid.

C. Nothing herein must be construed to limit or preclude partial payments for other items as provided for by the Contract.

D. No separate payment for any and all required utilities will be made, including for coordination with ComEd and establishing ComEd secondary service to the Contractor Staging/Trailer Areas. All costs for coordination with ComEd and required utility companies and associated ComEd and utility costs will be included in the Mobilization pay item.

E. All costs associated with preparing the storage and staging areas, including but not limited to clearing and grading of the site, access roads, security fencing, erosion and sediment control, demobilization, cleanup, and restoration of the site to its original condition will be included in the Mobilization pay item.

F. The staging area as shown on the drawings will be used by multiple contractors.

G. Payment will be made under the item Closeout Documentation per lump sum after all documentation has been accepted by the Commissioner.

H. Payment will be made under the following item:

ITEM NO.	DESCRIPTION	UOM
M-101-01	MOBILIZATION (TOTAL PRICE FOR MOBILIZATION MUST NOT EXCEED 6% OF THE TOTAL BASE BID)	LS
M-101-02	CLOSEOUT DOCUMENTATION	LS

END OF SECTION M-101

AIRPORT SAFETY AND SECURITY
SECTION M-103

PART 1 - DESCRIPTION

1.01 GENERAL

A. The work for this project will occur within, adjacent to, or in the vicinity of the Aircraft Operations Area (AOA) and is subject to the operational safety and security requirements of the Chicago Department of Aviation (CDA) and the FAA. The Contractor must comply with any additional requirements as may be deemed necessary by the aforementioned organizations at no cost to the Owner.

B. During the performance of Airport Safety and Security work the Contractor must adhere to the applicable provisions set forth in Part Two General Conditions, Article XIV – Safety and Environment and Article XV – Airport Security and Operations, Airport Safety and Security, Code of Federal Regulation (14 CFR) Part 139 and Part 77, O'Hare International Airport Certification Manual (ACM), all applicable FAA Advisory Circulars and as described herein.

C. Contractor must carry out his operations in a manner that must minimize interference with air traffic, and must cooperate with the FAA, the Commissioner, the Airlines, and other Contractors working in the area. The Contractor must designate a full-time safety representative for the Project in accordance with Paragraph XIV. B of Part 2 - General Conditions. All work must be completed in accordance with the Chicago Department of Aviation's Airport Construction Safety Manual, the Construction Phasing Plans, 14CFR Part 139, 14CFR Part 77, all applicable FAA Advisory Circulars (AC's), the O'Hare International Airport Certification Manual, and the Contract Documents.

D. All personnel that will be badged and allowed to perform work or duties within the AOA must complete the mandatory "303 Training" every year. Refer to the CDA Standard Notes on General Requirements for the requirements and details of the "303 Training".

E. Refer to the CDA Standard Notes on General Requirements for requirements and details on Traffic Control, Safety Requirement, and ID Badging Process; Staging and Storage Areas; and 14CFR Part 139 Requirements.

F. All vehicles and vehicle operations must comply with the Chicago Airport System, O'Hare and Midway International Airports, Ground Motor Vehicle Operation Regulation Manual, latest edition.

1. All vehicles must be equipped with flashing yellow lights and must have their headlights and flashing yellow lights turned on at all times while on the airfield or Aircraft Operations Area (AOA).

G. The Contractor must supply, place, maintain, move and store the items listed herein, as appropriate, to facilitate construction and protect air traffic. An adequate extra supply of these items must be available on site at all times.

PART 2 - EQUIPMENT AND MATERIALS

2.01 WARNING LIGHTS

A. Warning lights must be flashing red lights meeting the requirements of the latest edition of the "Manual on Uniform Traffic Control Devices" for Type A and Type B flashers.

2.02 WARNING MARKERS

A. Warning markers must be the type and size detailed on the Plans. Markers must be equipped with a red warning light per Paragraph 2.01.

2.03 BARRICADES

A. Barricades must be Class A or Low Slung Barricades, as detailed on the Plans and conforming to FAA Airport Circular 150/5370-2F or current version. All efforts are to be made to utilize O'Hare specific "A" frame barricades as detailed in the CDA Standards. However, if they are not available in emergency situations, Highway "A" conforming to IDOT Type II may be used with modifications noted herein. The stabilization tube must consist of alternating orange and white fluorescent stripes and must be filled with sand to prevent damage or dislodging resulting from jet blast. Low slung barricades must be plastic, interlocking and filled with sand to prevent damage, dislodging, or skidding resulting from jet blast. Each barricade must be equipped with two (2) red omnidirectional lights as detailed on the Plans. An adequate supply of such barricades must be kept on the Project site. The barricades must be placed in locations as directed by the Commissioner or shown in the plans.

B. The Contractor is responsible for placing, maintaining and repairing the barricades for the duration of the project, which includes, but is not limited to, installing new lights and/or bulbs as needed. Barricades not

in proper working order as determined by the Commissioner must be replaced immediately. The Contractor will be required to provide all transportation and storage for the barricades for the duration of the project. Barricades must be removed from construction site and turned over to the Commissioner in good working condition at the completion of the project or as directed by Commissioner. The cost of furnishing, placing, storing, maintaining, replacing, and transporting these items will be considered included in the contract.

2.04 TEMPORARY RUNWAY/TAXIWAY CLOSED DEVICES AND SYMBOL

A. The runway closed (RCM) device must be portable lighted "X". The Contractor must supply two (2) LED lighted closure "Xs" for use during the project. These items must be equipped with a protective cover to be used during storage. The Contractor must submit the proposed LED lighted closure "X" specifications and product data to the Commissioner for review and approval prior to procuring and/or purchasing these items. The Contractor will be responsible for all maintenance requirements for all lighted" Xs", including, but not limited to, oil changes, repairs, fueling, and bulb replacements for the duration of the project. The Contractor is also responsible for all transportation and storage of all lighted "Xs" during the project. At the end of the project, all lighted "Xs" must be turned over to the Commissioner in good working order and all lights must be functional.

2.05 TEMPORARY CRITICAL AREA FENCE

A. All safety areas (RSA and TSA), ROFA, TOFA, CSD, and NAVAID critical areas affected by construction work must be designated and marked with a clearly visible fence as delineated on the Contract Plans. The fence must be made of wood posts or stakes and a durable orange fabric stapled to the posts.

B. Wood supports must meet the following requirements:

1. Posts/stakes must be kiln dried oak or hickory.

2. Posts/stakes must be peeled, sound, straight-grained, and free from decay, cracks, and splits.

3. Posts/stakes must be 48 inches long and have a cross section of 2 inches by 2 inches. Any safety fence used within a runway or taxiway Object Free Area cannot be higher than 18 inches. Safety fence to delineate the outer limits of OFAs can be 36 inches in height.

4. Outer bark must be completely removed from all posts/stakes including depressions.

C. Support and bracing of wood posts/stakes, where needed must be of the same material and quality as the wood supports

D. Fabric must be sized appropriately, i.e., 12 inch wide (for the 18 inches high fence) or 30 inch wide (for the 36 inches high fence) and orange in color. Fabric must be woven polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride and meet the following requirements:

1. Minimum grab tensile strength in the machine direction per ASTM D4632 = 120 lb (550 N)

2. Minimum grab tensile strength in the cross machine direction per ASTM D4632 = 100 lb (450 N)

3. Minimum ultraviolet stability, percent of strength retained after 500 hours exposure per ASTM D4355 = 70%

E. Fabric Must be stapled to the wood supports using No.9 galvanized steel wire staples that are at least 1 inch long but no longer than 1-1/2 inches. Staples must be ¾ inch wide.

F. Safety fence used to delineate runway or taxiway critical areas must maintain a 6 inch gap between the grass line and the bottom of the fabric, to allow for efficient maintenance of vegetation cutting.

2.06 TEMPORARY UNDERGROUND UTILITY MARKING

A. Prior to start of earthwork, all underground utilities (to include but not limited to FAA ducts and cables, electrical and ComEd ductbanks and cables, telephone and communication lines, gas mains, watermains and sewer pipes, fuel lines, etc.) on the work area must be delineated with 2 inch diameter and 5 feet minimum length Schedule 40 PVC pipe posts with APWA colored labels identifying the specific utility type or as directed by the Commissioner.

B. Install the temporary underground utility marking in accordance with Paragraph 3.19.

PART 3 - CONSTRUCTION METHODS

3.01 CONTROL REQUIREMENTS

A. The Contractor will be held responsible for controlling his employees and his Subcontractors and their employees, with regard to traffic movement.

B. The Contractor must rebuild, repair, restore, and make good at his own expense all injuries or damages to any portion of the work occasioned by his use of these facilities before completion and acceptance of the work.

C. The Contractor must submit to the Commissioner in writing a detailed construction operation plan as outlined in IV.E.1, General Conditions. The plan must include, but not be limited to, construction sequencing of earthwork, paving, drainage, airfield lighting, signing and electrical systems, equipment haul roads, light plants and maintenance of airfield electrical and NAVAID power and control circuits. The plan must also include a breakdown of the work in each construction phase, as described in the Construction Phasing Plans. At least 14 calendar days before commencing work in each phase, an updated plan must be submitted for approval. No work within the construction phase may commence until the phase work plan is approved.

D. The Contractor must submit to the Commissioner in writing an Airport Traffic Management Plan, as outlined in IV.E.1, General Conditions. The plan must address the control of construction equipment and vehicular movements for each construction phase.

E. The Contractor must provide a responsible Traffic Manager whose duty will be to direct all traffic on or near active runways, taxiways, haul roads, and highways. Paved surfaces must be kept clear at all times and specifically must be kept free from all debris which might damage aircraft.

F. The Contractor must prepare a security badge control plan for review by the Commissioner. The plan must be submitted prior to or at the Pre-Construction Meeting. No work may commence until this plan is approved. The plan must be prepared on the Contractor's company letterhead and signed by the company representative who is authorized to sign the badge applications. The plan must describe, in detail, the Contractor's and/or Subcontractor's plan to control badges.

G. The Contractor must submit to the Commissioner in writing a detailed safety plan that outlines the procedures and methods intended to be

used to maintain the safety of the airfield, the traveling public and the Contractor's employees. The plan must be broken down by each construction phase and must be submitted at least 14 days prior to beginning construction. No work may commence until the Contractor's safety plan is approved in writing and can be immediately implemented. The plan should address the following items, as applicable:

1. Scope of work to be performed, including proposed duration of work.

2. Procedures and methods of protecting and maintaining all runway and taxiway lighting fixtures and conditions of all pavement markings.

3. Procedures for protecting all runway and taxiway operational areas as shown on the Construction Phasing Plans. This includes limitations on equipment height and stockpiled materials.

4. Areas and operations affected by the construction activity, including possible safety problems.

5. NAVAIDs that could be affected, especially critical area boundaries, and temporary marking of underground FAA utilities.

6. Methods of separating vehicle and pedestrian construction traffic from the Airport movement areas. This may include barricades, barriers, or fencing off construction areas to keep equipment operators in restricted areas in which they are authorized to operate. Fencing, or some other form of restrictive barrier, is an operational necessity in some cases.

7. Procedures and equipment, such as barricades, to delineate closed construction areas from the Airport operational areas, as necessary.

8. Limitations on construction.

9. Required compliance of Contractors or personnel with all Airport safety and security measures.

10. Location of stockpiled construction materials, construction site parking, and access and haul roads.

11. Radio communications.

12. Vehicle information.

13. Trenches and excavations and cover requirements.

14. Procedures for notifying ARFF personnel if water lines or fire hydrants must be deactivated or if emergency access routes must be rerouted or blocked.

15. Emergency notification procedures for medical and police response.

16. Use of temporary visual aids.

17. Wildlife management.

18. Foreign object debris (FOD) control provisions.

19. Hazardous materials (HAZMAT) management.

20. Notice to Airmen (NOTAM) issuance.

21. Inspection requirements.

22. Procedures for locating and protecting existing underground utilities, cables, wires, pipelines and other underground facilities in excavation areas.

23. Procedures for contacting responsible representatives / points of contact for all involved parties. This should include off-duty contact information so an immediate response may be coordinated to correct any construction-related activity that could adversely affect the operational safety of the Airport. Particular care should be taken to ensure that appropriate Airways Facilities personnel are identified in the event that an unanticipated utility outage or cable cut occurs that impacts FAA NAVAIDs.

24. Vehicle operator training.

25. Penalty provisions for noncompliance with Airport rules and regulations and the safety plan (e.g., if a vehicle is involved in a surface incident).

26. Any special conditions that affect the operation of the Airport and will require a portion of the safety plan to be activated (e.g., low-visibility operations, snow removal).

H. The Contractor must provide a responsible full time safety representative whose duty it is to monitor Contractor activities for compliance with all federal, state and local laws. This person must be

on-site at all times when any construction activity or setup is taking place.

I. Under the requirements of Advisory Circular 150-5370-2F, a Construction Safety Phasing Plan (CSPP) has been developed for this Project and submitted to the FAA and CDA for review and approval.

It is the responsibility of the contractor to carefully review the CSPP and submit a Safety Plan Compliance Document (SPCD) to the City of Chicago via the Resident Engineer for review and approval. The SPCD must be submitted and approved prior to any construction activities associated with the project beginning on the AOA.

The contractor shall identify any deviations, revisions or modifications to the CSPP. Any changes must clearly identify the following:

1. The reason why the deviation, revision or modification is required.

2. Provide detailed and sufficient narrative and/or graphical descriptions of the proposed changes so a complete review of the proposal can be made.

3. Detail interaction between new or revised construction activities and aircraft/airport operations.

4. Monetary values are not to be included in the description of proposed changes.

Any construction details that may not have been addressed at the time of the submission of the CSPP, must be addressed in the SPCD. The SPCD does not restate provisions already stated in the CSPP. If there are no deviations, revisions or modifications to be made to the CSPP, the contractor must clearly state: "**No deviations, revisions or modifications to the CSPP are proposed".**

Pursuant to AC 150-5370-2F section 104.c.1:

"Submit a Safety Plan Compliance Document (SPCD) to the airport operator describing how it will comply with the requirements of the CSPP and supplying any details that could not be determined before contract award. The SPCD must include a certification statement by the contractor that indicates it understands the operational safety requirements of the CSPP and it asserts it will not deviate from the approved CSPP and SPCD unless written approval is granted by the airport operator. Any construction practice proposed by the contractor that does not conform to the CSPP and SPCD may impact the airport's

operational safety and will require a revision to the CSPP and SPCD and re-coordination with the airport operator and the FAA advance".

Pursuant to AC 150-5370-2F section 204.b:

"**The Safety Plan Compliance Document (SPCD)** should include a general statement by the construction contractor that he/she has read and will abide by the CSPP. In addition, the SPCD must include all supplemental information that could not be included in the CSPP prior to the contract award. The contractor statement should include the name of the contractor, the title of the project CSPP, the approval date of the CSPP, and a reference to any supplemental information (that is, "I, Name of Contractor, have read the Title of Project CSPP, approved on Date, and will abide by it as written and with the following additions as noted.") The supplemental information in the SPCD should be written to match the format of the CSPP indicating each subject by corresponding CSPP subject number and the title. If no supplemental information is necessary for any specific subject, the statement, "No supplemental information", should be written after the corresponding subject title. The SPCD should not duplicate information in the CSPP."

The SPCD must also identify the contractor's on-site employee(s) who will be responsible for compliance with the CSPP and SPCD during all construction activities. At least one employee must be on-site whenever construction activities are occurring.

3.02 VEHICLE AND PEDESTRIAN CONTROL

A. Vehicle and access routes for Airport construction will be controlled as necessary to prevent inadvertent or unauthorized entry of persons, vehicles or animals onto the Air Operations Area (AOA). No vehicle will enter the AOA except at predetermined locations. The amount of construction traffic will require the Contractor to use security guards at access gates and flagpersons to control traffic crossing active taxiways. Two (2) bonded security guards are required at each access location when the Contractor works airside. Crossing of runways is to be avoided if at all possible. Any runway crossings that may be necessary must be approved by the Commissioner. Any vehicle crossing a runway must receive clearance through the CDA from the ATCT specifically Ground Control on their frequency. The Contractor is not to contact the ATCT directly. Contractor personnel who operate vehicles in the AOA must comply with the Airport operator's rules and regulations for vehicle marking, lighting, and operation as described in Article XV – Airport Security and Operations of Part 2 – General Conditions. Failure to comply may result in fines.

B. The Contractor may request or be required to use an AOA access gate that does not have existing infrastructure for security personnel. At the discretion of the Commissioner, the Contractor will be directed to provide for a fully functioning guard booth station. Depending on the location and the duration of use, a new or existing CDA guard booth will be installed with the necessary concrete pad and utilities to make operational.

3.03 CONTROL AND WARNING DEVICES

A. The Contractor must furnish and maintain warning markers as detailed on the Plans at the locations designated by the Commissioner. The Contractor must maintain warning markers and red warning flags around all equipment, stockpiles, or other areas as directed by the Commissioner.

B. The Contractor must provide the phone numbers of three (3) of its personnel, including the Project superintendent, who may be contacted in an emergency. Personnel must be on call 24 hours per day for maintaining warning markers. The Contractor will employ watchmen to maintain and service all traffic control equipment.

3.04 VEHICLE MARKING AND IDENTIFICATION

A. Large construction vehicles used on a job site located in the AOA must display in full view above the vehicle a 3' x 3' or larger, orange and white checkerboard flag, each checkerboard color being 1' square. Construction vehicles include but are not limited to: bull dozers, earth moving vehicles, paving machines, excavating machines, grinders, backhoes, lifting cranes, etc. Any construction vehicle operating in the AOA must be equipped with a flashing amber (yellow) dome-type light, mounted on top of the vehicle and of such intensity to conform to local codes for maintenance and emergency vehicles. All vehicles operating within the airfield boundary must be identified with a sign on each side of the vehicle bearing the Contractor's name.

B. All other vehicles that do not fall into the category in 3.04.A, must be equipped with a rotating or flashing yellow light (strobe, LED, or incandescent) mounted on the top of the vehicle and the light must be visible and in operation anytime the vehicle is on the AOA.

C. Vehicles making only occasional visits to the job site are exempt from the identification requirements contained above provided that a properly identified vehicle escorts them into, through, and out of the AOA. These and other vehicles needing intermittent identification may be marked with tape or with magnetically attached markers that are commercially available.

3.05 VEHICLE TRAFFIC AND OPERATIONS

A. When any vehicle other than those approved for use in the AOA is required to travel to or from the work area or over any portion of the work area, it must be escorted by a vehicle properly identified to operate in the area and be provided with a flag on a staff attached to the vehicle. All construction vehicles/equipment must have automatic signaling devices to sound an alarm when moving in reverse. All equipment must be operated within the approved speed limit(s).

3.06 VEHICLE PARKING

A. All vehicles must be parked and serviced in the designated staging and employee parking areas. The Contractor is responsible for transporting his/her employees from these areas to the jobsite.

3.07 RADIO COMMUNICATIONS

A. The control of vehicular activity on the AOA is of the highest importance and requires coordination with the Airport users and the Air Traffic Control Tower (ATCT). The Contractor will have no direct contact with ATCT Ground Control. All communications with ATCT will be coordinated through CDA personnel. However, the Contractor must properly train his/her personnel, particularly flagpersons, on the proper procedures for monitoring radio frequencies.

B. All vehicles and/or construction equipment operating inside the active AOA, but outside of the designated haul roads, must be escorted by CDA personnel, who will maintain radio contact with the ATCT. Crossing an active runway will not be permitted. Vehicular traffic crossing an active taxiway will be controlled by the CDA via two-way radio with the ATCT and through the use of a CDA escort or a flagperson. Active runways and taxiways are those pavements being used for the operation of aircraft. The clearance will be through the CDA escort and confirmed by the driver's personal observation that no aircraft is approaching his/her position. Aircraft always have the right-of-way and construction equipment must always yield to aircraft.

C. The Contractor must have a flagperson stationed on each side of an active taxiway crossing to monitor aircraft movement and to direct construction traffic. The flagperson must be equipped with handheld signs or flags to assist in the direction of construction traffic. The flagperson must also be equipped with lighted wands and light plants on each side of the taxiway during nighttime construction. In addition, a sufficient number of sweepers shall be dedicated to maintaining the surface of all active taxiway crossings free from construction traffic

debris. Mud and other material tracked onto taxiway surfaces must be removed by hand if necessary to achieve its complete removal. The Contractor must arrange a physical inspection of the completed work area with CDA for inspections prior to opening for aircraft use any runway, taxiway, ramp area or Airport roadway that has been closed for work, or that has been used for a crossing point or haul route by the Contractor.

D. All flaggers are required to complete the O'Hare Flagger Certified Training Program. Flagpersons will not be permitted to operate on the airfield in that capacity until all training requirements are met.

3.08 AIRPORT SECURITY REQUIREMENTS

A. The Airport is operated in strict compliance with Federal Aviation Regulation (FAR) Part 107, 49 CFR Parts 1520 (Protection of Sensitive Security Information), 1540 (Civil Aviation Security), and 1542 (Airport Security), which prohibits unauthorized persons or vehicles in the AOA. Yearly "303 Training" is mandatory for all personnel that will be badged and allowed to perform work or duties within the AOA. Equipment and personnel will be restricted to the work area defined on the Plans. Any violations by Contractor's personnel will subject the Contractor to penalties imposed by the FAA and the CDA Airport Security Office.

B. Airport restricted areas are fenced and must remain fenced at all times. Any required temporary security fences and/or gates will be constructed by the Contractor. Temporary fencing must be constructed as shown on the Plans. The gates will remain closed and locked, or if it is being continuously used for ingress and egress, a gate operator will be provided at the Contractor's expense. The Contractor must furnish the gate operator with a roster of personnel and ensure that each individual has adequate identification. Interlocking locks supplied by the Contractor will not be allowed.

C. Gate guards, as required by Part Two of the Contract documents, provided by the Contractor will be provided direct and/or indirect methods of communications to contact the CDA. Direct access is defined as a guard having immediate access to a telephone. Indirect access is defined as the guard having a radio that communicates with an individual who has direct access. Gate guards are to be instructed on rules of performance relative to AOA Security. Entrance to the airfield is subject to strict security regulations. All personnel entering the airfield must obtain and display security identification badges and all vehicles must have and display special permits which are available through the CDA Security Badge Office. All vehicles are subject to inspection upon entering the AOA. All vehicles may be searched each time prior to

entering or exiting the security checkpoint and may be subject to random searches while operating in the AOA.

D. All vehicle deliveries must be coordinated in advance. The persons escorting the delivery will coordinate with the Commissioner. The vehicle license plate and expected delivery time must be provided. The Contractor may compile the expected daily delivery schedule on one (1) sheet for submission to the Commissioner. The vehicle operator must have in his or her possession a commercial manifest, which identifies the contents of the vehicle and/or trailer. An escort from the company for whom the shipment is intended must respond to the vehicle access gate and remain with the vehicle until the vehicle exits the secured area. Once the vehicle search is completed, vehicles will be permitted escorted access to their delivery point. Priority consideration may be offered to concrete trucks, with resulting delays estimated to be 20 minutes. To receive priority consideration, concrete deliveries must be scheduled with Airport security at the time of batching. These requirements may severely reduce throughput of vehicles entering the AOA at these check points, thereby potentially affecting the execution time of some construction activities. The Contractor must account for the possible loss of time associated with these vehicle searches in his/her bid. No additional time or compensation will be permitted for actions resulting from these vehicle searches.

E. The Contractor must maintain the security integrity between the public and the AOA. All barrier designs and their phasing must be submitted to and approved by the Commissioner, in writing, prior to erection.

F. All construction personnel assigned to the Project, except for escorted in-transit material suppliers, must make application for and wear security badges. The prime Contractor and the Subcontractor can make application for these items by contacting the City of Chicago CDA at (773) 894-3828 (Badging Office) to make arrangements. The Contractor must comply will all provisions of the latest version of the Chicago Airport System Security Credentials Manual Policy and Procedures Handbook. The Contractor will be responsible for assuring that all employees have background checks performed in accordance with CDA security badging procedures. Photo identification badges will be made for each employee. Replacement cost for lost badges is $50.00. Badges must be surrendered upon termination of the employee or Contract.

G. Company official/officials listed on the company application for AOA access must sign each individual employee badge application form and state why the individual badge is required.

H. The Contractor must maintain an up-to-date record of all badge holders showing name, address, sex, height, weight, eye color and badge number. The Contractor will be required to furnish this information to the Airport upon request.

I. The Contractor must restrict passage into the secured area to badged persons, vehicles and equipment displaying company identification or that of the Airport. Should the Contractor wish to allow visitors, vendors or delivery vehicles through access points, the following items must be provided:

1. A method, acceptable to the CDA, of temporarily placing company identification on each person or vehicle. (An acceptable alternate will be to provide an escort for each person or vehicle).

2. Each person or vehicle entering the secured area displaying the Contractor's identification or under escort will carry the full coverage of his liability and property damage.

J. The Contractor will be responsible to provide at his own cost an escort service for all vehicles that do not operate on a daily basis within the AOA. Escorted vehicles must not be left unattended. Any escorted vehicle allowed on the AOA by the Contractor must be escorted back and forth to the point of entry.

K. The Contractor is required to submit a plan on how he/she will safely operate within the AOA. This plan must be submitted and approved by the Commissioner before the commencement of any construction.

L. The Contractor will contact the Security Manager, telephone (773) 894-3828 ten (10) days prior to start of construction to submit the necessary Airport security information for all vehicles and personnel required inside the restricted area during construction.

3.09 VIOLATION OF RESPONSIBILITIES

A. Any violation of Paragraphs 3.01 through 3.08 must be considered a violation of the Contract itself and will be sufficient cause for halting the work without extending the time limit of the Contract.

3.10 COORDINATION OF CONSTRUCTION ACTIVITIES

A. The Contractor must contact the Commissioner each day before work begins to coordinate the status and nature of work to be done that day.

The Contractor must also report to the Commissioner at the end of each day to schedule the work planned for the following day.

B. Violations of any coordination requirements will be considered a violation of the Contract itself and will be sufficient cause for halting the work without extending the time limit of the Contract.

3.11 SAFETY REQUIREMENTS

A. Before entering upon or crossing any runway or taxiway, the Contractor will obtain permission from the Commissioner, who will request the proper clearance through the CDA escort from the ATCT. Emergencies and operating conditions may necessitate sudden changes, both in Airport operations and in the operations of the Contractor. Aircraft operations must always have priority over any and all of the Contractor's operations. Should runways or taxiways be required for the use of aircraft and should Airport operations, the ATCT, or the Commissioner deem the Contractor to be too close to active runways or taxiways the Contractor must suspend operations, remove personnel, plant, equipment, and materials to a safe distance and stand by until the runways and taxiways are no longer required for use by aircraft. There will be no compensation for delays or inefficiencies due to these changes.

B. Throughout the duration of the job, any practice or situations that the Commissioner determines to be unsafe or a hindrance to regular Airport operations will be immediately rectified.

C. Any violation of these safety requirements will be considered a violation of the Contract itself and will be sufficient cause for halting the work without extending the time limit of the Contract.

D. The Contractor must acquaint supervisors and employees with the operations that are inherent to Chicago O'Hare International Airport and must conduct construction activities to conform to all routine and emergency air traffic requirements and guidelines for safety specified herein. The Contractor will be responsible for providing all safety devices as required for the protection of personnel.

E. Protection of all persons must be provided throughout the progress of the work. The work must proceed in such a manner as to provide safe conditions for all workers and personnel. The sequence of operations must be such that maximum protection is afforded to ensure that personnel and workers in the work area are not subject to any dangerous conditions. The Contractor must provide safety measures to guard against injury.

F. During the performance of this Contract, the Airport facility must remain in use to the maximum extent possible. Use of areas near the Contractor's work will be controlled to minimize disturbance to the Airport's operation. The Contractor must not allow employees, Subcontractors, suppliers, or any other unauthorized person to enter or remain in any Airport area which would be hazardous to persons.

G. All work to be performed which is too close to an active runway, taxiway or apron under operational conditions must be performed when the runway, taxiway or apron is not in use. Such work must not be accomplished without prior permission from the Commissioner. Requested closings must be directed to the Commissioner in writing at least 72 hours in advance. The Commissioner will then notify the CDA of the upcoming closure.

H. The Contractor must be aware of the following types of safety problems and/or hazards. These problems or hazards will not be permitted. Should any of these problems or hazards arise during construction, the Contractor must immediately rectify/correct the problem or hazard to the satisfaction of the Commissioner and CDA Personnel:

1. Trenches, holes, or excavations on, adjacent to, or within 250 feet of the centerline of any active runway.

2. Trenches, holes or excavation in any apron, active taxiway, or within 107 feet of the centerline of any active taxiway used by ADG V, or within 131 feet of the centerline of any active taxiway used by ADG VI.

3. Mounds or piles of earth, construction materials, temporary structures, or other objects within 400 feet of the centerline of any active runway, or within 160 feet of any active taxiway used by ADG V, or 193 feet of any active taxiway used by ADG VI, or in a related safety, approach, or departure area.

4. Vehicles or equipment (whether operating or idle) on any active runway, taxiway, taxilane, or in any related safety, approach, or departure area.

5. Vehicles, equipment, excavations, stockpiles, or other materials which could degrade or otherwise interfere with electronic signals from radios or electronic navigational aids (NAVAIDS).

6. Runway paving projects resulting in excessive lips greater than 1 inch between abutting pavement edges and exceeding 3 inches between the edge of pavements and the infield.

7. Unmarked utility, NAVAID, weather service, runway lighting, or other power or signal cables that could be damaged during construction.

8. Objects (whether or not marked or flagged) or activities anywhere on or in the vicinity of the Airport which could be distracting, confusing, or alarming to pilots during aircraft operations.

9. Unflagged/unlighted low visibility items (such as tall cranes, drills, and the like) anywhere within the limits defined in Item 3, or in any approach or departure area.

10. Misleading or malfunctioning obstruction lights or unlighted/unmarked obstructions in an approach to any open runway.

11. Inadequate approach/departure surfaces needed to assure adequate landing/takeoff clearance over obstructions or work or storage areas.

12. Inadequate, confusing or misleading (to user pilots) marking/lighting of runways, taxiways, or taxilanes, including displaced or relocated thresholds.

13. Water, dirt, debris, or other transient accumulation which temporarily obscures pavement marking, pavement edges, or derogates visibility of runway/taxiway marking or lighting.

14. Inadequate or improper methods of marking, barricading, and lighting of temporarily closed portions of the AOA.

15. Trash or other materials with foreign object damage (FOD) potential, within the limits defined in Item 3.

16. Inadequate barricading or other marking which is placed to separate construction or maintenance areas from active aircraft operating areas.

17. Failure to control vehicle and human access to Airport Operations Area (AOA).

18. Failure to maintain radio communication between construction/maintenance vehicles and the ATCT, as coordinated with Chicago Department of Aviation Operations personnel.

19. Construction/maintenance activities or materials which could hamper the response of Aircraft Rescue and Firefighting (ARFF)

equipment from reaching all aircraft or any part of the runway/taxiway system, runway approach and departure areas, and aircraft parking locations.

20. Bird attractants on Airport, such as edibles (food scraps, etc.), miscellaneous trash, or ponded water.

21. Parking or staging of material or equipment on closed pavements. However, in the event of larger pieces of construction equipment that cannot be readily moved, these may be permitted to be parked on closed pavements provided prior approval is received from CCA and CDA Operations and the equipment are properly barricaded and lighted.

I. The Contractor must conduct activities so as not to violate any safety standards contained herein. The Contractor must inspect all construction and storage areas as often as necessary and promptly take all steps needed to prevent/remedy any unsafe or potentially unsafe conditions/activities discovered.

J. Before actual commencement of construction activity, the Contractor must notify in writing, at least seven (7) days in advance, the CDA and the Commissioner of his intentions to begin construction, stating the proposed time, date, and area in which commencement is to occur in order for the appropriate NOTAM to be issued.

K. Upon completion of work and return of all related areas to standard conditions, the Contractor must again notify the CDA and the Commissioner in writing, and describe the area that is complete and available for normal Airport operations.

L. Debris, waste and loose material or any other FOD (including dust and dirt) capable of causing damage to aircraft landing gear, propellers or being ingested in jet engines must not be allowed on active aircraft movement areas or adjacent infield areas. Materials observed to be within these areas must be removed immediately and/or continuously by the Contractor. The Contractor must be required to have an adequate number of sweeping machines and operators on site, ready at all times during construction activity. Where travel on or across runways, ramp areas, taxiways or aircraft aprons is required, the Contractor must provide adequate personnel and equipment to keep such surfaces clear of debris at the discretion of the Commissioner. Closed pavements must be swept clean prior to reopening to aircraft traffic. Exposed earth in excavation areas adjacent to active taxiways must be covered to prevent dust from jet blast. Cover material must be weighted to prevent movement from jet blast.

M. Flagpersons. In accordance with the Specifications, the Contractor must furnish, at his or her own expense, flagpersons as necessary to control traffic unless otherwise directed by the Commissioner. Flaggers are required to complete the O'Hare Flagger Certified Training Program. Flagpersons will not be permitted to operate on the airfield in that capacity until all training requirements are met.

N. Trenches, Excavations and Stockpiled Material. Open trenches or excavations exceeding 3" in depth and 3" in width will not be permitted within the limits defined in Paragraphs 3.11.H.1 and 3.11.H.2. Stockpiled material will not be permitted within the limits defined in Paragraph 3.11.H.3. Covering for open trenches or excavations must be of sufficient strength to support the weight of the heaviest aircraft operating on the runway or taxiway.

O. Construction in Proximity to Active Runways and Taxiways

1. Runway Sides. If appropriate construction/maintenance NOTAM has been issued, construction is permissible as close as 250 feet from the centerline of the active runway provided that all CDA and FAA criteria are met including FAA approval of the construction safety phasing plan. The 250 feet must be clearly marked in the infield areas with orange fabric as described in Paragraph 2.05. Safety fence to identify the RSA cannot exceed 18 inches in height.

2. Runway Ends. No work will be permitted and no equipment or materials may be stored within 1,000 feet of the end of the active runway.

3. Taxiway Sides. If appropriate construction/maintenance NOTAM has been issued, construction is permissible as close as the dimensions shown on the Construction Phasing Plans, provided that all CDA and FAA criteria are met including FAA approval of the construction safety phasing plan. This dimension(s) must be clearly marked in the infield areas with orange fabric as described in Paragraph 2.05. Safety fence to identify the TSA and CSD (if approved for the Project) cannot exceed 18 inches in height.

P. Equipment Height Restrictions

1. Maximum equipment height requirements are shown on the Construction Phasing Plans and must not be exceeded unless prior approval is obtained from the Commissioner. Atop all equipment booms must be mounted the white and orange checkered flag described in Paragraph 3.04. The top ten feet

(10') of these booms must be painted fluorescent orange and they must be equipped with a red obstruction light. Any crane erections must be coordinated with CDA Operations and the Commissioner during every shift.

Q. Miscellaneous

1. Open flame, welding or torch cutting operations are prohibited unless adequate fire and safety precautions have been taken and the procedure has been approved by the Commissioner. Under no circumstances will flare pots be used.

2. All materials and equipment when not in use must be placed in approved areas where they will not constitute a hazard to aircraft operations and not penetrate clearance height restrictions as shown on the Construction Phasing Plan(s). All equipment must be parked in the appropriate area(s) when not in use.

3. The Contractor must provide the Commissioner with a current list of all employees working on the Airport. The list must be maintained current by the Contractor and Subcontractors.

4. Except for emergencies, all contact with Airport personnel must be made through the Commissioner. For emergencies involving safety (injuries, fires, security breaches, etc.), the Contractor will make direct contact with the CDA followed by notification to the Commissioner as soon as possible.

3.12 HAZARD MARKINGS

A. Hazard-marking barricades, traffic cones, red flashers, etc. should be used to identify and define the limits of construction making them visible to aircraft, personnel, or vehicles; to identify hazards such as open manholes, small areas under repair, stockpiled material, waste areas, etc.; to prevent aircraft from taxiing onto a closed runway for takeoff; and to identify FAA, Airport, and National Weather Service facilities, cables, power lines, instrument landing system (ILS) critical areas, and other sensitive areas to prevent damage, interference, and facility shutdown. The Contractor must have a designated person on call 24 hours a day for emergency maintenance of Airport hazard lighting and barricades.

3.13 CONSTRUCTION AREA MARKING AND LIGHTING

A. All construction areas should be clearly and visibly separated from active air operation areas. Low profile temporary lights, retroreflective taxiway edge markers, low profile low mass barricades must be provided and

erected by the Contractor as shown on the Plans or as directed by the Commissioner (flags are not to be installed on barricades. Hazard areas, facilities, cables, and power lines should also be clearly identified by the Contractor. The Contractor is responsible for maintaining the condition and visibility of all markers identifying above-mentioned areas and that marking and lighting aids remain in place. Approved barricades, omnidirectional red flashers, and/or signs should be used as necessary to clearly separate all construction/maintenance areas from other parts of the AOA. All barricades, temporary markers, and other objects placed and left on or in the vicinity of the object free area of an open runway or taxiway cannot exceed 18 inches in height and must be of low mass; easily collapsible upon contact with an aircraft or any of its components; weighted down or sturdily attached to the surface to prevent displacement from propwash, jet blast, wing vortex, or other surface wind currents; and if affixed to the surface, frangible at ground level. Barricades, temporary markers, and other objects are not permitted to remain within the safety area of an open runway or taxiway.

3.14 CONSTRUCTION NEAR NAVIGATIONAL AIDS

A. Construction materials and equipment must not be placed or parked where they may interfere with the line-of-sight of the ATCT and navigational aids in operation. The Commissioner will determine if any materials or equipment will cause any type of interference.

3.15 CONSTRUCTION SITE ACCESS AND HAUL ROADS

A. The Contractor will not be permitted to use any access or haul roads other than those designated on the Contractor's approved construction phasing plan. The Contractor will submit specific proposed ingress and egress routes associated with specific construction activities to the Commissioner for evaluation and approval prior to commencing construction activities. Aircraft Rescue and Firefighting (ARFF) right-of-way on access roads, haul roads, taxiways, and runways will not be impeded at any time.

3.16 CONSTRUCTION MATERIALS STOCKPILING AND EQUIPMENT STORAGE

A. Stockpiling of construction materials and equipment storage is not permitted within 400 feet of the runway centerline, or 160 feet of the taxiway centerline for Aircraft Design Group (ADG) V aircraft, or 167 ft. for the B747-8 or A340-600 using an ADG V Taxiway, or 193 ft. for ADG VI aircraft. See Plans for the applicable distances for each taxiway/taxilane within the Project work area. {Note to Consultant/Designer: The Consultant/Designer must indicate and

delineate on the Plans the appropriate critical distances associated with his specific Project}

B. Stockpiled materials and equipment should be prominently marked with safety fence and red obstruction lights during hours of restricted visibility or darkness if in the air operations area. Stockpiled material or equipment should not be stored near aircraft turning areas or operational movement areas, aprons, or excavations and trenches. Stockpiled materials must not be stored near NAVAIDs, visual or approach aids, nor will they obstruct the ATCT's line of sight to any runway or taxiway. The Contractor must ensure that stockpiled construction materials and equipment do not cause degraded or hazardous conditions to Airport safety. This includes determining and verifying that stockpiled materials and equipment are stored or parked at an approved location, that they are properly stowed to prevent foreign object debris (FOD), attraction by wildlife, or obstruction of air operations either by their proximity to NAVAIDs or to aircraft movement areas.

3.17 FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT

A. Waste and loose materials capable of causing damage to aircraft landing gears or propellers, or capable of being ingested in jet engines must not be left or placed on or near active aircraft movement areas. Materials tracked onto these areas must be continuously removed during the construction Project. Waste or loose materials which would attract wildlife must be carefully controlled and removed on a continuous basis.

3.18 RUNWAYS AND TAXIWAYS

A. Contractor must inform Commissioner 48 hours prior to start of any work on runways or taxiways. No work may proceed, and nothing must be placed on runways, taxiways, taxilanes, or aprons without written authorization from the Commissioner.

3.19 INSTALLATION OF TEMPORARY CRITICAL AREA FENCE

A. Installation of the safety area fence must conform to the following:

1. The fence must be placed 1 ft. outside the critical area being delineated.

2. The fence must be installed on the existing grade along the edge the safety area (RSA and TSA) as determined by field survey. Fence delineating the RSA and TSA must not exceed 18 inches in height.

3. Safety fence installed within any runway or taxiway Object Free Area must not exceed 18 inches in height. Fence delineating the outer limits of the OFAs can be 36 inches in height.

4. Safety fence is NOT permitted within any runway or taxiway Safety Area unless prior approval by CDS Operations is obtained.

5. Posts/stakes must be set plumb, and in good line on the side on which the fabric is to be fastened. Posts/stakes must be set full depth and must not be cut off to eliminate rock or other excavation. Where rock is encountered, it must be removed. The posts/stakes adjacent to ends, corners, or anchors must be braced. Posts/stakes should be driven 18 inches into the ground and be spaced at 4 feet maximum.

6. The top edge of the fabric must be affixed to within 1 inch of the top of each post/stake leaving a nominal 6 inch clearance between the ground surface and the bottom edge of the fabric.

7. A minimum of four evenly spaced staples per post must be used to affix the fabric. Where joints are necessary, each end of the fabric must be securely fastened to a post and those posts be placed adjacent to each other or wrapped around each other similar to a silt fence.

3.20 INSTALLATION OF TEMPORARY UNDERGROUND UTILITY MARKING

A. For FAA underground utilities including ducts, cables, and structures, the Contractor must provide, install, and maintain 2" PVC posts with light blue colored labels identifying FAA along the center and over the utility, at 25 feet intervals for the entire work zone except inside the 250' Runway Safety Area (RSA) or 160' Taxiway Object Free Area (OFA), where marking paint on the ground only must be used to mark utilities. In areas where the FAA utility will be exposed, the Contractor must provide, install, and maintain two lines of similarly marked 2" PVC posts at 5 feet offsets each side of the FAA utility centerline at 25 feet intervals. Post markers must also be installed at all points where the FAA line changes direction.

B. For all other underground utilities (electrical and ComEd ductbanks and cables, telephone and communication lines, gas mains, watermains, sewer pipes, fuel lines, etc.), the Contractor must provide, install and maintain 2" PVC posts with APWA colored labels identifying the specific utility type along the center and over the utility, at 25 feet intervals for the entire work zone except inside the 250' RSA or 160' Taxiway OFA, where marking paint on the ground only must be used to mark utilities.

C. Labels for 2" PVC pipe must be self-adhesive vinyl labels, with high visibility APWA color coded per the detail provided by the Commissioner, a minimum 12 inches long by 7.5 to 7.75 inches wide, with 1.75 inches lettering with the words "GAS, POWER, FAA, PHONE, WATER, CED, FIBER, OR STORM/SAN" as required.

D. Provide labels from the following manufacturers (or equal):

1. Mainstreet Lettering – 5659 Box Elder Road, Marshall, WI 53559, 608-655-4757.

2. Uline – Custom Dept. 2105 South Lakeside Drive, Waukegan, IL 60085, 800-295-5510 Ext. 5099.

3. Impact Label Corporation – 3434 South Burbick Street, Kalamazoo, MI 49001, 800-820-0362.

E. The PVC posts must be a minimum of 5 feet in overall length. The exposed post height must be at least 4 feet and embedment to a depth necessary to keep the post vertical and stable. Maintenance of posts and/or replacement of any damaged posts will be at the Contractor's cost.

3.21 PROTECTION AND SUPPORTS FOR UNDERGROUND UTILITIES

A. The Contractor must provide adequate provisions to protect all underground utilities and structures exposed during the proposed work or being crossed by access roads, new sewer lines, new electrical ducts, new drainage lines and haul roads.

B. The Contractor must submit a plan and design indicating the size, type and configuration of the materials to be used in supporting the underground utilities and structures that will be exposed. Drawings showing how the utility lines/structures will be protected must be provided in advance by the Contractor for approval by the Utility Owner before installation. The Contractor must provide the identity of the registered Professional Engineer approving the design prior to the work. At least one copy of the stamped/approved design must be maintained at the jobsite while the support is being constructed. The Contractor is responsible for all associated costs to acquire approved design, materials and the construction of the utility supports.

C. The Contractor will be responsible for notifying the Utility Owner at the Project pre-construction meeting should utility relocation become necessary (for FAA cable relocation, notify the FAA Technical Operations).

D. All excavating within 5 feet on either side of existing underground utilities and infrastructures is to be performed by hand. The Contractor will be responsible for locating and hand digging to locate the utility lines and structures.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. With the exception of the Allowance for Security Guard Infrastructures for the bonded security guards assigned airside or the AOA as described in paragraph 3.02.A of this Section, all Airport safety and security as described herein will not be measured for separate payment. The cost of meeting these requirements of this Specification will be included in the Contract as a whole and no additional compensation will be allowed.

B. Allowance for Security Guard Infrastructures will cover costs of prefabricated guard booths, portable toilets, and lighting and heating for these infrastructures only. Expenses from the Allowance will be subject to prior review and approval by the Commissioner.

C. Temporary Critical Area Fence will be measured for payment in linear feet of fence installed in accordance with these specifications.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. With the exception of expenses from the Allowance for Security Guard Infrastructures for the bonded security guards assigned airside or the AOA, Airport safety and security will not be paid for separately, but will be considered included in all other items of work included in these Specifications. Airport safety and security will include furnishing all materials and equipment, including but not limited to flagpersons, guards assigned outside the AOA, escort vehicles and operators, sweepers, temporary gates, warning markers, safety area markings, underground utility markings, protection and supports for underground utilities, medium and low level barriers, other traffic control devices and necessary equipment, and other materials and equipment listed herein, and the maintenance thereof and all other labor, materials, equipment, tools, and all work necessary to accomplish this item. No additional payment will be made for these items.

B. Item M-103-01 – Allowance for Security Guard Infrastructures: Payment for the required infrastructures will be based from Time and Materials

proposals from the Contractor, approved and accepted by the Commissioner. Any remaining balance from the Allowance will be returned to the City in the form of an appropriate credit upon completion of the project.

C. Payment will be made at the Contract unit price per linear foot for Temporary Critical Area Fence. The price will be full compensation for furnishing all materials, placing all materials and for all labor, equipment, tools, and all work necessary to complete the work.

D. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
M-103-01	ALLOWANCE FOR SECURITY GUARD INFRASTRUCTURES	AL
M-103-02	TEMPORARY CRITICAL AREA FENCE	LF

END OF ITEM M-103

NIGHT CONSTRUCTION
SECTION N-100

PART 1 - DESCRIPTION

1.01 GENERAL

A. This Section will cover all airfield construction work normally scheduled as Night Time Work that requires turn over of the work site to Airport Operations during the day. All work must be completed by 6:00 AM and the work area turned over for the morning runway, taxiway, or AOA reopening. Delay in turn over will be subject to penalty as specified in the Contract documents.

1.02 ADVANCE NOTICE

A. The Contractor is required to give a minimum of 48 hours advance notice to Airport Operations prior to performing any night work. Under no circumstance will any work be performed at night without written approval by the Commissioner and/or the Airport Operations Manager.

1.03 STANDBY EQUIPMENT

A. The Contractor will be required to provide standby equipment at the construction site for all work included in the specifications and Plans. The standby equipment must be provided for all types of equipment to be used in the required construction operations. Operators will not be required for the standby equipment. The standby equipment must not be used except in the case of emergencies or regular equipment breakdown. The standby equipment must be listed in the daily equipment as usually required by the Contract specifications. When standby equipment is required to be used, the Contractor will be required to promptly repair or replace the broken equipment before being allowed to begin the next scheduled work shift. No Contract time extension will be granted due to the broken equipment being repaired or replaced nor will the Contractor be entitled to any compensation for the suspension of work.

B. The standby equipment will be required in the following:

Regular Equipment Used	Standby Equipment Required
1 - 6 units	1 unit
7 or more units	2 units

C. In all cases the Contractor will be required to park standby equipment readily available to the construction area in the event of breakdown of the regular equipment. Suitable equipment will be provided for the rapid movement of the asphalt spreaders and other equipment units and in no event will crawl-type equipment be allowed to traverse grassed areas.

1.04 OBSTRUCTION LIGHTING

A. At the beginning of each night's work and after having received instructions to proceed with the work from the Commissioner, the Contractor must place illuminated barricades to block off any connecting taxiways if required.

B. At the end of each night's work all illuminated barricades must be removed from the runway and stored in the Contractor's work area outside the approach zone of the runway.

C. Contractor must install the illuminated barricades and temporary lights in accordance with the locations and details must be as shown on the Plans or as directed by the Commissioner.

D. The Contractor must replace lighting units when the brilliancy of the lamps becomes inadequate as determined by the Commissioner. If any light fails or the barricade is damaged, displaced, or not in an upright position, from any cause, the Contractor must restore the barricade to its original acceptable condition.

1.05 CONSTRUCTION LIGHTING

A. The Contractor is required to install, maintain, and relocate temporary lights to illuminate each work area during the hours of darkness when construction activities are in progress.

B. The lighting equipment must be trailer-mounted units, each with 4-1,000 watt metal halide or high pressure sodium lights on a winch-lift telescopic mast. The Contractor will provide sufficient units to have the capacity of producing an average maintained illumination level of 5 horizontal foot candles throughout the working area. The Contractor is required to submit isolux curves or charts showing the pattern of lights. Levels should be calculated and measured in accordance with the standards of Illumination Engineering Society (IES) current practice. In addition, quality control personnel will be required to verify and document nightly compliance with this requirement.

C. In addition, all excavating machinery, backhoes, paving machines, rollers, distributors, trucks, and other equipment (except haul trucks) must be equipped with sufficient illumination to safely complete the work.

D. Location of lights may need to be changed as directed by the Commissioner to correct problems to the Control Tower caused by the lights.

E. Minimum illumination level must be 5 horizontal foot candles and should be maintained in the following areas:

1. An area 25' wide and 12' long immediately behind the asphalt spreader during the operation of the machine.

2. An area 12' wide by 30' long immediately in front and back of all rolling equipment during the operation of the equipment.

3. An area 12' wide by 12' long at any point where an area is being tack-coated prior to placement of the hot mix asphalt.

4. All concrete paving operations and electrical installation work areas.

5. Minimum 5 foot horizontal candles should be maintained in an area 25 feet wide and 30 feet long in front and behind the concrete paver or finishing equipment.

F. Contractor will be allowed access to work areas each night subject to the operational requirements of the Airport as determined by the Commissioner. It is the intent that the Contractor will be allowed access to work areas by 10:30 p.m. each working night. If permission for such access is delayed due to such operational requirements of the Airport as determined by the Commissioner, the Contractor will be allowed compensation for labor, time, and equipment costs for delay in starting work in excess of one hour past the nominal time for starting night time work. This claim will be in accordance with the General Conditions. Any such claim for delay will not exceed amounts for labor and equipment costs in excess of 4 hours per working night.

1.06 LIMITS OF OVERLAY/SCARILAY OPERATIONS

A. The Contractor must be required to mill and subsequently pave a single lift of bituminous overlay for a minimum of 500 linear feet for the full width of runway, including shoulders, or taxiway per night on average. If the Contractor Plans to pave more than 500 feet per night, he must guarantee the Commissioner that he will be able to complete the desired

length of full width paving prior, including cool down time, to the scheduled morning runway reopening. Bituminous tack coat must be applied immediately prior to the night's paving operations. The tack coat must be applied only to the length of pavement to be overlaid each night.

B. For scarilay work, the Contractor will be required to scarify and pave (scarilay) a single lift for a minimum of 50,000 Square Feet (including Shoulders) per night on average. If the Contractor Plans to scarilay more than 50,000 Square Feet per night, he must guarantee the Commissioner that he will be able to complete the desired length of paving prior, including cool down time, to the scheduled morning runway reopening.

1.07 GRADE CONTROL

A. Transition joints and grades must be installed as detailed on the Contract Drawings.

B. Final grades and elevations must conform to the requirements of the Plans and specifications. Automatic grade control devices must be used on the paving and milling machines to insure accuracy of grades and elevations. Any pavement that does not meet specified tolerance must be corrected at the Contractor expense.

C. Paving limits must be set so that all interim pavement configurations ensure that active pavement meets FAA Part 139 Criteria and plan restrictions, including longitudinal and transverse grades, drop-offs, and smoothness.

1.08 OTHER BITUMINOUS CONCRETE REQUIREMENTS

A. All other requirements for bituminous concrete as stated in Section P-401 and/or P-405 of these specifications must apply, respectively.

1.09 ASPHALT AND CONCRETE PLANTS

A. Asphalt Plants must be as specified in Section P-401 and/or P-405 as applicable. The Contractor must maintain a standby asphalt plant to be used in case of breakdown of the main asphalt plant.

PART 2 - PRODUCTS – Not Applicable

PART 3 - EXECUTION – Not Applicable

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Night construction procedures as described herein will not be measured for separate payment. The costs of meeting the requirements of this specification will be included in the Contract price as a whole, and no additional compensation will be allowed.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. Night construction will be considered included in the overall Contract price. No additional payment will be made for this item.

END OF SECTION N-100

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STANDBY TIME
SECTION N-110

PART 1 - DESCRIPTION

1.01 GENERAL

A. Some of the work in this Contract must be constructed at locations that are critical to the overall operation of the airfield. The Contractor will coordinate the scheduling and sequencing of the Work with the Commissioner in a manner that avoids unacceptable construction impacts on airfield operations. However, aircraft arrivals and departures are subject to weather conditions and cannot always be accurately predicted. Portions of the Work will require the Contractor to work within allotted time frames that could be subject to changing airfield conditions. On occasion, the Commissioner, on short notice, may direct the Contractor to temporarily stop work for departing and/or arriving aircraft. The purpose of this section is to establish a means to compensate the Contractor for temporary disruptions to his work resulting from airfield operations. Any compensable disruptions, further identified as Standby Time, must be approved by the Commissioner.

B. Work under this section is subject to the requirements of the Contract Documents.

1.02 SUBMITTALS

A. During the Mobilization phase of the Contract, the Contractor will submit a listing of hourly billing rates (idle and operating rates) for each type of equipment that will be used on the Project. The Commissioner will review these rates against IDOT standards and negotiate any differences with the Contractor. The agreed upon equipment rates will be used to pay for any approved Standby Time.

B. Only Regular equipment scheduled for actual use and operation will be subject to Standby Time. Standby equipment as replacement for the Regular equipment will not be subject to Standby payment.

PART 2 - MATERIALS

2.01 STORAGE OF MATERIALS

A. The Contractor will not be allowed to stockpile materials in any locations that could interfere with airfield operations unless the Contractor can demonstrate to the Commissioner that: (1) the materials must be staged

in critical areas to facilitate construction, and (2) the Contractor will be able to remove the materials within 30 minutes of notification.

2.02 PAYMENT FOR IMPACTS TO MATERIALS

A. If a Standby Time period results in impacts to materials that renders the materials unusable, the Contractor will submit invoices to the Commissioner documenting the costs for these materials. For example, if the Contractor has concrete on site that cannot be used due to a Standby Time period, and the concrete has to be discarded, the costs for this material can be submitted for reimbursement. No Contractor mark up will be allowed for this type of material reimbursement.

PART 3 - EXECUTION

3.01 PROJECT WORK SCHEDULE

A. Prior to beginning construction, the Contractor will prepare and submit a construction schedule to the Commissioner for review and approval. In preparing the schedule, the Contractor will incorporate phasing details and construction restraints set forth in the Contract Documents. During the review of the Contractor's schedule, the Commissioner will conduct a meeting with the Contractor, the Chicago Department of Aviation (CDA), and the Federal Aviation Administration (FAA) to review potential airfield operational impacts on the Contractor's schedule. The Contractor, as necessary, will modify his schedule to minimize these impacts.

3.02 DAILY WORK SCHEDULES

A. Prior to the end of each work day (by 6:00 am, or as otherwise approved by the Commissioner), the Contractor will meet with the Commissioner to review the next day's schedule for work in proximity to active taxiways and runways. Prior to the meeting, the Commissioner will check with FAA and CDA to determine which taxiways and runway configurations are planned for the next 24 hours. During the daily meeting, the Contractor and Commissioner will determine which construction activities can be scheduled for the following 24 hours, and those construction activities that will be significantly impacted by planned airfield operations and will not be approved for the following day/night. For any work activity the Commissioner approves that could be impacted by an airfield operation, the Contractor will provide a plan for removing equipment, materials, and manpower from that area within thirty (30) minutes of notification.

3.03 AUTHORIZATION AND CANCELLATION OF WORK

A. At the daily scheduling meeting described above, the Commissioner will authorize the Work for the following 24 hour period. If airfield conditions change such that the Contractor's scheduled work will be significantly impacted, and the Commissioner notifies the Contractor at least four (4) hours prior to the start of the scheduled shift that the work will be cancelled, the Contractor will not be eligible to receive any additional compensation as a result of the cancellation.

3.04 ADDITIONAL COMPENSATION

A. If a Contractor is authorized to perform work that is not cancelled four (4) hours prior to the start of the scheduled shift, and airfield operations require the Commissioner to either temporarily stop the work or terminate the work for the day, the Contractor will be eligible for compensation as follows.

1. Work is Terminated for the Day Prior to Starting

a. If the Contractor's crew for the cancelled work arrives at the site and is sent home, the Contractor will be compensated for two crew hours based on the hourly rates provided in certified payrolls. If the Contractor diverts the crew to other Project work, no additional compensation will be approved. The Contractor will also be compensated for two (2) hours of idle equipment time for any equipment that was scheduled for the cancelled work. If the Contractor diverts the equipment to other Project work, no additional compensation for lost equipment time will be approved. If the Contractor has rented specialized equipment for a portion of the work that was cancelled, and the Contractor incurs additional rental time as a result of the cancellation, the Commissioner may approve additional payment for more than two (2) hours of the shift. Before the Commissioner will consider this additional payment, the Contractor must provide information (actual invoices) quantifying the Contractor's costs.

2. Work is Temporarily Stopped and Restarted

a. If the Contractor is directed to temporarily stop any portion of work as a result of airfield operations, the Contractor will be compensated for the labor impacted by the temporary stoppage. The Commissioner's representative will document the crew members and the duration of the

temporary stoppage. Additional compensation will be calculated using hourly rates provided in certified payrolls. If the Contractor's production is not impacted by the temporary stoppage, no Standby Time compensation will be approved. Additional compensation for equipment Standby Time will only be authorized for impacted equipment that directly reduced the Contractor's production during the temporary stoppage. This compensation will be calculated using approved idle time rates.

3. Work is Started and Terminated for the Day

a. If the Contractor is directed to stop an element of work for the remainder of the day, additional compensation will be authorized for two hours of impacted labor if, at the time of the stoppage, the impacted labor has worked six (6) hours or less for the day/night. For any stoppage after six (6) hours of work, additional compensation will be made for the difference between eight (8) hours and the actual time worked. Compensation for labor will be calculated based on hourly rates provided in certified payrolls. Additional compensation for equipment will be calculated in the same manner as long as the Commissioner agrees that the lost equipment time reduced the Contractor's production for the shift. Compensation will be calculated using approved idle time rates.

4. Standby Time Documentation

a. For any component of authorized work temporarily stopped by the Commissioner as a result of airfield operations, the Commissioner's representative will complete the "CDA Work Report" form included with this Section. At the end of the work shift the Contractor and Commissioner's representative will verify the labor and equipment impacted, the duration of the temporary stoppage, and any materials lost as a result of the temporary stoppage.

PART 4 - METHOD OF MEASUREMENT

4.01 COMPENSATION FOR STANDBY TIME

A. Compensation for Standby Time will be made to the Contractor in accordance with the criteria set forth in this subsection. Compensation

will be limited to the Contractor's labor and equipment costs and materials lost. Materials lost due to delays or work stoppages qualified as "Standby Time" per the criteria of this subsection, will be paid for at the discretion of the Commissioner. All compensation requests must be documented on the "CDA Work Report" found in this section of the specifications. In calculating compensation for Standby Time, the Commissioner will not authorize any Contractor mark up on materials, labor, or equipment. This includes Subcontractor expenses.

4.02 ADDITIONAL CONTRACT TIME

A. Additional Contract time will be allowed for any day during which **all** of the following criteria are met:

B. The impacted work was scheduled by the Contractor and authorized by the Commissioner

C. The Contractor can demonstrate that the impacted work is critical to meeting one or more of the Contract phase durations.

D. The temporary work stoppage impacts more than four (4) hours of scheduled work.

E. The Contractor submits a written request in accordance with Part Two, Article VIII, requesting that additional time be added to the Contract duration.

PART 5 - BASIS OF PAYMENT

5.01 STANDBY TIME

A. Payment for Allowance items will be based from time and materials proposals from the Contractor, approved and accepted by the Commissioner, and supported by the completed "CDA Work Reports".

1. The work will be paid for as shown in Article X, "Changes in the Work", of the Part 2, General Conditions. Any remaining balance from the Allowance will be returned to the City in the form of an appropriate credit upon completion of the project.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
N-110-01	ALLOWANCE FOR STANDBY TIME	AL

END OF SECTION N-110

(attached "CDA Work Report" follows)

Chicago Department of Aviation
City of Chicago

WORK REPORT

SHIFT 12-8 ☐; 8-4 ☐; 4-12 ☐

PCM No. DATE OF WORK

☐ CONTRACT ADMIN. (ORIG.)
☐ RESIDENT ENGINEER
☐ CONTRACTOR

1.01. Work Report #___

CDA/CCA NO.

WORK REPORTS ARE TO BE MADE OUT DAILY WHEN EXTRA WORK (AUTHORIZED OR UNAUTHORIZED) IS IN PROGRESS, AND MUST BE SUBMITTED TO RESIDENT ENGINEER FOR SIGNATURE DURING THE DAY FOLLOWING SUCH WORK.

CONTRACT NO _____

CONTRACT NAME _____

GENERAL CONTRACTOR

WORK DESCRIPTION, LOCATION, F.O. NO., SSC ITEM NO.

SUBCONTRACTOR

LABOR / PERSONNEL			EQUIPMENT USED	
NAME	CLASSIFICATION	HRS	TYPE - MANUFACTURER - CAPACITY	HRS
			MATERIAL USED	
			FULL DESCRIPTION	QTY
TOTAL LABOR / PERSONNEL				

CORRECT AS TO TIME, MATERIALS AND EQUIPMENT

Contractor DATE

SUBMITTED

Resident Engineer DATE

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PAVEMENT REMOVAL
SECTION P-150

PART 1 - DESCRIPTION

1.01 GENERAL

A. This work will include removal of the existing bituminous concrete pavement; Portland Cement Concrete (PCC) pavement; and composite pavement, composed of PCC pavement with bituminous overlay shown on the Plans to be removed within the Project limits. Limits of pavement removal must be as shown on the Plans. The Contractor must note the variable depths of the concrete and bituminous concrete pavements, as shown on the Drawings. The work under this Section is subject to the requirements of the Contract Documents.

1.02 RELATED WORK

A. Related work specified elsewhere includes:

1. Section 01356 – Recycled Content
2. Section 01524 – Construction Waste Management
3. Section 02245 – Recycled Asphalt Pavement
4. Section P-152 – Excavation and Embankment
5. Section P-154 – Frost Protection Course
6. Section P-617 – Pavement Scarification
7. Section X-100 – Site Demolition

1.03 REFERENCES

A. Illinois Department of Transportation, 'Standard Specification for Road and Bridge Construction', latest edition, (SSRBC).

PART 2 - CONSTRUCTION METHODS

2.01 PAVEMENT REMOVAL

A. Method of Removal – Equipment and methods used for removing pavement or shoulders will be such as to prevent cracking, shattering, or

spalling of the pavement remaining in place. Breaking pavement by means of a ball breaker or a gravity drop hammer will not be permitted. All pavement to be removed must be sawcut full-depth prior to removal.

B. Areas of Pavement Removal/Replacement – Areas of the subgrade or base course that are below the required elevation of the proposed finished subgrade will be built up with compacted granular material (CA-7 or Asphalt Millings) in accordance with Section P-154.

C. Disposal – Surplus materials and broken pavement will be disposed of off Airport property or as directed by the Commissioner. The Contractor will be responsible for all removal, hauling, dumping, and any other costs associated with the elimination of this material in a manner that meets all applicable regulations.

PART 3 - METHOD OF MEASUREMENT

3.01 MEASUREMENTS

A. All types of pavement to be removed will be measured in place at the top of pavement and the area computed in square yards. Sawcutting limits of removal of all pavements will be included in this item. The removal of subgrade material and the base granular materials, when necessary, under the pavement to be removed will be measured and paid for as Grading and Shaping described in Section P-152.

B. Miscellaneous in-pavement items within the pavement removal limits that are not shown in the Drawings must be removed and will be included in the cost of Pavement Removal. Such items include, but are not limited to: reflectors, reinforcement, dowels, tie bars, kerfed conduits, etc. Underdrain and electrical conduit are included in the cost of shoulder removal when shown in the plans to be removed.

C. If additional pavement is removed due to negligence on the part of the Contractor, the additional quantity of pavement removal and replacement will not be measured for payment.

D. Pavement thicknesses identified are approximate. Contractor to remove the full lift of pavement material as indicated on the plans and approved by the Commissioner.

PART 4 - BASIS OF PAYMENT

4.01 PAYMENTS

A. Payment will be made at the Contract unit price per square yard for each type of pavement removal, which will be payment in full for all labor, materials, equipment, saw-cutting, and all work necessary to remove the pavement and dispose of in accordance with this Specification.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
P-150-01	PAVEMENT REMOVAL - BITUMINOUS CONCRETE SHOULDERS (FULL-DEPTH)	SY

END OF SECTION P-150

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EXCAVATION AND EMBANKMENT
SECTION P-152

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item covers excavation, disposal, placement, backfilling, and compaction of materials within the limits of the work required to construct the safety areas, runways, taxiways, aprons, pavements, and intermediate as well as other civil work areas in accordance with these Specifications and in conformity to the dimensions and typical sections shown on the Drawings or as directed by the Commissioner.

1.02 RELATED DOCUMENTS

A. Related Specification Sections include the following:

1. Section 01111 –Air Quality – Equipment Emissions
2. Section 02710 – Dust Control
3. Section M-103 – Airport Safety and Security
4. Section P-150 – Pavement Removal
5. Section P-154 – Frost Protection Course
6. Section P-156 – Temporary Air and Water Pollution, Soil Erosion, and Sediment Control
7. Section T-905 – Topsoiling
8. Section X-100 – Site Demolition
9. Section Q-100 – Contractor Quality Control Program

1.03 CLASSIFICATION – EXCAVATION AND EMBANKMENT

A. All excavated material will be classified as defined below:

1. Unclassified Excavation: Unclassified excavation will consist of the excavation, placement, and/or disposal of all material, regardless of its nature, which is not otherwise classified and paid for under other items. Unclassified Excavation includes the following:

a. Required Excavation: Excavation will consist of the excavation within the project limits required to achieve the grading depicted on the Drawings or as directed by the Commissioner.

b. Borrow Excavation: Borrow Excavation will consist of excavation of approved material required for the construction of embankment or for other portions of the work in excess of the quantity of usable material available from required excavations. Borrow material will be obtained from areas as shown on the Drawings or as directed by the Commissioner.

c. Topsoil Stripping: Topsoil Stripping will consist of the stripping of topsoil material. Topsoil which cannot be placed in its final location will be stockpiled or disposed of as instructed by the Commissioner. Stockpiles will be at the locations and to the heights and slopes approved by the Commissioner. Section P-156 requirements will apply to all stockpiles and all stockpiles will be included in this Work.

d. Excavation of Recyclable Material: This refers to the excavation of any recyclable material such as large chunks of Portland cement concrete, large chunks of bituminous concrete, wood, brick, metallic debris, or materials otherwise considered unsuitable for embankment construction with a maximum dimension exceeding two feet in any direction. These items must be delivered to the Recyclable Material stockpile area on the Airport as shown on the Drawings or as instructed by the Commissioner, within five miles of the site for materials to be stockpiled or for recycling or disposal by others. Wood must chipped and disposed of offsite or onsite at a location as directed by the Commissioner.

e. Unsuitable Material is any material containing vegetable or organic matter, such as muck, peat, organic silt, topsoil, or sod and will be considered unsuitable for use in embankment construction. Such material, when approved by the Commissioner as capable of supporting vegetation, may be used on embankment slopes.

2. Unclassified Excavation – Contaminated Material: Unclassified Excavation – Contaminated Material will consist of the excavations, on-site handling, and placement of non-hazardous contaminated materials; and the excavation and offsite disposal of

hazardous waste and Non Aqueous Phase Liquids (NAPL). This also includes removal and disposal of underground storage tanks (UST), drums, and other containers with either regulated substances or contaminated materials inside.

Contaminated Material is any material which contains a regulated substance. A regulated substance is a hazardous substance, special waste, Non-Aqueous Phase Liquids (NAPL) or petroleum or any fraction thereof, as those terms are defined in the Illinois Compiled Statutes. Environmental testing must be performed by the Contractor on any contaminated material to determine how the material should be classified, if existing data which may be provided to the Contractor does not sufficiently characterize the material.

The Contractor must assume that due to working in an airport environment, per- and polyfluoroalkyl substances (PFAS) may be present in the soil, as PFAS is present in Aqueous Film-Forming Foam (AFFF) used at airports for fire-fighting.

State and local permitting requirements must be complied with prior to disturbing underground storage tanks (UST). The requirements include, but are not limited to, applying for regulatory permits, environmental sampling protocols, and site visits by the regulatory agencies to approve the removal of the tank.

Based on the results of the environmental studies, the soils will be classified as non-hazardous contaminated material, hazardous contaminated material, or NAPL. If environmental studies of the work area have identified areas of contaminated soil, non-hazardous contaminated material maybe stockpiled on the Airport as directed by the Commissioner. If the Commissioner directs the Contractor to dispose of the hazardous waste or NAPL offsite, the Contractor must document proper disposal of these soils at a licensed facility. Alternately, the Commissioner may direct the disposal by others. Based on the data from the environmental studies, the soils will be classified as non-hazardous contaminated materials, hazardous waste, or NAPL. Disposal must conform to Article XIV, Part Two, General Conditions of the Contract Documents.

B. All embankment material will be classified as defined below:

1. Suitable Material: To be considered suitable for construction of subgrade and embankment areas for safety areas, runways,

taxiways, aprons, pavements, building foundations, or service roadways, the material must meet the conditions described below:

a. Suitable material is unclassified excavation material that is non-organic, non-decayable, and non-rubble material having a maximum dry density of not less than 98 pounds per cubic foot. It will contain no rock, stones, or broken concrete greater than four (4) inches in the largest dimension in the top twelve (12) inches of the proposed subgrade; no greater than nine (9) inches in the largest dimension within one (1) foot to four (4) feet below the finished subgrade; and no greater than twenty (20) inches in the largest dimension below four (4) feet of the finished subgrade. The material must be easily compactable to the required density and approved by the Commissioner. Compaction requirements for suitable material are provided in Table 1.

   In addition, the top 1.5 feet minimum of embankments under all pavement areas must be an impervious cohesive soil, uncontaminated by deicing salts, chemical waste, sewage, or disposal wastes of any kind, with the following properties:

   The material will not possess an organic content greater than five percent when tested in accordance with AASHTO T-194.

   The material must have:
   - 40% or more passing No. 200 sieve.
   - A plasticity index between 12% and 25%.
   - A liquid limit between 25% and 50%.

2. Restricted Material: Material with deviations from the above requirements for suitable material is restricted to use for construction of embankments in areas outside of the runway or taxiway safety areas, apron pavements, service roadways, or building footprints if acceptable to the Commissioner. The Commissioner will be the sole judge of the suitability of all materials whether taken from required excavations, on-site stockpiles, or off-site borrow sources. Compaction requirements for restricted material are provided in Table 1.

3. Unsuitable Material:

a. Material as defined in Section 1.03.A.1.e is not suitable for embankment construction.

b. Asphalt grindings must not be used in embankments.

4. Recyclable Material:

a. Recyclable Material refers to any large chunks of Portland cement concrete or bituminous concrete with a maximum dimension exceeding 20 inches in any direction.

b. Masonry, brick, metallic debris, or other such materials unacceptable for use in embankment construction may be considered Recyclable Material, if directed by the Commissioner.

c. These items must handled, as stipulated in Section 1.03.A.1.d.

1.04 SUBMITTALS

A. Work Plan – The Contractor must submit a work plan to the Commissioner for approval prior to beginning the excavation and embankment work. The Work Plan must include:

1. Excavation of materials and direct placement, excavation of materials and stockpiling in temporary stockpile areas and placement, and excavation and placement of excess materials to the stockpile areas shown on Drawings or as directed by the Commissioner.

2. The plan must provide for multiple work areas within the Project area for performing Work such that there will always be work areas available if certain areas are shut down or are unavailable to the Contractor for any reason.

3. The plan must include seeding and mulching, and erosion control in accordance with the Erosion Control Plan.

4. List of equipment to be used for excavation, hauling, compaction, disking, and testing.

5. Sequence of excavation and placement and schedule in compliance with Contract requirements.

6. Quality Control testing plan and independent testing laboratory experience for performing quality control testing as established in

the requirements of Section Q-100, “Contractor Quality Control Program”, of these Specifications.

7. Procedures for constructing, maintaining, and removing haul roads, including signage as required.

8. Submit all proposed licensed disposal facilities for Commissioner approval. Facilities required for submittal include, but are not limited to, a currently permitted RCRA Subtitle D landfill (non-hazardous solid waste), a currently permitted RCRA Subtitle C landfill (hazardous waste), and a currently permitted Clean Construction or Demolition Debris or Uncontaminated Soil Fill Operation (CCDD/USFO) facility.

9. The Contractor must provide a letter from the proposed disposal facility, stating that the disposal facility acknowledges and will accept material from an airport environment, that may contain per- and polyfluoroalkyl substances (PFAS) from aqueous film-forming foam (AFFF) used for fire-fighting. This acknowledgement, from one or more disposal facilities, should be in place prior to Contractor bidding for a particular facility, so as to avoid unforeseen material rejections from the disposal facility. The letter will be included with the bid documents to Commissioner. The purpose of this letter is for the Contractor and Commissioner to be transparent and avoid coordination delays following Notice to Proceed. Coordinating the testing and acceptance of this material is the responsibility of the contractor. There will be no additional payments made to the Contractor for facilities rejecting the material or delays resulting from sample lead times. A copy of CDA’s PFAS policy, approved by the Commissioner, is attached with this specification.

PART 2 - CONSTRUCTION METHODS

2.01 GENERAL

A. The Contractor must inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated. The Commissioner will make final determination of classification of all excavated material. No payment will be made for any excavated material which is used for purposes other than those designated. Before beginning excavation, grading and embankment operations in any area, the area must be completely cleared and grubbed and stripped of topsoil. Erosion control measures and materials must be installed prior to land disturbing activities in accordance with the Contractor’s approved Erosion

Control Plan as accepted by the Commissioner and in accordance with Section P-156.

B. The suitability of material to be placed in embankments must be acceptable to the Commissioner. All Unsuitable Material must be disposed of at Contractor's expense in waste areas on the Airport as directed by the Commissioner or as designated on the Drawings. All hazardous waste and NAPL must be disposed of in a licensed disposal site in accordance with Article XIV of the General Conditions. All waste areas on the Airport, if so designated, will be graded to allow positive drainage of the area and of adjacent areas. The surface elevation of waste areas will not extend above the surface elevation of adjacent usable areas of the Airport, unless specified on the Drawings or approved by the Commissioner.

C. Recyclable Material and all other materials not considered suitable for use elsewhere must be disposed of in designated areas for recycling and disposal by others as directed by the Commissioner. In no case will any discarded materials be left in windrows or piles adjacent to or within the Airport limits. The manner and location of disposal of materials will be subject to the acceptance of the Commissioner and must not create an unsightly or objectionable view. When the Contractor is required to locate a disposal area outside the Airport property limits at its own expense, the Contractor must obtain and file with the Commissioner, permission in writing from the property owner for the use of private property for this purpose.

D. Blasting will not be allowed.

E. If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor will be responsible for and must take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor must notify the Commissioner, who will arrange for their removal if necessary. The Contractor must, at its own expense, satisfactorily repair or pay the cost of all damage to such facilities or structures which may result from any of the Contractor's operations during the period of the Contract.

F. When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations must be temporarily discontinued. At the direction of the Commissioner, the Contractor must excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

G. Those areas outside of the pavement areas in which the top layer of soil material has become compacted, by hauling or other activities of the Contractor, must be scarified and disked to a depth of 4 inches, in order to loosen and pulverize the soil.

H. The excavation must be carried out to the required lines and grades shown on the Drawings unless the Commissioner authorizes over-excavation to remove unsuitable materials. Should the Contractor, through negligence or other fault, excavate below the designated lines, it must replace the excavation with approved materials, in an acceptable manner and condition, at its own expense.

I. The Contractor must repair eroded areas and take all measures to prevent continued erosion immediately and/or as indicated by the Commissioner. No separate payment will be made for this Work.

J. The Contractor must sort, separate, and remove all logs and wood material encountered in excavated material with a maximum dimension exceeding 2 feet in any direction. The Contractor must chip this wood material and dispose of offsite. No separate payment will be made for this Work.

2.02 EXCAVATION

A. The Contractor must assume that due to working in an airport environment, per- and polyfluoroalkyl substances (PFAS) may be present in the soil, as PFAS is present in Aqueous Film-Forming Foam (AFFF) used at airports for fire-fighting. A policy document approved by the Commissioner is attached with this specification. Contractor will collect representative soil samples from the site and perform required analysis for waste stream authorization from one or more permitted Subtitle D landfills for the disposal of non-hazardous special waste.

B. No excavation will be started until the work has been staked out and cross sectioned by the Contractor and the Commissioner has received, reviewed, and concurred with the elevations and measurements of the ground surface. All Suitable Material must be used in the formation of embankment, subgrade, or for other purposes shown on the Drawings. Excess Suitable Material will be disposed of as shown on the Drawings or as directed by the Commissioner. All Unsuitable Material must be disposed of as shown on the Drawings or as directed by the Commissioner.

C. Soil disposed off Airport property must be disposed of at a Subtitle D facility, and within the confines of landfill controls. The material must not

be used as a surface capping material for facilities in closure process, or for general site work at the facilities (i.e. constructing access roads).

D. The number of waste characterization samples required must be coordinated with the disposal facility. If the disposal facility requires a PFAS sample(s), the Contractor will be responsible for sample collection and understanding and planning for any lead time associated with this testing. Testing will be in accordance with ASTM D7968-17a or as directed by the disposal facility.

E. When the Contractor encounters an area of suspected contaminated material, any container with suspect contents inside, and/or underground storage tank (UST), the Commissioner must be notified immediately prior to any further work in the general vicinity. The area must be marked and delineated with safety fencing to alarm personnel of potential hazard in the area. The Commissioner will perform tests as necessary to determine the degree of contamination and the limits of material to be removed and disposed of as Unclassified Excavation-Contaminated Material. At the direction of the Commissioner, the Contractor, at no expense to the City, must redirect its labor and equipment to other work areas until the City's environmental consultant can evaluate the types and levels of contamination. Test results will be furnished to the Contractor for his use in securing the necessary permits and licenses for disposal. The Contractor must be responsible for any additional testing required in obtaining permits for hauling and disposal of the Contaminated Material.

F. Based on the results from the Commissioner's environmental consultant's assessment, the Commissioner will direct the Contractor as follows:

1. Material Can Remain on Site: The City will issue the Contractor a Field Order to proceed with the excavation and placement on site. Should the Commissioner's direction require the Contractor to perform work beyond the effort necessary to comply with Contract requirements, the City will compensate the Contractor for eligible costs in accordance with Article X.C.3 of Part 2 – General Conditions using the allowance included in Pay Item "Allowance for "Unclassified Excavation-Contaminated Material". Where applicable, the Commissioner will subtract the volume of the contaminated material removed from the appropriate P-152 Pay Item to avoid double payment for the same quantity of soil.

2. Material Must be Transported by the Contractor to a Licensed Disposal Facility: If the contractor has the resources to properly manage this material, the City may issue the Contractor a Field Order to handle and transport the material to a licensed disposal facility. The Contractor must be responsible for any additional

testing required in obtaining permits for hauling and disposal. Compensation for this Work will be in accordance with Article X.C.3 of Part 2 – General Conditions using the allowance included in Pay Item "Allowance for "Unclassified Excavation-Contaminated Material". For any soil handled by the Contractor in this manner, the City will subtract this soil volume from the appropriate P-152 Pay Item to avoid double payment for the same quantity of soil.

3. Material must be transported by a Third Party Contractor to a Licensed Disposal Facility: The City reserves the right to use a third party Contractor for managing this type of soil. If the City selects this option, the Contractor will not be eligible for any additional compensation as a result of the third party Contractor's work. For any soil removed by a third party Contractor, the City will deduct the volume of this soil from the Contractor's appropriate P-152 Pay Item quantity.

4. If the Contractor's additional compensation for Items 1 and 2 above exceeds the allowance amount in Pay Item "Allowance for Unclassified Excavation-Contaminated Material, a Contract Modification will be required in accordance with Article X.D of Part 2 – General Conditions. Any additional compensation resulting from the Contractor's handling and management of contaminated soil is subject to the Commissioner's approval.

G. When the volume of the required excavation exceeds that required to construct the embankments to the grades indicated, the excess will be used to grade the areas of ultimate development or disposed of as directed by the Commissioner.

H. When the volume of required excavation is not sufficient for that required to contrast the embankments to the grades indicated, the deficiency will be obtained from borrow areas. Borrow must be obtained from sources as shown on the Drawings or as directed by the Commissioner. The Contractor must notify the Commissioner at least 15 days prior to beginning the excavation, so necessary measurements and tests can be made. All borrow pits must be opened up to expose the vertical face of various strata of acceptable material to enable obtaining a uniform product. Borrow pits must be excavated to regular lines to permit accurate measurements, and they must be drained and left in a neat, presentable condition with all slopes dressed uniformly.

I. The grade must be maintained so that the surface is well drained at all times. When necessary, temporary drains and drainage ditches must be installed to intercept or divert surface water which may affect the work.

J. After surface stripping in areas of proposed embankment, and in cut areas, the cut grade or subgrade must be inspected by proof-rolling in embankment areas, after surface stripping, and in cut areas after excavating to the required subgrade level. The subgrade must be proof-rolled with a 25 ton (or heavier) pneumatic tired roller making at least 8 passes over the entire area in alternate (perpendicular) directions or a fully loaded semitruck loaded to the legal limit at the Commissioner's discretion. Any continuously yielding or unstable area, as determined by the Commissioner, must be undercut and backfilled in accordance with the undercutting requirements below. The final lift of embankment must be proof rolled under pavement areas.

K. When Selective Grading is indicated on the Drawings or Specifications, the more suitable material as designated by the Commissioner must be used in constructing the embankment or in capping the pavement subgrade. If, at the time of excavation, it is not possible to place this material in its final location, it must be stockpiled in approved areas for later use.

L. The Contractor is advised that it must classify and sort all materials encountered according to the requirements of Section P-152. Attention is called to the Drawings, and other Contract Documents. The Contractor may need to modify its excavation methods and operations in order to sort, embank, and stockpile materials accordingly. The Contractor must adhere to the requirements of Section Q-100 and employ qualified Quality Control technicians on a full-time basis to accomplish this task. The Commissioner will make the final determination of classification of excavated material. The suitability of material to be placed in embankments or stockpiles must be acceptable to the Commissioner.

M. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for runway safety areas, subgrades, roads, shoulders, or any areas intended for turfing must be excavated to a minimum depth of 3 feet, or to the depth specified by the Commissioner, below the subgrade or designated grade. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation as determined by the Commissioner, must be removed to the depth specified by the Commissioner and backfilled with either Suitable Material or with Stabilization Stone CA-1, as directed by the Commissioner, in accordance with Section P-152 and/or the requirements for undercut and backfill of Section P-154, Frost Protection Course. Any failures of proof rolls on the final lift of embankment placed by the Contractor under pavement areas, will be undercut or corrected by the Contractor to the satisfaction of the Commissioner at no cost to the Commissioner.

N. Overbreak, including slides, is that portion of any material displaced or loosened beyond the finished work as shown on the plan or authorized by the Commissioner. All overbreak must be graded or removed by the Contractor and disposed of as directed; however, payment will not be made for the removal and disposal of overbreak. Unavoidable overbreak as determined by the Commissioner, will be classified as "Grading and Shaping".

2.03 EMBANKMENT

A. Compaction Requirements: Refer to Table 1 for subgrade compaction requirements in Sections under proposed pavements and Sections outside pavement areas.

1. The Commissioner will make the determination as to cohesive and non-cohesive soil in regards to selecting the proper type of equipment required to compact the material.

2. When the level of compaction of in-situ soils reaches the specified level of compaction, no further removal, manipulation and recompaction is necessary.

3. Further removal, manipulation and recompaction necessary to obtain the required field density will not be paid separately, but considered included in the Grading and Shaping.

4. The in-place field density will be determined in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 6938. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in top 6 inches of the subgrade. The finished grading operations, conforming to the typical cross section, must be completed and maintained ahead of the paving operations or as directed by the Commissioner.

5. All excavation operations must meet the requirements of the phasing plans and Specification N-100 Night Construction, and restore all graded areas to meet Part 139 requirements within safety areas before the runway and taxiways are reopened to air traffic.

6. In cuts, all loose or protruding rocks on the back slopes must be bared loose or otherwise removed to line of finished grade of slope. All cut-and-fill slopes must be uniformly dressed to the slope, cross section, and alignment shown on the Drawings or as directed by the Commissioner.

TABLE 1
Soil Compaction Requirements
Percent of Maximum Density as Determined by ASTM D-1557

	Beneath Rigid Pavement[1]		Beneath Flexible Pavement[2]		Outside Pavement Area	
	Cohesive Soils	Noncohesive Soils[3]	Cohesive Soils	Noncohesive Soils[3]	Cohesive Soils	Noncohesive Soils
Cut sections (compaction of subgrade)	• Top 6 inches of subgrade - 90%	• Top 6 inches of subgrade - 100% • Next 18 inches - 95%	• Top 9 inches of subgrade - 95% • 9 to 18 inches below top of subgrade - 90% • 18 to 27 inches below top of subgrade - 85% • 27 to 36 inches below top of subgrade - 80%	• Top 23 inches of subgrade- 100% • 23 to 41 inches below top of subgrade - 95% • 41to 59 inches below top of subgrade - 90% • 59 to 76 inches below top of subgrade - 85%		
Fill sections (including existing subgrade if fill thickness is less than 36 inches for cohesive soils and 76 inches for noncohesive soils)	• Entire fill section - 90% • Top 6 inches of existing soil - 90%	• Top 6 inches of fill - 100% • Remaining depth of fill - 95% • Top 6 inches of existing soil - 90%	• Top 9 inches of fill - 95% • 9 to 18 inches below top of fill - 90% • 18 to 27 inches below top of fill – 85% • 27 to 36 inches depth and below - 80% (including top 6 inches of existing soil if fill thickness is greater than 36 inches)	• Top 23 inches of fill - 100% • 23 to 41 inches below top of fill - 95% • 41 to 59 inches below top of fill - 90% • 59 to 76 inches below top of fill - 85% • 76 inch depth and below - 80% (including top 6 inches of existing soil if fill thickness is greater than 76 inches)	• Entire fill section – 90%	Entire fill section – 95%

[1]Rigid pavements consist of Portland Cement Concrete placed upon a granular or treated subbase course over compacted subgrade. Rigid pavements may have bituminous overlays.

[2]Flexible pavements consist of a bituminous wearing surface placed on a base course and possibly a subbase over a compacted subgrade. The base course may consist of bituminous base, crushed aggregate base or cement treated base course.

[3]For those soils having a plasticity index (P.I.) of greater than or equal to 4 or less than 6 and other borderline soils, the Commissioner will determine the soil classification for the purpose of determining soil compaction requirements and compaction equipment (see 2.08.A). The Commissioner will determine the type of compaction equipment under 2.08.A. Non-cohesive soils for purposes of determining compaction are those soils having a plasticity index (P.I.) of less than 6.0.

B. Where an embankment is to be constructed, all topsoil, sod, and vegetable matter must be removed from the surface upon which the embankment is to be placed, and the cleared surface must be completely broken up by plowing or scarifying to a minimum depth of 6 inches. This area must then be compacted as required by this Specification.

C. Disposal – Surplus materials and broken pavement will be disposed of off Airport property or as directed by the Commissioner. The Contractor will be responsible for all removal, hauling, dumping and any other costs associated with the elimination of this material in a manner that meets all applicable regulations.

D. Where embankments are to be placed on natural slopes steeper than 3 to 1 (H:V), or against cut slopes, horizontal benches 2 to 3 feet wide must be cut into the slope or constructed as directed by the Commissioner.

E. No direct payment will be made for the preparation work performed under this Section. No separate payment will be made for benching. This work will be considered included in the Contract unit price for Grading and Shaping.

F. Embankments will be formed in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross section, unless otherwise directed by the Commissioner.

G. The grading operations must be conducted, and the various soil strata must be placed, to produce a soil structure as shown on the typical cross section or as directed. Materials such as topsoil, brush, hedge, roots, stumps, grass and other organic matter will not be incorporated or buried in the embankment. All materials used in the formation of embankments under the pavement will be Suitable Material.

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

I. The material in the layers must be within +/- 2 percent of optimum moisture content as determined by ASTM D 1557 before rolling to obtain the prescribed compaction. In order to achieve uniform moisture content throughout the layer, wetting or drying of the material and manipulation must be required when necessary. Should the material be too wet to permit proper compaction or rolling, all Work on all of the affected

portions of the embankment must be delayed until the material has dried to the required moisture content. The material may be disked to a depth of 8 inches to hasten drying and then be recompacted to the requirements listed in Table 1. Sprinkling of dry material to obtain the proper moisture content must be done with approved equipment that will sufficiently distribute the water. Sufficient equipment to furnish the required water must be available at all times. Samples of all embankment materials for testing, both before and after placement and compaction, will be taken for each 250 cubic yards or in a 100 ft x 100 ft grid of material placed per layer, or as required by the Commissioner. Based on these tests, the Contractor must make the necessary corrections and adjustments in methods, materials or moisture content in order to achieve the correct embankment density. The Contractor must at a minimum perform two modified proctor ASTM D1557 at times and locations as determined by the Commissioner.

J. Wet soils are defined as those soils whose moisture content, when placed in an embankment, exceeds the optimum moisture content necessary for compaction in accordance with this Specification. Embankment layers that are determined to be wet as a result of the moisture content of the in-situ excavation will be subject to the requirements below. No separate payment will be made for drying by any means of embankment layers that become wet as the result of the Contractor's failure to properly control surface drainage during construction. If wet soils are encountered during embankment construction or subgrade preparation, the Contractor, at a minimum, must take the following steps in an effort to obtain the moisture content needed to achieve the specified level of compaction:

1. If the moisture is within 4% of the optimum moisture for the soil, the Contractor must air dry the uncompacted layer. The Contractor must disc, till or use whatever means appropriate to process the full depth of the uncompacted layer each day for three (3) consecutive good drying days. The Contractor must periodically check the moisture content during processing. As soon as acceptable moisture contents are achieved, the Contractor must acceptably complete the compaction of that layer.

2. If, in the opinion of the Commissioner, the specified level of compaction or moisture content cannot be obtained after air drying or the in situ moisture level at the time of excavation is excessive, Lime Modification in accordance with Specification P-159, Lime Modified Soil may be authorized by the Commissioner in writing. The quantity of lime approved for modification of the soil layer will be determined by the moisture content of that soil layer and by the type of the soil. Lime modified soil layers will be accepted based on the compaction and testing requirements of this Specification.

The Commissioner has the sole discretion in the use of lime for the purpose of modifying soils in order to achieve the specified level of compaction.

K. Compacting operations must be continued until the embankment is compacted to the requirements listed in Table 1.

L. On all areas outside of the pavement area, no compaction will be required on the top 4 inches.

M. The in-place field density must be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 6938.

N. Compaction areas must be kept separate, and no layer will be covered by another until the proper density is obtained.

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

P. In the construction of embankments, layer placement must begin in the deepest portion of the fill; as placement progresses, layers must be constructed approximately parallel to the finished pavement grade line.

1. In embankments greater than 10 feet, sands, silts, silty sands, and sandy silts shall be placed in the lower portion of the embankment as directed by the Commissioner.

Q. The final lift of embankment must be proof rolled under pavement areas. Any failures of proof roll on the final lift of embankment under pavement areas will be undercut or corrected by the Contractor to the satisfaction of the Commissioner at no cost to the Commissioner.

1. Sands, silts, silty sands, and sandy silts should not be placed in the top 5 feet of embankment.

R. When rock and other embankment material are excavated at approximately the same time, the rock must be incorporated into the outer portion of the embankment and the other material must be incorporated under the future paved areas. Stones or fragmentary rock larger than 4 inches in their greatest dimensions will not be allowed in the top 6 inches of the subgrade. Rockfill must be brought up in layers as

specified or as directed and every effort must be exerted to fill the voids with the finer material forming a dense, compact mass. Rock or boulders must not be disposed of outside the excavation or embankment areas, except at places and in the manner designated by the Commissioner.

S. When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in layers of the prescribed thickness without crushing, pulverizing or further breaking down the pieces, such material may be placed in the embankment, as directed by the Commissioner, in layers not exceeding 2 feet in thickness. Each layer must be leveled and smoothed with suitable leveling equipment and by distribution of spalls and finer fragments of rock. These type lifts must not be constructed above an elevation 4 feet below the finished subgrade. Density requirements will not apply to portions of embankments constructed of materials which cannot be tested in accordance with specified methods.

T. Frozen materials must not be placed in the embankment nor will embankment be placed upon frozen material.

U. There will be no separate measurement for payment for compacted embankment, and all costs of placing in layers, compacting, disking, watering, mixing, sloping, and other necessary operations for construction of embankments will be included in the Contract price for Grading and Shaping.

V. No additional payment will be considered for material excavated, stockpiled, and rehandled. The work required to rehandle stockpiled material will be considered included in the Contract unit price for Grading and Shaping.

W. Any embankment in paving areas placed in the previous year must be recompacted to the requirements of Table 1 for the top 8 inches and re-approved before paving. This requirement will consist of disking, recompacting, and proof-rolling the embankment surface in accordance with the Specifications. No additional payment will be made for this Work.

X. Excavation materials must not be stockpiled on airfield pavements as to avoid damaging the finish and/or structural integrity of the pavement.

2.04 FINISHING AND PROTECTION OF SUBGRADE

A. After the subgrade has been substantially completed, the full width must be conditioned by removing any soft or other unstable material which will not compact properly. The resulting areas and all other low areas, holes, or depressions must be brought to grade with suitable select material.

Scarifying, blading, rolling, and other methods must be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the Drawings.

B. Grading of the subgrade must be performed so that it will drain readily. The Contractor must limit hauling over the finished subgrade to that which is essential for construction purposes.

C. All ruts or rough places that develop in a completed subgrade must be smoothed and recompacted.

D. No subbase, or other paving course will be placed on the subgrade until the subgrade has been accepted by the Commissioner. Any damage to the accepted subgrade due to the Contractor must be repaired to the satisfaction of the Commissioner by the Contractor at the Contractor's expense.

2.05 HAUL

A. All hauling will be considered a necessary part of the work. Its cost must be considered by the Contractor and included in the Contract unit price for the pay of items of work involved. No payment will be made separately or directly for hauling on any part of the work.

2.06 EQUIPMENT

A. The Contractor may use any type of earth moving, compaction, and watering equipment it may desire or has at its disposal, provided that the equipment is in satisfactory condition and is of sufficient capacity to perform the Work as specified. The only requirements specified are that tamping rollers (generally referred to as Sheepsfoot Rollers) will be considered the proper type of equipment for compaction of cohesive soils and vibratory/mechanical tamping equipment will be applicable for compacting granular soils. Subgrade rollers can be used to smooth minor surface deviations in both types of subgrade/embankment, but in no case will a steel wheel or vibratory roller be used to compact cohesive embankment. In all cases, the adequacy of the equipment will be determined by the Commissioner. Failure to obtain the specified results, or failure to meet the schedule planned by the Contractor and acceptable to the Commissioner, due to inadequate equipment will not be cause for delay or additional payment. The Contractor must furnish, operate, and maintain such equipment as is necessary to control density, section, and smoothness of grade.

B. The requirements of Section 01111, Construction Air Quality – Diesel Vehicle Emissions apply to this Specification Section.

2.07 TOLERANCES

A. In those areas upon which a subbase or base course is to be placed, the top of the subgrade must be of such smoothness that, when tested with a 16-foot straightedge applied parallel and at right angles to the centerline, it must not show any deviation in excess of ½-inch, or must not be more than 0.05-foot from true grade as established by grade hubs or pins. Any deviation in excess of these amounts must be corrected by loosening, adding, or removing materials; reshaping; and recompacting by sprinkling and rolling.

B. On safety areas, intermediate and other designated areas, the surface must be of such smoothness that it will not vary more than 0.10 foot from the design grade. Any deviation in excess of this amount must be corrected by loosening, adding or removing materials, and reshaping.

2.08 TOPSOIL

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

B. Upon completion of grading operations, stockpiled topsoil must be handled and placed as directed, or as required in Section T-905. No stockpiles will be allowed to remain at the end of the Project.

C. No separate payment will be made for topsoil as such under Section P-152. The quantity removed and placed directly or stockpiled is included in Grading and Shaping.

2.09 BACKFILLING OF REMOVAL ITEMS

A. Any items removed as part of site demolition that lie in the proposed pavement or shoulder areas must be backfilled with FA-6 or CA-6 and mechanically compacted with vibratory equipment in accordance with Section X-100 as directed by the Commissioner.

PART 3 - METHOD OF MEASUREMENT

3.01 GENERAL

A. Unclassified Excavation will be measured as Grading and Shaping.

B. The quantity of Grading and Shaping to be paid for will be the number of square yards of disturbed and regraded area measured in place after pavement removal has been completed.

C. Measurement will not include the quantity of materials excavated without authorization beyond normal slope lines, or the quantity of material used for purposes other than those directed.

D. No measurement or payment will be made for stockpiled or rehandled material that is used for embankment or topsoil.

E. Topsoil stripping and placement will not be measured separately for payment.

F. Borrow excavation and placement will not be measured separately for payment.

G. Allowance for Unclassified Excavation-Contaminated Material: An allowance is established for approved excavation and on site placement of non-hazardous contaminated materials and excavation and disposal offsite of hazardous waste and NAPL contaminated soils. The allowance is to be used exclusively to pay for the additional/extra work, if required, to remove and dispose of the contaminated material above and beyond the conditions shown on the Drawings. Work under this allowance will be subject to prior approval by the Commissioner.

H. Cost of excavation for erosion control devices/measures will not be measured separately and will be considered included in the erosion control P-156 Pay Items.

PART 4 - BASIS OF PAYMENT

4.01 GENERAL

A. For “Grading and Shaping” payment will be made at the Contract unit price per square yard. This price will be full compensation for excavation of material from its original place and placement to the final location or embankment as specified, directed by the Commissioner, or shown on the Drawings including single or multiple handling. This price will be for

furnishing all materials, labor, equipment, tools, hauling, and all work necessary to complete the item, including topsoil stripping and placement, undercutting, borrow material excavation and hauling, sorting, stockpiling, and disposal required by this Specification or shown on the Drawings.

B. For "Allowance for Unclassified Excavation – Contaminated Material" payment will be made for excavation, onsite placement or offsite disposal of contaminated material and includes approved additional special handling and procedures required during excavation, obtaining waste stream authorization, surveying, loading into hauling trucks, transporting and disposing of the materials at an approved disposal facility. This allowance is only for effort that is clearly above and beyond the effort required for Unclassified Excavation. Any work under this allowance must have prior approval by the Commissioner. Unused portions of this allowance will not be paid to the Contractor, but will be returned to the City in the form of an appropriate credit.

C. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
P-152-01	GRADING AND SHAPING	SY
P-152-02	ALLOWANCE FOR UNCLASSIFIED - CONTAMINATED MATERIAL	AL

END OF SECTION P-152

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CONTROLLED LOW STRENGTH MATERIAL (CLSM)
SECTION P-153

PART 1 DESCRIPTION

1.01 GENERAL

A. This item consist of furnishing, transporting and placing a controlled low-strength material (CLSM) as flowable backfill in trenches or at other locations shown on the Drawings or as directed by the Commissioner.

PART 2 MATERIALS

2.01 GENERAL

A. Portland Cement – Portland cement must conform to the requirements of ASTM C150 Type I. If for any reason, cement becomes partially set or contains lumps of caked cement, it will be rejected. Cement salvaged from discarded or used bags will not be used.

B. Fly Ash – Fly Ash must conform to ASTM C618, Class C or F.

C. Fine Aggregate (Sand) – Fine aggregate must conform to the requirements of ASTM C33 except for aggregate gradation. Any aggregate gradation which produces performance characteristics of the CLSM specified herein will be accepted, except as follows:

Sieve Size	**Percent Passing by Weight**
¾ inch (19.0 mm)	100
No. 200 (0.075 mm)	0-12

D. Water – Water used in mixing must be free of oil, salt, acid, alkali, sugar, vegetable matter, or other substances injurious to the finished product.

E. Dyes and other methods of coloring the backfill material may be incorporated if desired.

2.02 MIX DESIGN

A. PROPORTIONS

1. Mix Proportions – The Contractor must submit to the Commissioner a mix design including the proportions and source of materials, admixtures, and dry cubic yard (cubic meter) batch weights. The mix must contain a minimum of 50 pounds of cement and 250 pounds fly ash per cubic yard (30kg cement and 148kg fly ash per cubic meter), with the remainder of the volume composed of sand, water, and any approved admixtures.

2. Compressive Strength – CLSM must be designed to achieve a 28-day compressive strength of 100 to 200 psi (690 to 3680 kPa) when tested in accordance with ASTM C39. There should be no significant strength gain after 28 days. Test specimens will be made in accordance with ASTM C31 except that the samples will not be rodded or vibrated and will be air cured in their molds for the duration of the cure period.

3. Consistency – Consistency of the fresh mixture will be such that the mixture may be placed without segregation. A desired consistency may be approximated by filling an open-ended three-inch (75 mm) diameter cylinder, six inches (150 mm) high to the top, with the mixtures and the cylinder immediately pulled straight up. The correct consistency will produce an approximate eight-inch (205 mm) diameter circular-type spread without segregation. Adjustments of the proportions of materials should be made to achieve proper solid suspension and flowable characteristics, however theoretical yield must be maintained at one cubic yard (cubic meter) for the given batch weights.

PART 3 CONSTRUCTION METHODS

3.01 PLACEMENT

A. Placement – CLSM may be placed by any reasonable means from a mixing unit into the space to be filled. Agitation is required during transportation and waiting time. Placement will be performed in such a manner that structures or pipes are not displaced from their desired final position and intrusion of CLSM into undesirable areas is avoided. The material will be brought up uniformly to the fill line shown on the Drawings or as directed by the Commissioner. Each placement of CLSM will be as continuous an operation as possible. If CLSM is

placed in more than one layer, the base layer must be free of surface water and loose or foreign material prior to placement of the next layer.

B. Limitations of Placement – CLSM will not be placed on frozen ground. Mixing and placing may begin when the air temperature is at least 35 degrees F (2 degrees C) and rising. At the time of placement, CLSM must have a temperature of at least 40 degrees F (4 degrees C). Mixing and placement must stop when the air temperature is 40 degrees F (4 degrees C) and falling or when the anticipated air temperature will be 35 degrees F (2 degrees C) or less in the 24-hour period following proposed placement.

3.02 CURING AND PROTECTION

A. Curing – The air in contact with the CLSM should be maintained at temperatures above freezing for a minimum of 72 hours. If the CLSM is subjected to temperatures below 32 degrees F (0 degrees C), the material may be rejected by the Commissioner if damage to the material is observed.

B. Protection – the CLSM will not be subject to loads and will remain undisturbed by construction activities for a period of 48 hours or until a compressive strength of 15 psi (105 kPa) is obtained. The Contractor will be responsible for providing evidence to the Commissioner that the material has reached the desired strength. Acceptable evidence will be based upon compression tests made in accordance with Section 2.02.

3.03 MATERIAL ACCEPTANCE

A. Acceptance of CLSM delivered and placed as shown on the Drawings or as directed by the Commissioner will be based upon mix design approval and batch tickets provided by the Contractor to confirm that the delivered material conforms to the mix design. The Contractor will verify by additional testing, each 150 cubic yards of material used, but perform a minimum of one set of compressive strength specimens per day. Verification will include confirmation of material proportions and tests of one set of compressive strength specimen per day to confirm that the material meets the original mix design and the requirements of CLSM as defined in this Specification. Adjustments will be made as necessary to the proportions and materials prior to further production.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. CLSM, unless otherwise specified, will not be measured separately for payment but will be included in the unit of measurement for the associated utility pipe and/or structure, and no additional compensation will be allowed.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

A. No separate payment will be made for CLSM unless otherwise specified. All costs associated with this work will be included in the unit price of the associated pay item as detailed in these specifications and as noted in the plan details.

END OF SECTION P-153

FROST PROTECTION COURSE
SECTION P-154

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item consist of a subbase course, hereinafter referred to as the frost protection course, composed of granular materials constructed on a prepared subgrade or underlying course or stabilization course in accordance with these Specifications, and in conformity with the dimensions and typical cross section shown on the Drawings, or as directed by the Commissioner. The work under this Section is subject to the requirements of the Contract Documents.

1.02 RELATED WORK

A. As specified in the following Sections:

1. Section P-152 Excavation and Embankment

2. Section P-629 Geotextile Fabric

3. Section 02245 Recycled Asphalt Pavement

PART 2 - MATERIALS

2.01 GENERAL:

A. The frost protection material must consist of crushed stone or crushed recycled concrete having a gradation of CA-1, CA-6, CA-5, Recycled Concrete Base (RCB) or as specified on the Drawings, conforming to the requirements of the Illinois Department of Transportation, Standard Specifications for Road and Bridge Construction (S.S.R.B.C.), latest edition. The material must be Class D quality or better. The portion of the frost protection material passing a No. 40 sieve must have a plasticity index of not more than 4 when tested in accordance with ASTM D 4318.

B. The materials to be used for Stabilization Stone must consist of crushed stone or crushed recycled concrete having a gradation of CA-6 or CA-1 as directed by the Commissioner, quality Class D or better, conforming to the requirements of Article 1004.01 of the S.S.R.B.C.

C. Where crushed recycled concrete (CA-1, CA-6, CA-5, and RCB) are used for frost protection course or stabilization stone, they must be produced

on site by the Contractor by crushing Portland cement concrete from the O'Hare stockpiles only. They must be crushed from clean rubble obtained from pavement removal or foundations from O'Hare Airport projects. Refer to relevant provisions of Section 02245 Recycled Crushed Concrete and Asphalt.

D. For the material to be used for the geotextile fabric, see Section P-629.

PART 3 - CONSTRUCTION METHODS

3.01 GENERAL:

A. The frost protection course must be placed where designated on the Drawings or as directed by the Commissioner. The material must be shaped and thoroughly compacted within the tolerances specified.

B. Stabilization stone must only be placed in areas of severely adverse subgrade conditions and as directed by the Commissioner.

C. Granular subbases which, due to grain sizes or shapes, are not sufficiently stable to support without movement the construction equipment, must be mechanically stabilized to the depth necessary to provide such stability as directed by the Commissioner. The mechanical stabilization must principally include the addition of a fine-grained medium to bind the particles of the subbase material sufficiently to furnish a bearing strength, so that the course will not deform under the traffic of the construction equipment. The addition of the binding medium to the subbase material must not increase the soil constants of that material above the limits specified.

D. The frost protection course and stabilization stone must be placed in accordance with the requirements of Section 311 of the S.S.R.B.C. for Type B except as modified herein.

3.02 OPERATION IN PITS:

A. All work involved in clearing and stripping pits and handling unsuitable material encountered must be performed by the Contractor at his/her expense. The frost protection and stabilization stone material must be obtained from pits or sources that have been accepted by the Commissioner. The material in the pits must be excavated and handled in such a manner that a uniform and satisfactory product can be secured.

3.03 PREPARING UNDERLYING COURSE:

A. Before any frost protection or stabilization stone material is placed, the underlying course must be prepared and conditioned as specified. The course must be checked and accepted by the Commissioner before placing and spreading operations are started. The subgrade must be compacted in accordance with the requirements of Section P-152 "Excavation and Embankment." Immediately before placement of the frost protection course, the subgrade must be proof-rolled with a 25 ton or heavier pneumatic tired roller making at least 8 passes over the entire area in alternate (perpendicular) directions or a fully loaded semi-truck loaded to the legal limit at the Commissioner's discretion.

B. Grade control between the edges of the pavement must be by means of grade stakes, steel pins, or forms placed in lanes parallel to the centerline of the pavement and at intervals which will permit string lines or check boards to be placed between the stakes, pins, or forms.

C. In areas where the Commissioner directs the Contractor to over-excavate below subgrade level and backfill the over-excavation with stabilization stone, the stabilization stone must be placed on a layer of non-woven geotextile filter fabric per Section P-629, leveled and compacted to make the subgrade firm and stable. Areas of undercut of 6 inches or less must be stabilized with CA-6, crushed stone or crushed recycled concrete and areas of undercut greater than 6 inches must be stabilized with crushed stone or crushed recycled concrete, CA-1 capped to subgrade level with 4 inches of CA-6. All undercut and backfill work to be directed by the Commissioner.

D. To protect the subgrade and to ensure proper drainage, the spreading of the frost protection course must begin along the centerline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

3.04 MATERIALS ACCEPTANCE IN EXISTING CONDITION:

A. When the entire frost protection or stabilization stone material is secured in a uniform and satisfactory condition and contains approximately the required moisture, such approved material may be moved directly to the spreading equipment for placing. The material may be obtained from gravel pits, stockpiles, or may be produced from a crushing and screening plant with the proper blending. The materials from these sources must meet the requirements for gradation, quality, and consistency. It is the intent of this section of the Specifications to secure materials that will not require further mixing. The moisture content of the material must be approximately that required 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 must be blading or dragging, if necessary, to obtain a smooth uniform surface true to line and grade.

3.05 PLANT MIXING:

A. When materials from several sources are to be blended and mixed, the material must be processed in a central or travel mixing plant. The material must be thoroughly mixed with the required amount of water. After the mixing is complete, the material must be transported to and spread on the underlying course without undue loss of the moisture content.

3.06 GENERAL METHODS FOR PLACING:

A. The frost protection course must be constructed in layers. Any layer must be not more than 6 inches thickness for CA-6; nor more than 12 inches for CA-5, CA-1, or RCB. The material, as spread, must be of uniform gradation with no pockets of fine or coarse materials. The frost protection course, unless otherwise permitted by the Commissioner, must not be spread more than 2,000 square yards in advance of the rolling. Any necessary sprinkling must be kept within this limit. No material will be placed in snow or on a soft, muddy, or frozen course.

B. When more than one layer is required, the construction procedure described herein must apply similarly to each layer.

C. During the placing and spreading, sufficient caution must be exercised to prevent the incorporation of subgrade, shoulder, or foreign material in the frost protection course mixture.

D. Where geotextile fabric is required to be placed under the frost protection course, it must be placed over the subgrade in accordance with the manufacturer's recommendations and Section P-629. The fabric must be non-woven. In areas of undercut and backfill, the fabric must be placed over the backfill at the top of subgrade level. The frost protection course material must be back-dumped on the fabric in a sequence of operations beginning at the outer edges of the area with subsequent placement toward the middle. Dumping of the material directly on the fabric will only be permitted to establish an initial working platform. No vehicles or construction equipment will be allowed on the fabric prior to the placement of the frost protection course. Fabric which is damaged during installation or subsequent placement of frost protection course must be

repaired or replaced by the Contractor at his own expense to the satisfaction of the Commissioner.

3.07 FINISHING AND COMPACTING:

A. After spreading or mixing, the material must be thoroughly compacted by rolling and sprinkling, when necessary. Sufficient rollers must be furnished to adequately handle the rate of placing and spreading of the frost protection course.

B. The field density of the compacted material under aircraft pavements must be at least 100 percent of the maximum density of laboratory specimens prepared from samples of the subbase material delivered to the jobsite for CA-6 material. The laboratory specimens must be compacted and tested in accordance with ASTM D 1557. The in-place field density shall be determined using a nuclear gage in accordance with ASTM D6938.

C. The course must not be rolled when the underlying course is soft or yielding or when the rolling causes undulation in the subbase. When the rolling develops irregularities to the CA-6 that exceed 1/2-inch when tested with a 16-foot straightedge, the irregular surface must be loosened and then refilled with the same kind of material as that used in constructing the course and again rolled as required above. Irregularities in the CA-5 or RCB placement must not exceed ½ inch and must be checked by means of surveying.

D. The field density of the compacted CA-6 material for runway and taxiway shoulders, FAA access roads, haul roads and service roads must be at least 95% of the maximum density of laboratory specimens when compacted and tested in accordance with ASTM D1557. The in-place field density shall be determined using a nuclear gage in accordance with ASTM D6938.

E. CA-1 and CA-5 must be compacted to consolidation in a manner approved by and to the satisfaction of the Commissioner. They must be rolled to consolidate and lock the aggregates into stable layers.

F. Verification of consolidation and interlocking of the RCB will be performed via a rolling pattern procedure. The rolling pattern will be developed by recording the number of passes of a vibratory roller needed to ensure proper consolidation and interlocking of the RCB material using survey elevation data. The RCB will be installed in twelve (12) inch lifts and rolled an acceptable number of times until survey data shows that the consolidation of the material is negligible and to the acceptance of the Commissioner. The specified number of passes, determined by the

rolling pattern, will be the required amount of passes used for the RCB material and that particular vibratory roller for the project. If the Contractor wishes to change vibratory rollers during the project, then a new rolling pattern must be developed. The Contractor must verify the rolling pattern once per week or every time a new piece of equipment is used. The rolling pattern development must be performed in the presence of and to the satisfaction of the Commissioner. The Contractor will perform a rolling pattern verification whenever the Commissioner deems it is needed to properly control the process or the Commissioner deems the process out of control.

G. Along places inaccessible to rollers, the subbase material must be tamped thoroughly with mechanical or hand tampers.

H. Sprinkling during rolling, if necessary, must be in the amount and by equipment acceptable to the Commissioner. Water must not be added in such a manner or quantity that free water will reach the underlying layer and cause it to become soft.

3.08 ACCEPTANCE SAMPLING AND TESTING

A. CA-6, CA-5, CA-1 and RCB shall be accepted for gradation and density or consolidation as specified herein. Sampling locations shall be determined on a random basis in accordance with statistical procedures contained in ASTM D3665. Sampling of aggregates shall be in accordance with ASTM D75.

B. One gradation test per ASTM C136 must be run per 5000 tons per aggregate type delivered or a minimum of one test per week, whichever is more frequent, or when materials substantially change as determined by the Commissioner. The aggregate type will be accepted for gradation when it falls within the limits and tolerances specified for CA-6, CA-5, CA-1 and RCB. If the proper gradation is not attained, the gradation test will be repeated. A material that does not pass the gradation after retest shall be rejected and replaced by the Contractor at the Contractor's expense.

C. For CA-6, each lift must be tested for density; a minimum of one test must be taken for each 250 cubic yards of material placed per layer, or as directed by the Commissioner. The material will be accepted for density when the field density is at least the specified percent of the maximum density of the laboratory specimen prepared from samples delivered to the job site. If the specified density is not attained, the material shall be reworked and additional random density tests made. This procedure shall be followed until the specified density is reached.

D. Consolidation of the RCB will be accepted if the proper rolling pattern had been utilized during the installation of the material, all aggregate interlock is complete and the consolidation effort has been checked. The consolidation effort will be checked via the survey data per P-154.3.07.F every 400 LF/lift installed.

3.09 SURFACE TEST:

A. After the course is completely compacted, the surface must be tested for smoothness and accuracy of grade and crown; any portion found to lack the required smoothness or to fail in accuracy of grade or crown must be scarified, reshaped, recompacted, and otherwise manipulated as the Commissioner may direct until the required smoothness and accuracy are obtained. The finished surface must not be above the theoretical vertical grade and may not vary more than 1/2-inch when tested with a 16 foot straightedge applied parallel with, and at right angles to the centerline. Surface test may be made by means of survey and/or templates.

3.10 THICKNESS:

A. The thickness of the completed subbase course must be determined by depth tests, survey, or cores conducted by the Contractor taken at intervals so each test must represent no more than 500 square yards. When the deficiency in thickness is more than 1/2 inch, the Contractor must correct such areas by scarifying, adding satisfactory mixture, rolling, sprinkling, reshaping, and finishing in accordance with these Specifications. The Contractor must replace at his/her expense the frost protection material where borings are taken for test purposes.

3.11 PROTECTION:

A. Work on frost protection course must not be conducted during freezing temperature nor when the subgrade is wet. When the subbase material contains frozen material or when the underlying course is frozen, the construction must be stopped.

3.12 MAINTENANCE:

A. Following the final shaping of the material, the subbase must be maintained throughout its entire length by the use of standard motor graders and rollers until, in the judgment of the Commissioner, the frost protection course meets all requirements and is acceptable for the construction of the next course. The Contractor is totally responsible for the preparation, maintenance and protection of the frost protection course and no additional compensation will be considered for any reworking of the material for any reason.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT:

A. Frost protection course to be paid for will be the number of cubic yards of frost protection material of a variable thickness based on average cross-sectional area per Drawing dimensions multiplied by the length placed, compacted and accepted in the completed course. The quantity of frost protection and granular subbase course material will be measured in final position based on surface area, or by means of average end areas computed from depth dimensions in the Drawings. Frost protection and granular subbase materials will not be included in any other excavation quantities.

B. Undercut and backfill with stabilization stone will be paid for in accordance with and under Specification Section P-152.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT:

A. Payment will be made at the Contract unit price per cubic yard for RCB (if approved by the Commissioner), CA-5 and CA-7 frost protection course. This price will be full compensation for furnishing all materials including geotextile fabric; for all preparation, hauling, placing and compacting of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

B. Payment will be made under the following items:

ITEM NO.	DESCRIPTION	UOM
P-154-01	PAVING - FROST PROTECTION COURSE, CA-7	CY
P-154-02	PAVING - FROST PROTECTION COURSE, CA-5	CY

END OF SECTION P-154

TEMPORARY AIR AND WATER POLLUTION, SOIL EROSION, AND SEDIMENT CONTROL
SECTION P-156

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item consists of temporary control measures as shown on the Plans or as ordered by the Commissioner during the life of a Contract to control water pollution, soil erosion, and sediment control through the use of erosion control blankets, temporary seeding, inlet and pipe protection, and other erosion control devices or methods.

B. This special provision will be used in conjunction with the plan documents and the Storm Water Pollution Prevention Plan (SWPPP).

C. The Contractor must control soil erosion in accordance with the provisions of NPDES permit issued by the Illinois Environmental Protection Agency (IEPA) for stormwater discharges from construction site activities.

D. The Contractor must meet the Specifications of the Illinois Urban Manual (latest edition, published by IEPA and Illinois Natural Resources Conservation Service), as modified in the Contract Drawings and Specifications.

E. The Contractor must coordinate temporary erosion control measures with the permanent erosion control measures to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

F. Temporary erosion control is not limited to areas within the construction limits; construction operations at sites such as borrow pits, equipment and material storage sites, waste areas, temporary stock piles, temporary plant sites, and others are also subject to erosion control requirements.

G. The best way to prevent sediment from entering storm sewer systems and waterways is to stabilize the disturbed areas of a site as quickly as possible, preventing erosion and stopping sediment transport at its source.

H. Prior to commencing land disturbing activities other than those indicated on the Plans (including but not limited to additional phases of

the development and off-site borrow, waste, asphalt and/or concrete batch plant areas) a supplemental erosion and sediment control plan must be submitted to the Commissioner for review and approval by North Cook County Soil and Water Conservation District (NCCSWCD) or Kane DuPage Soil and Water Conservation District (KDSWCD).

1.02 REFERENCES

A. Illinois Department of Transportation - Standard Specifications for Road and Bridge Construction, latest edition (SSRBC).

B. Illinois Urban Manual: A Technical Manual for Urban Ecosystem Protection and Enhancement, latest edition. United States Department of Agriculture, Natural Resources Conservation Service, Champaign, Illinois.

1.03 DEFINITIONS

A. Channels: All ditches and watercourses will be considered “channels.”

1.04 SUBMITTALS

A. Contractor to submit Product Data – catalogs, brochures, and performance and test data to support conformance with the Specifications for the materials to include but not limited to:

B. Temporary Seed – Signed statement by Vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing, within 6 months of delivery. Statement must include: name and address of laboratory, date of test, lot numbers for each kind of seed, results of the tests as to seed name, percentages of purity, and of germination, and in case of mixture, and the proportion of each kind of seed.

C. Erosion Control Blanket

D. Fertilizer

E. Sediment Containment Filter Bag

F. Inlet Protection

G. Concrete Washout Facility – 30 mil polyethylene liner

PART 2 - MATERIALS

2.01 SEEDING, TEMPORARY

A. Temporary Protection by Vegetation.

1. Seed:

a. For disturbed areas that will not be in the active work area between 14 days and 365 days, seed must be applied at the following rates:

(1) Seed with 90 lbs. per acre of cereal rye and 25 lbs. per acre of perennial ryegrass, or

(2) Seed with 90 lbs. per acre of spring oats and 25 lbs. per acre of perennial ryegrass.

Mixture	Temporary Grass Seed Mixture	Lbs/acre (pure live seed)
1	Cereal rye Perennial ryegrass	90 25
2	Spring Oats Perennial ryegrass	90 25

2.02 EROSION CONTROL BLANKET

A. Erosion Control Blanket must consist of a machine produced mat of straw fiber and must be furnished in rolls that meet the following requirements. Acceptable manufacturers include North American Green, Enviroscape ECM, Ltd., and U.S. Construction Fabrics LLC.

B. The appropriate type of Erosion Control Blanket (short term or long term) must be installed as shown on the Drawings.

C. Slopes 4 to 1 or greater, channels, ditches, swales, conveyances, flow lines, and other areas of concentrated flow that may be subject to

erosion, must be stabilized with Erosion Control Blanket as shown on the Drawings and as required below.

1. Slopes greater than 4 to 1 and all channels, swales, conveyances, flow lines, etc., must be stabilized at a minimum with a double net erosion control blanket that meets a maximum shear stress of 1.5 lbs/ft² and a minimum tensile strength of 50 lbs/ft.

2. Slopes of 4 to 1 must be stabilized at a minimum with a single net erosion control blanket that meets a maximum shear stress of 0.5 lbs/ft² and a minimum tensile strength of 5 lbs/ft.

3. Slopes less than 4 to 1 do not require erosion control blanket unless indicated on the Drawings, in which case, a single net erosion control blanket that meets a maximum shear stress of 0.5 lbs/ft² and a minimum tensile strength of 5 lbs/ft. shall be used.

D. "U" shaped staples must consist of 0.12 inch diameter (No. 11 wire gage) or greater, with a minimum leg length of 6 inches and a minimum width of 1 inch and must be used to anchor the Erosion Control Blanket. In sandy soils, the minimum leg length of the staples must be 9 inches. Push pins or circle top pins are acceptable and must meet the material specifications stated above.

2.03 FERTILIZER

A. Fertilizer must meet the Specifications of Section T-901, Seeding. Fertilizer must be a standard commercial grade and must conform to all federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

2.04 SEDIMENT CONTAINMENT FILTER BAG

A. Sediment Control Filter Bags must be ACF Environmental ERO-TEX dewatering filter bag, US Fabrics filter bag, or JMD Enviro-Protection filter bag as approved by the Commissioner, of the size required to adequately filter pumped water per the manufacturers' specifications.

2.05 INLET PROTECTION

A. Materials for Above Ground Inlet protection must be per manufacturer's specification, and as approved by the Commissioner. Acceptable products for above ground inlet protection include the following:

1. Dandy Bag, Curb Bag, and Dandy Pop by Dandy Products

2. Sediguard Inlet Protection Device by Earth Support Systems

3. Storm Drain Inlet Frame and Filter Assembly by Silt Saver Sediment Control Products

B. Materials for Below Ground Inlet protection must be per manufacturer's specification, and as approved by the Commissioner. Acceptable products for below ground inlet protection include the following:

1. Catch-All Inlet Protector by Mar-Mac Manufacturing Co., Inc.

2. Dandy Sack and Dandy Curb Sack by Dandy Product

3. SedCatch Sediment Basket by SedCatch Environmental Products

C. Inlet protection is only to be used as a filter for sheet flow or in conjunction with a sediment containment filter bag. Inlet protection is not to be used as a filter for dewatering directly to the structure.

2.06 TEMPORARY CONCRETE WASHOUT FACILITY

A. Install a device to control concrete wastes to prevent both on-site and off-site pollution. The device must be installed on any construction site where concrete is used.

B. Temporary concrete washout facility must be in accordance with CCA/CDA Standard Detail No. 7-03-02II Barrier Type or 7-03-02JJ Earthen Type or 7-03-02KK Straw Bale Type.

C. Temporary concrete washout facilities must be supplied in sufficient quantity and size to manage all liquid and solid wastes generated by washout operations.

D. The walls of above grade facilities may be constructed of straw bales, barrier walls, or earthen berms. Straw bales and barrier walls must be butted tightly end-to-end. All types of concrete washout facilities must be lined with a 30-mil polyethylene liner free of holes and tears and must be secured using sandbags, 6" wire staples, or other anchors, as approved by the Commissioner.

2.07 SEDIMENT LOG AND GEOSYNTHETIC CHECK STRUCTURE

A. Material for Sediment Logs must be either American Excelsior Company standard 12-inch diameter Curlex Sediment Log, North

American Green Straw Wattle, Western Excelsior Excel Aspen Excelsior Logs or similar 12-inch diameter (minimum) and as approved by the Commissioner.

B. Material for Geosynthetic check structure must be rigid or foam pad wrapped with geosynthetic fabric material meeting requirements of the Illinois Urban Manual material Specification 592. Fabric material must be stapled in a 3 to 6 inch trench on the upstream end and securely stapled to the ground on both sides of the check structure.

2.08 OTHER

A. All other materials must meet commercial grade standards and must be approved by the Commissioner before being incorporated into the Project.

PART 3 - CONSTRUCTION METHODS

3.01 GENERAL

A. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal, state, or local agencies, the more restrictive laws, rules, or regulations must apply.

3.02 SCHEDULE

A. Prior to the start of construction, the Contractor must submit schedules (timing for erosion control work to be performed relative to other construction items) for accomplishment of temporary and permanent erosion control work. The Contractor must also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of waste materials. Work must not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the Commissioner and initial erosion control items have been properly installed.

3.03 AUTHORITY OF COMMISSIONER

A. The Commissioner has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, to limit the surface area of erodible earth material exposed by excavation, borrow and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment.

3.04 TEMPORARY STOCKPILES

A. Stockpile Sediment and Erosion Control. If a stockpile is to remain in place more than 3 days, perimeter barrier must be installed and "tracking" with machinery (tracking up and down the slope parallel to the direction of the slope, such that the track cleat marks are perpendicular to the direction of the slope in order to prevent the development of erosion rills/gullies) must be provided. If the construction activity temporarily or permanently ceased and construction activity will not occur for a period of 14 days, temporary stabilization must be provided for each stockpile within 1 working day after activity has ceased. If the stockpile is to remain inactive for more than 365 days, the stockpile must be permanently seeded per Contract Specifications. Stockpile sediment and erosion control can include Temporary Seeding, Permanent Seeding, Polymer, Silt Fence, Erosion Control Blanket, or other methods approved by the Commissioner. Contractor must maintain the installed sediment and erosion control measures for the duration of the Project or until the Contractor's responsibilities for maintenance cease as determined by the Commissioner.

3.05 INLET PROTECTION

A. All inlets to storm sewers that will potentially be affected by the Contractor's construction activities must be protected with Inlet Protection barriers. Above ground and below ground inlet protection meeting manufacturer's specification and as approved by the Commissioner must be installed at the direction of the Commissioner.

B. Inlet protection must be constructed before upslope land disturbance begins and before the storm drain becomes operational.

C. The inlet protection barriers must allow for overflow from a severe storm event.

3.06 EROSION CONTROL BLANKET

A. The erosion control blanket (single, double net) must be installed in accordance with the Manufacturer's specification and requirements. The erosion control blanket must be in firm contact with the soil. It must be anchored per the manufacturer's recommendation with the proper number and spacing of wire staples. The staples must be the proper width and length to meet the Manufacturer's specification. On slopes and in channels the blanket must be unrolled upstream to downstream parallel to the direction of flow. The upstream end and at the top of the slope, each blanket must be anchored in a minimum 6-

inch deep anchor trench. The blankets must be laid like shingles, i.e., ends and edges of blanket sections must be overlapped in rows in the direction of flow.

B. The type of erosion blanket must be based on the flow velocity and shear force in the channel.

3.07 TEMPORARY SEEDING

A. This work consists of the temporary seeding of unfinished, disturbed areas as designated by the Commissioner within the construction site.

B. Except as provided herein, stabilization measures must be initiated as soon as practical in portions of the site where construction activities have temporarily or permanently ceased.

1. Disturbed areas that will not be in the active work area for 14 to 90 days must be seeded within 24 hours after suspension of work in the area with no fertilizer or seedbed preparation, or, must be seeded within 7 working days after suspension of work in the area with no fertilizer and with rough seedbed preparation.

a. During dormant seasons (between June 15 and August 15 and between November 15 and December 31 or until the ground becomes frozen) mulch must be applied.

2. Disturbed areas that will not be in the active work area for 90 to 365 days must be seeded and fertilized within 24 hours after suspension of work in the area with no seedbed preparation, or, must be seeded and fertilized within 7 working days after suspension of work in the area with rough seedbed preparation.

a. During dormant seasons (between June 15 and August 15 and between November 15 and December 31 or until the ground becomes frozen) mulch must be applied.

3. Disturbed areas that will not be in the active work area for longer than one year must be seeded and fertilized in accordance with Section T-901 (Seeding) within 7 working days after suspension of work in the area with seedbed preparation.

C. Where the initiation of stabilization measures by the 7th day after construction activity temporary or permanently cease is precluded by snow cover, stabilization measures must be initiated as soon as practical.

D. Where construction activity will resume on a portion of the site within 14 days from when activities ceased, (e.g. the total time period that construction activity is temporarily ceased is less than 14 days) then stabilization measures do not have to be initiated on that portion of site by the 7th day after construction activity temporarily ceased.

E. Dates: Temporary seeding must occur between March 15 and October 1. If protection is required outside of these dates, mulch must be used.

F. Seed Bed Preparation: Seedbed preparation must be as described in Section T-901, Seeding. A rough seedbed must be obtained with a minimum of one pass with a disc harrow.

G. Fertilization of Temporary Vegetation. The Contractor must perform soil tests to determine the amount of fertilizer necessary. The following rates of fertilizer application are the benchmark application rates per acre, but the Contractor must aim to minimize the amount of fertilizer used, while still allowing for the healthy growth of the seed.

1. Nitrogen (N) - 120 pounds of N

2. Phosphorus (P) - 60 pounds of P_20_5

3. Potassium (K) - 60 pounds of K_20

3.08 RIPRAP AND COARSE AGGREGATE

A. Riprap and Coarse Aggregate are specified for use in several erosion control items as shown on the detail Drawings.

B. Where filter fabric is required on the Drawings, the fabric must conform to the Illinois Urban Manual material Specification 592 Geotextile.

C. Coarse aggregate and riprap or rock/reclaimed concrete for Culvert Inlet Stone Protection, Rock Check Dams, Temporary Sediment Trap, Stabilized Construction Entrance, Construction Road Stabilization, and Temporary Steam Crossing must be placed in accordance with the IL Urban Manual construction Specification 25 Rockfill, using Method 1 and Class III compaction.

1. Foundations for rockfill must be stripped to remove vegetation and other unsuitable materials. Earth foundation surfaces must be graded to remove surface irregularities and cavities filled with compacted earthfill of approximately the same kind and density as the adjacent foundation material. Rockfill and/or bedding

must not be placed until the foundation preparation is completed and the foundation or excavations have been inspected and approved by the Commissioner.

2. When a bedding layer beneath rockfill is specified, the bedding material must be spread uniformly on the prepared subgrade surfaces to the depth indicated.

3. Reclaimed concrete materials must be free from reinforcing bars.

4. For Method 1 placement, the rock must be dumped and spread into position in approximately horizontal layers not to exceed 3 feet in thickness. It must be placed in a manner to produce a reasonably homogeneous stable fill that contains no segregated pockets of large or small fragments or large unfilled rock fragments.

5. Moisture content of the bedding material must be controlled to ensure that bulking of the sand material does not occur.

6. Class III Compaction of Rockfill and Bedding – No compaction will be required beyond that resulting from the placing and spreading operations.

D. Riprap for Pipe Outlets and Structural Streambank Stabilization must be placed in accordance with the Illinois Urban Manual construction Specification 61 Rock Riprap.

1. The subgrade surfaces on which the rock riprap, filter, bedding or geotextile is to be placed must be cut or filled and graded to the lines and grades as shown on the Drawings. When fill to subgrade lines is required, it must consist of approved materials and conform to the requirements of the specified class of earthfill. Rock riprap, filter, bedding or geotextile must not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the Commissioner.

2. Equipment–Placed Rock Riprap

The rock riprap must be placed by equipment on the surfaces and to the depths specified. The rock riprap must be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials.

The rock for riprap must be delivered and placed in a manner that will ensure that the riprap in-place will be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface. Rock riprap must be placed in a manner to prevent damage to structures. Hand placing will be required or necessary to prevent damage to any new and existing structures.

3. Hand–Placed Rock Riprap

The rock riprap must be placed by hand on the surfaces and to the depths specified. It must be securely bedded with the larger rocks firmly in contact one to another without bridging. Spaces between the larger rocks must be filled with smaller rocks and spallo. Smaller rocks must not be grouped as a substitute for larger rock. Flat slab rock must be laid on its vertical edge; except where it is laid like paving stone and the thickness of the rock equals the specified depth of the riprap course.

4. When the Drawings specify filter, bedding or geotextile beneath the rock riprap, the designated material must be placed on the prepared surface as specified. Compaction of filter or bedding aggregate will not be required, but the surface of such material must be finished reasonably smooth and free of mounds, dips, or windrows.

3.09 STABILIZED CONSTRUCTION ENTRANCE / EXIT

A. Construction entrance / exit must be used at all points of construction ingress and egress to the public road.

B. The aggregate for the construction entrance / exit must meet the requirements of IDOT SSRBC and Geotextile Fabric must meet the requirements of the Illinois Urban Manual material Specification 592.

C. Each construction entrance / exit must meet the following minimum dimensions: thickness of 6 inches, width of 14 feet; but not less than full width of ingress or egress point, and length of 70 feet. Filter fabric must be installed under aggregate to minimize the migration of the stone into the underlying soil.

3.10 DEWATERING

A. Sump Pit. Pumping water from open trenches or other areas must be performed in a manner to minimize the turbidity of the pumped water in accordance with CCA Detail No. 7-03-02E (Illinois Urban Manual IL-650). The pumping operation must start with the installation of the intake hose into the Sump Pit and then discharge directly into a sediment trap, stabilized ditch, temporary stabilized ditch that leads to a sediment trap, designed treatment channel, sediment containment filter bag, or another Best Management Practice (BMP) that is approved by the Commissioner.

B. Sediment Containment Filter Bag. When water cannot be pumped directly to a sediment trap, or site conditions call for use of an additional layer of erosion control, water must be pumped directly into a Sediment Containment Filter Bag. Sediment Containment Filter Bags must be used according to the manufacturer's instructions, as modified by the Contract Drawings and Specifications. Sediment Containment Filter Bag must be placed flat on a stabilized surface as shown in the Drawings.

3.11 TEMPORARY STOCKPILES

A. Stockpile Sediment and Erosion Control. If a stockpile is to remain in place more than 3 days, perimeter barrier must be installed and "tracking" with machinery (tracking up and down the slope parallel to the direction of the slope, such that the track cleat marks are perpendicular to the direction of the slope in order to prevent the development of erosion rills/gullies) must be provided. If the construction activity temporarily or permanently ceased and construction activity will not occur for a period of 14 days, temporary stabilization must be provided for each stockpile within 1 working day after activity has ceased. If the stockpile is to remain inactive for more than 365 days, the stockpile must be permanently seeded per Contract Specifications. Stockpile sediment and erosion control can include Temporary Seeding, Permanent Seeding, Polymer, Silt Fence, Erosion Control Blanket, or other methods approved by the Commissioner. Contractor must maintain the installed sediment and erosion control measures for the duration of the Project or until the Contractor's responsibilities for maintenance cease as determined by the Commissioner.

3.12 INLET AND PIPE (CULVERT) PROTECTION

A. All inlets to storm sewers that will potentially be affected by the Contractor's construction activities must be protected with Inlet and

Pipe Protection barriers. Coarse Aggregate for culvert protection, above ground and below ground inlet protection meeting manufacturer's specification and as approved by the Commissioner must be installed at the direction of the Commissioner.

B. Inlet protection must be constructed before upslope land disturbance begins and before the storm drain becomes operational.

C. The inlet protection barriers must allow for overflow from a severe storm event.

3.13 MAINTENANCE OF TEMPORARY CONCRETE WASHOUT FACILITY

A. Perform washout of concrete trucks in designated areas only. Each temporary washout facility must have appropriate signage to inform concrete truck drivers and equipment operators of the proper washout locations. The concrete washout facility must be installed prior to any concrete placement on site.

B. Each facility must be located in an area protected from possible damage from construction traffic and have stabilized access to prevent tracking onto streets. Washout facilities must be located on level ground a minimum of 50 feet from storm drain inlets and open drain facilities. For smaller sites where the distance criteria may not be practical, washout facilities must be located as far from drainage facilities as possible and additional inspections must be conducted to ensure no illicit discharges occur.

C. Washout water from low volume facilities must be allowed to evaporate and not be discharged into the environment. Washout water from high volume facilities must be removed with a vacuum truck and taken back to the batch plant.

D. Solidified concrete waste from washout facilities shall be considered Clean Construction or Demolition Debris (CCDD) as per the Illinois Environmental Protection Act (415 ILCS 5) and must be disposed of in accordance to the Act.

E. Temporary concrete washout facilities must be maintained to provide adequate holding capacity with a minimum freeboard of 4 inches for above grade facilities and 12 inches for below grade facilities. Existing facilities must be cleaned, or new facilities must be constructed and ready for use once the washout is two-thirds full.

F. Maintaining temporary concrete washout facilities must include removing and disposing of hardened concrete or slurry and waste in

accordance with Federal and State regulations or as directed by the Commissioner, and returning the facilities to a functional condition.

G. When temporary concrete washout facilities are no longer required for the Work, the facilities must be removed from the site. Holes, depressions, or other ground disturbances caused by the removal must be restored to the satisfaction of the Commissioner. The disturbed area must be seeded and mulched or otherwise stabilized in a manner acceptable to the Commissioner.

3.14 CONSTRUCTION DETAILS

A. The Contractor must incorporate all permanent erosion control features into the Project at the earliest practical time as outlined in the accepted schedule.

B. Temporary erosion and pollution control measures must be used (1) to correct conditions that develop during construction that were not foreseen during the design stage; (2) where needed prior to installing permanent control features; or (3) to temporarily control erosion that develops during normal construction practices, but are not associated with permanent control features on the Project.

C. Where erosion is likely to be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately thereafter if the Project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages.

D. The Commissioner will limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures must be taken immediately to the extent feasible and justified.

E. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or are ordered by the Commissioner, such work must be performed by the Contractor at his/her own expense.

F. The Commissioner may increase or decrease the area of erodible earth material to be exposed at one time as determined by analysis of Project conditions.

G. The erosion control features installed by the Contractor must be maintained by the Contractor during the construction period to the satisfaction of the Commissioner.

H. Whenever construction equipment must cross watercourses at frequent intervals, temporary structures must be provided.

I. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials must not be discharged into or near rivers, streams, and impoundments or into natural or manmade channels leading thereto. Contractor must dispose all materials properly at an approved location and according to the local regulations.

3.15 OPERATION AND MAINTENANCE

A. All installed erosion control features must, at a minimum, be inspected at least once every 7 days and within 24 hours of a storm event that produces 0.5 inches of rain or more during a 24-hour period, in accordance with NPDES permit.

B. Removal. Unless incorporated into the permanent stormwater management system, all erosion control features must be removed and properly disposed of once final grading and stabilization has been completed, or at the direction of the Commissioner.

C. Surplus or waste material. Surplus or waste material resulting from riprap operations must be disposed of by the Contractor at his own expense.

D. The Contractor must be solely responsible for the maintenance of all soil erosion devices installed by the Contractor. Maintenance must be completed as soon as possible with consideration to site conditions.

E. For each specific Erosion and Sediment control measure maintenance and inspection, refer to the Illinois Urban Manual Standard practice.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Temporary erosion and pollution control work includes all labor and materials for installation, maintenance, and removal of each erosion control item. Temporary erosion and pollution control work required which is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls must be performed as scheduled or ordered by the Commissioner. Completed and accepted work will be measured as follows:

1. Inlet Protection: This work must include furnishing, installing, maintaining and removing Inlet Protection barriers and will be measured for payment per each in place of the type specified.

2. Erosion Control Blanket (single or double net): This work must include furnishing, installing and maintaining Erosion Control Blanket and will be measured for payment in square yards in place, for the type specified.

3. Sediment Containment Filter bags: This work must include furnishing, bedding, maintaining, and disposing of Sediment Containment Filter bags but will be considered included in the Contract. No separate payment will be made for Sediment Containment Filter bags.

4. Temporary Seeding: This work must include furnishing, installing and maintaining seed for erosion control and will be measured for payment per acre installed for the seed mix specified.

5. Pumping: Pumping water from excavated trenches or other areas will be considered included in the work item to which it pertains and will not be paid for separately.

6. Temporary Concrete Washout Facilities: Construction, maintenance, and removal of temporary concrete washout facilities will not be measured for payment; but will be considered included in the Contract. No separate payment will be made for temporary concrete washout facilities.

7. Stabilized Construction Entrance / Exit: This work must include furnishing, installing, maintaining, and removing Stabilized Construction Entrance / Exit as shown on Plans and will be measured for payment in square yards in place.

8. Stabilization and erosion control of borrow sites will not be measured separately for payment but will be considered included and incidental to excavation work or the overall Project.

B. Control work performed for protection of construction areas outside the construction limits, such as borrow and waste areas, haul roads, equipment and material storage sites, and temporary plant sites, will not be measured and paid for directly but will be considered as a subsidiary obligation of the Contractor with costs included in the Contract prices bid for the items to which they apply. Routine maintenance of soil erosion control measures will not be paid for separately but must be considered included in the Contract pay items to which they apply. Soil erosion items damaged by Contractor must be immediately replaced at no additional cost to the Contract.

C. Allowance for Supplemental Erosion Control Measures will cover costs of materials, tools, installation, and other required appurtenances for erosion control measures not shown or detailed in the plans, to be installed as directed by the Commissioner.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. Accepted quantities of temporary water pollution, soil erosion, and sediment control work ordered by the Commissioner and measured as provided in paragraph 4.01.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
P-156-01	ALLOWANCE FOR SUPPLEMENTAL EROSION CONTROL MEASURES	AL
P-156-02	SEEDING, TEMPORARY	AC
P-156-03	INLET PROTECTION	EA
P-156-04	EROSION CONTROL BLANKET	SY
P-156-05	STABILIZED CONSTRUCTION ENTRANCE / EXIT	SY

END OF ITEM P-156

TRENCH BACKFILLING
SECTION P-157

PART 1 - DESCRIPTION

1.01 GENERAL:

A. This Section must consist of furnishing, transporting and placing stabilization stone, bedding material, fine aggregate for trench backfill and suitable fill material for all trenches (pipes or duct banks) and structure excavations. The work under this Section is subject to the requirements of the Contract Documents.

PART 2 - MATERIALS

2.01 MATERIALS:

A. Fine aggregate for trench backfill must consist of natural sand or washed crushed limestone having a FA-6 gradation conforming to Section 1003 of the Standard Specifications for Road and Bridge Construction (S.S.R.B.C.), Illinois Department of Transportation, latest edition.

B. Suitable Fill must be as defined in Section P-152.1.03.B.1.a.

C. Bedding Material, except for cathodically protected pipes, must be gravel, crushed gravel, crushed stone, or crushed recycled concrete having a CA-11 gradation conforming to Section 1004 of the Standard Specifications for Road and Bridge Construction (S.S.R.B.C.), Illinois Department of Transportation, latest edition.

D. Stabilization stone must be crushed stone conforming to Section P-154.

E. Where required in the Plans, geotextile filter fabric must comply with the requirements of Section P-629.

PART 3 - CONSTRUCTION METHODS

3.01 METHODS:

A. All trenches and excavations must be backfilled within a reasonable time after the pipes are installed, unless other protection of the pipe is directed. The backfill material must be as specified herein. Backfill

materials and compaction procedures must be acceptable to the Commissioner. In all backfilling, any compressible or destructible rubbish and refuse must be removed from the excavated space before backfilling is started, except that sheeting and bracing must be left in place or removed as the work progresses as specified or directed.

B. Trench excavated with sloped or benches wall must be backfilled for the full width of the trench, as herein specified.

C. All backfill materials must be placed longitudinally along the trench.

D. The backfill material must be brought up evenly on each side of the pipe or duct.

3.02 TRENCH STABILIZATION:

A. If the Commissioner finds that the materials encountered at the elevations specified are unstable and not suitable or in case it is found desirable or necessary to go to an additional depth, the excavation must be carried to a depth where a bearing of at least 1 TSF is achieved, or as the Commissioner may direct in writing. The Contractor must refill such excavated space with Stabilization Stone as specified in Section 2.01.D. Stabilization Stone must be compacted to a firm but slightly yielding condition.

3.03 BEDDING:

A. The pipe laid in trenches must be bedded in accordance with the details shown on the Plans. Bedding material must be as shown, specified or directed. Bedding must be to a minimum of spring line of the pipe. The bedding material must be placed over the stabilization stone or trench subgrade as applicable.

3.04 TRENCH BACKFILL:

A. The fine aggregate for trench backfill must be brought up evenly on each side of the pipe or structure to an elevation 1 foot over the top of the pipe. If the trench is to be under pavement, or within 2 feet of the proposed, future or existing pavement edge, then placement and compaction of the fine aggregate trench backfill must continue until the top of subgrade is reached. If the trench is not under, or adjacent to, existing, proposed or future pavement, then acceptable fill must be placed and compacted from an elevation 1 foot over the top of the pipe to top of subgrade.

3.05 MATERIALS PLACEMENT:

A. Material used as stabilization, bedding and fine aggregate trench backfill to 1 foot over the top of the pipe must be placed by hand in uniform layers not greater than 6 inches in loose thickness and thoroughly compacted in pace. Special care must be taken to secure thorough compaction under the haunches and at the sides of the pipe.

B. Each layer of bedding material and fine aggregate trench backfill to 1 foot over the top of the pipe must be thoroughly tamped and compacted in place with vibratory methods to not less than 90% of maximum dry density as determined by ASTM D 1557.

C. If the backfill placed from 1 foot above the pipe is fine aggregate trench backfill, it must be placed in uniform layers not greater than 9 inches in loose thickness and thoroughly compacted in place with suitable equipment to not less than 95% of the maximum density as determined by ASTM D 1557. Each lift of Suitable Material must be within +/- 2% of optimum moisture content before the succeeding lift is placed. If the backfill is Suitable Material it must be placed in uniform layers not greater than 9 inches in loose thickness and each layer compacted to 85% of maximum density as determined by ASTM D 1557. Backfilling with Suitable Material in uniform layers of 12 inches may be allowed as directed by the Commissioner.

D. The suitability of compacting equipment will be defined per Section P-152.2.06.

3.06 FINISH GRADES:

A. Finish grading must be performed in accordance with the completed contour elevations and grades shown and must be made to blend into the existing or plan ground surfaces. All finished grading surfaces must be left smooth and free to drain. Finish grades must be brought to elevations within plus or minus 0.10 foot of elevations or contours shown.

B. The top 4 inches of trench fill in areas to be landscaped must be topsoil in accordance with Section T-905.

C. Where necessary or where shown, finish grading must be extended to insure that water will be carried off and the site area left smooth and free from depressions holding water.

D. Movement of construction machinery over a pipe or trench must be at the Contractor's risk. Any pipe damaged thereby must be replaced at the expense of the Contractor.

E. Any depression which may develop from settlement in backfilled areas within 1 year after the work is fully completed and accepted must be the responsibility of the Contractor. The Contractor must provide, as needed, at his own expense, additional backfill material, pavement base replacement, permanent pavement repairs or replacement and must perform the necessary reconditioning and restoration work to bring such depressed areas to proper grade as acceptable to the Commissioner.

3.07 TESTING:

A. Trench backfill compaction must be tested and monitored by the Contractor a minimum of 1 test per 100 lineal feet of trench, each lift, a minimum of 3 tests per lift, or as directed by the Commissioner. All material and backfill operations must be subjected to testing by the Commissioner with the assistance of the Contractor.

PART 4 - METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.01 MEASUREMENT AND PAYMENT:

A. No separate measurement or payment will be made for items described in this Section of the Specifications. All costs for this work will be considered included in the unit prices for the pay items requiring the various work items delineated in this Specification Section.

END OF SECTION P-157

HOT MIX ASPHALT (HMA) PAVEMENTS

ITEM P-401 (FAA)

PART 1 DESCRIPTION

1.01 GENERAL

A. This item consists of pavement courses composed of mineral aggregate and asphalt cement binder (asphalt binder) mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and must conform to the lines, grades, thicknesses, and typical cross-sections shown on the plans. Each course must be constructed to the depth, typical section, and elevation required by the plans and must be rolled, finished, and approved before the placement of the next course.

1.02 RELATED WORK

A. Related Work specified elsewhere includes:

1. Section P-602 – Bituminous Prime Coat
2. Section P-603 – Bituminous Tack Coat
3. Section Q-100 – Contractor Quality Control Program
4. Section Q-110 – Method of Estimating Percentage of Material Within Specification Limits (PWL)
5. Section P-629 – Geotextile Fabric
6. Section P-608R – Rapid Cure Seal Coat

PART 2 MATERIALS

2.01 AGGREGATE

A. Aggregates must consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The aggregates should be free of ferrous sulfides, such as pyrite, that would cause “rust” staining that can bleed through pavement markings. The portion retained on the No. 4 (4.75 mm) sieve is coarse aggregate. The portion passing the No. 4 (4.75 mm) sieve and retained on the No. 200 (0.075 mm) sieve is fine aggregate, and the portion passing the No. 200 (0.075 mm) sieve is mineral filler.

B. Coarse aggregate. Coarse aggregate must consist of sound, tough, durable particles, free from films of matter that would prevent thorough coating and bonding with the bituminous material and free from organic

matter and other deleterious substances. The percentage of wear must not be greater than 40% when tested in accordance with ASTM C131. The sodium sulfate soundness loss must not exceed 12%, or the magnesium sulfate soundness loss must not exceed 18%, after five cycles, when tested in accordance with ASTM C88. Clay lumps and friable particles must not exceed 1.0% when tested in accordance with ASTM C142.

C. Aggregate must contain at least 75 percent by weight of individual pieces having two or more fractured faces and 85 percent by weight having at least one fractured face. The area of each face must be equal to at least 75% of the smallest mid-sectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures must be at least 30 degrees to count as two fractured faces. Fractured faces must be achieved by crushing.

D. The aggregate must not contain more than a total of 8%, by weight, of flat particles, elongated particles, and flat and elongated particles, when tested in accordance with ASTM D4791 with a value of 5:1.

1. Fine aggregate. Fine aggregate must consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, slag, or gravel that meets the requirements for wear and soundness specified for coarse aggregate. The aggregate particles must be free from coatings of clay, silt, or other objectionable matter.

   The fine aggregate, including any blended material for the fine aggregate, must have a plasticity index of not more than six (6) and a liquid limit of not more than 25 when tested in accordance with ASTM D4318.

   The soundness loss must not exceed 10% when sodium sulfate is used or 15% when magnesium sulfate is used, after five cycles, when tested per ASTM C88.

   Clay lumps and friable particles must not exceed 1.0%, by weight, when tested in accordance with ASTM C142.

   Natural (non-manufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. The amount of sand to be added will be adjusted to produce mixtures conforming to requirements of this specification. If used, the natural sand must meet the requirements of ASTM D1073 and must have a plasticity index of not more than six (6) and a liquid limit of not more than 25 when tested in accordance with ASTM D4318.

   The aggregate must have sand equivalent values of 45 or greater when tested in accordance with ASTM D2419.

2. Sampling. ASTM D75 must be used in sampling coarse and fine aggregate, and ASTM C183 must be used in sampling mineral filler.

E. Mineral Filler. If filler, in addition to that naturally present in the aggregate, is necessary, it must meet the requirements of ASTM D242.

2.02 ASPHALT CEMENT BINDER

A. Asphalt cement binder must conform to ASTM D6373 Performance Grade (PG) 70-28, PG64-28 or PG58-34 can be used. A certificate of compliance from the manufacturer must be included with the mix design submittal.

B. The supplier's certified test report with test data indicating grade certification for the asphalt binder must be provided to the Commissioner for each load at the time of delivery to the mix plant. A certified test report with test data indicating grade certification for the asphalt binder must also be provided to the Commissioner for any modification of the asphalt binder after delivery to the mix plant and before use in the HMA.

2.03 PRELIMINARY MATERIAL ACCEPTANCE

A. Prior to delivery of materials to the job site, the Contractor must submit certified test reports to the Commissioner for the following materials:

1. Coarse aggregate:
   a. Percent of wear
   b. Soundness
   c. Clay lumps and friable particles
   d. Percent fractured faces
   e. Flat and elongated particles
2. Fine Aggregate:
   a. Liquid limit and Plasticity index
   b. Soundness
   c. Clay lumps and friable particles
   d. Percent natural sand
   e. Sand equivalent
3. Mineral Filler
   a. Asphalt Binder.
   b. Test results for asphalt binder must include temperature/viscosity charts for mixing and compaction temperatures.

The certifications must show the appropriate ASTM tests for each material, the test results, and a statement that the material meets the specification requirement.

The Commissioner may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

2.04 ANTI-STRIPPING AGENT

A. Anti-stripping agent or additive is required. It must be heat stable, must not change the asphalt cement viscosity beyond specifications, must contain no harmful ingredients, must be added in recommended proportion by approved method, and must be a material approved by IDOT.

PART 3 COMPOSITION

3.01 COMPOSITION OF MIXTURE

A. The HMA mix must be composed of a mixture of well-graded aggregate, filler and anti-strip agent as required, and asphalt binder. The several aggregate fractions must be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF).

3.02 JOB MIX FORMULA (JMF)

A. No hot-mixed asphalt (HMA) for payment must be produced until a JMF has been approved in writing by the Commissioner. The asphalt mix-design and JMF must be prepared by an accredited laboratory that meets the requirements of paragraph 401-3.04. The HMA must be designed using procedures contained in Asphalt Institute MS-2 Mix Design Manual, 7th Edition. Samples must be prepared at various asphalt contents and compacted using the gyratory compactor in accordance with ASTM D6925.

Tensile strength ratio (TSR) of the composite mixture, as determined by ASTM D4867, must not be less than 75 when tested at a saturation of 70-80%. The anti-strip agent required, must be provided by the Contractor at no additional cost to the Commissioner.

The JMF must be submitted in writing by the Contractor at least 30 days prior to the start of paving operations. The JMF must be developed within the same construction season using aggregates currently being produced.

The submitted JMF must be stamped or sealed by the responsible professional Commissioner of the laboratory and must include the following items as a minimum:

1. Percent passing each sieve size for total combined gradation, individual gradation of all aggregate stockpiles and percent by weight of each stockpile used in the job mix formula.
2. Percent of asphalt cement.
3. Asphalt performance grade and type of modifier if used.
4. Number of gyrations.
5. Laboratory mixing temperature.
6. Laboratory compaction temperature.
7. Temperature-viscosity relationship of the PG asphalt cement binder showing acceptable range of mixing and compaction temperatures; and for modified binders include supplier recommended mixing and compaction temperatures.
8. Plot of the combined gradation on a 0.45 power gradation curve.
9. Graphical plots of air voids, voids in the mineral aggregate, and unit weight versus asphalt content.
10. Specific Gravity and absorption of each aggregate.
11. Percent natural sand.
12. Percent fractured faces.
13. Percent by weight of flat particles, elongated particles, and flat and elongated particles (and criteria).
14. Tensile Strength Ratio (TSR).
15. Anti-strip agent.
16. Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season must not be accepted.
    a. The Contractor must submit to the Commissioner the results of verification testing of three (3) asphalt samples prepared at the optimum asphalt content. The average of the results of this testing must indicate conformance with the JMF requirements specified in Tables 1 and 3.
    b. When the project requires asphalt mixtures of differing aggregate gradations, a separate JMF and the results of JMF verification testing must be submitted for each mix.
    c. The JMF for each mixture must be in effect until a modification is approved in writing by the Commissioner.

Should a change in sources of materials be made, a new JMF must be submitted within 15 days and approved by the Commissioner in writing before the new material is used. After the initial production JMF has been approved by the Commissioner and a new or modified JMF is required for whatever reason, the subsequent cost of the Commissioner's approval of the new or modified JMF will be borne by the Contractor. There will be no time extension given or considerations for extra costs associated with the stoppage of production paving or restart of production paving due to the time needed for the Commissioner to approve the initial, new or modified JMF.

d. The Gyratory Design Criteria applicable to the project must meet the criteria specified in Table 1.

Table 1. Gyratory Compaction Criteria

Test Property	Value
Number of compactor gyrations	75
Air voids (%)	3.5
Percent voids in mineral aggregate, minimum (Base Course)	15
Percent voids in mineral aggregate, minimum (Surface Course)	16

e. The mineral aggregate must be of such size that the percentage composition by weight, as determined by laboratory sieves, will conform to the gradation or gradations specified in Table 3 when tested in accordance with ASTM C136 and ASTM C117.

f. The gradation(s) in Table 3 represent the limits that must determine the suitability of aggregate for use from the sources of supply; be well graded from coarse to fine and must not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa.

Table 3. Aggregate - HMA Pavements

Sieve Size	Percentage by Weight Passing Sieve
1 inch (25 mm)	--
3/4 inch (19 mm)	100
1/2 inch (12 mm)	79-99

Table 3. Aggregate - HMA Pavements

Sieve Size	Percentage by Weight Passing Sieve
3/8 inch (9 mm)	68-88
No. 4 (4.75 mm)	48-68
No. 8 (2.36 mm)	33-53
No. 16 (1.18 mm)	20-40
No. 30 (0.60 mm)	14-30
No. 50 (0.30 mm)	9-21
No. 100 (0.15 mm)	6-16
No. 200 (0.075 mm)	3-6
Asphalt Percent:	
Stone or Gravel	5.0-7.5

g. The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves must be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition.

3.03 RECLAIMED ASPHALT PAVEMENT (RAP) – NOT USED

3.04 JOB MIX FORMULA (JMF) LABORATORY

A. The Contractor's laboratory used to develop the JMF must be accredited in accordance with ASTM D3666. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for developing the JMF must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods must be submitted to the Commissioner prior to start of construction.

3.05 TEST SECTION

A. Prior to full production, the Contractor must prepare and place a quantity of HMA according to the JMF. The amount of HMA must be sufficient to construct a test section 300 ft. long and two paver widths wide, placed in two lanes, with a longitudinal cold joint, and must be of the same depth specified for the construction of the course which it represents. A cold joint for this test section is an exposed construction joint at least four (4) hours old or whose mat has cooled to less than 160°F (71°C). The cold joint must be cut back using the same procedure that will be used during production in accordance with 401-4.13. The underlying grade or

pavement structure upon which the test section is to be constructed must be the same as the remainder of the course represented by the test section. The equipment used in construction of the test section must be the same type and weight to be used on the remainder of the course represented by the test section.

1. The test section must be evaluated for acceptance as a single lot in accordance with the acceptance criteria in paragraph 401-5.01 and 401-5.02. The test section must be divided into equal sublots. As a minimum, the test section must consist of three (3) sublots.

2. The test section will be considered acceptable if (1) mat density, air voids, and joint density are 90% or more within limits, (2) gradation and asphalt content are within the action limits specified in paragraphs 401-6.05A and -6.05B, and (3) the voids in the mineral aggregate are within the limits of Table 2.

3. If the initial test section should prove to be unacceptable, the necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures must be made. A second test section must then be placed. If the second test section also does not meet specification requirements, both sections must be removed at the Contractor's expense. Additional test sections, as required, must be constructed and evaluated for conformance to the specifications. Any additional sections that are not acceptable must be removed at the Contractor's expense. Full production must not begin until an acceptable test section has been constructed and accepted in writing by the Commissioner. Once an acceptable test section has been placed, payment for the initial test section and the section that meets specification requirements will be made in accordance with paragraph 401-8.01.

4. Job mix control testing must be performed by the Contractor at the start of plant production and in conjunction with the calibration of the plant for the JMF. If aggregates produced by the plant do not satisfy the gradation requirements or produce a mix that meets the JMF, it will be necessary to reevaluate and redesign the mix using plant-produced aggregates. Specimens must be prepared and the optimum asphalt content determined in the same manner as for the original JMF tests.

5. Contractor will not be allowed to place the test section until the Contractor Quality Control Program, showing conformance with the requirements of Paragraph 401-6.01, has been approved, in writing, by the Commissioner.

PART 4 CONSTRUCTION METHODS

4.01 WEATHER LIMITATIONS

A. The HMA must 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 by the Commissioner, if requested; however, all other requirements including compaction must be met.

Table 4. Surface Temperature Limitations of Underlying Course

Mat Thickness	Base Temperature (Minimum)	
	°F	°C
3 inches (7.5 cm) or greater	40	4
Greater than 2 inches (50 mm) but less than 3 inches (7.5 cm)	45	7

4.02 HMA PLANT

A. Plants used for the preparation of HMA must conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M156 with the following changes:

1. Requirements for all plants include:

a. Truck scales. The HMA must be weighed on approved scales furnished by the Contractor, or on certified public scales at the Contractor's expense. Scales must be inspected and sealed as often as the Commissioner deems necessary to assure their accuracy. Scales must conform to the requirements of the Part Two of Three, General Conditions: Federally Funded Projects.

(1) In lieu of scales, and as approved by the Commissioner, HMA weight may be determined by the use of an electronic weighing system equipped with an automatic printer that weighs the total HMA production and as often thereafter as requested by the Commissioner.

b. Testing facilities. The Contractor must ensure laboratory facilities are provided at the plant for the use of the Commissioner. The lab must have sufficient space and equipment so that both testing representatives (Commissioner's and Contractor's) can operate efficiently. The lab must meet the requirements of ASTM D3666 including all necessary equipment, materials, calibrations,

current reference standards to comply with the specifications and a masonry saw with diamond blade for trimming pavement cores and samples.

c. The plant testing laboratory must have a floor space area of not less than 200 square feet (18.5 sq. m), with a ceiling height of not less than 7-1/2 feet (2 m). The laboratory must be weather tight, sufficiently heated in cold weather, air-conditioned in hot weather to maintain temperatures for testing purposes of 70°F ±5°F (21°C ±2.3°C). The plant testing laboratory must be located on the plant site to provide an unobstructed view, from one of its windows, of the trucks being loaded with the plant mix materials. In addition, the facility must include the minimum:

   (1) Adequate artificial lighting.

   (2) Electrical outlets sufficient in number and capacity for operating the required testing equipment and drying samples.

   (3) A minimum of two (2) Underwriter's Laboratories approved fire extinguishers of the appropriate types and class.

   (4) Work benches for testing.

   (5) Desk with chairs and file cabinet.

   (6) Sanitary facilities convenient to testing laboratory.

   (7) Exhaust fan to outside air.

   (8) Sink with running water.

d. Failure to provide the specified facilities must be sufficient cause for disapproving HMA plant operations.

e. Laboratory facilities must be kept clean, and all equipment must be maintained in proper working condition. The Commissioner must be permitted unrestricted access to inspect the Contractor's laboratory facility and witness quality control activities. The Commissioner will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting the test results, the incorporation of the materials into the work must be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

f. Inspection of plant.

(1) The Commissioner, or Commissioner's authorized representative, must have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

g. Storage bins and surge bins. The HMA stored in storage and surge bins must meet the same requirements as HMA loaded directly into trucks and may be permitted under the following conditions:

(1) Stored in non-insulated bins for a period of time not to exceed three (3) hours.

(2) Stored in insulated bins for a period of time not to exceed eight (8) hours.

2. If the Commissioner determines that there is an excessive amount of heat loss, segregation, or oxidation of the HMA due to temporary storage, no temporary storage will be allowed.

4.03 HAULING EQUIPMENT

A. Trucks used for hauling HMA must have tight, clean, and smooth metal beds. To prevent the HMA from sticking to the truck beds, the truck beds must be lightly coated with a minimum amount of paraffin oil, lime solution, or other material approved by the Commissioner. Petroleum products must not be used for coating truck beds. Each truck must have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds must be insulated or heated and covers must be securely fastened.

1. Material transfer vehicle (MTV). Material transfer vehicles used to transfer the material from the hauling equipment to the paver, must use a self-propelled, material transfer vehicle with a swing conveyor that can deliver material to the paver without making contact with the paver. The MTV must be able to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. The Material Transfer Vehicle will have remixing and storage capability to prevent physical and thermal segregation.

4.04 HMA PAVERS

A. HMA pavers must be self-propelled with an activated heated screed, capable of spreading and finishing courses of HMA that will meet the

specified thickness, smoothness, and grade. The paver must have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

1. The paver must have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper must be equipped with a distribution system to place the HMA uniformly in front of the screed without segregation. The screed must effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

2. If, during construction, it is found that the spreading and finishing equipment in use leaves tracks or indented areas, or produces other blemishes in the pavement that are not satisfactorily corrected by the scheduled operations, the use of such equipment must be discontinued and satisfactory equipment must be provided by the Contractor.

B. Automatic grade controls. The HMA paver must be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system must be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices that will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller must be capable of maintaining the screed at the desired slope within ±0.1%.

1. The controls must be capable of working in conjunction with any of the following attachments:

   a. Ski-type device of not less than 30 feet (9 m) in length.

   b. Taut string-line (wire) set to grade.

   c. Short ski or shoe.

   d. Laser control.

4.05 ROLLERS

A. Rollers of the vibratory, steel wheel, and pneumatic-tired type must be used. They must be in good condition, capable of operating at slow speeds to avoid displacement of the HMA. The number, type, and weight of rollers must be sufficient to compact the HMA to the required density while it is still in a workable condition.

B. All rollers must be specifically designed and suitable for compacting HMA concrete and must be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils must not

be used. Depressions in pavement surfaces caused by rollers must be repaired by the Contractor at their own expense.

1. The use of equipment that causes crushing of the aggregate will not be permitted.

4.06 DENSITY DEVICE

A. The Contractor must have on site a density gauge during all paving operations in order to assist in the determination of the optimum rolling pattern, type of roller and frequencies, as well as to monitor the effect of the rolling operations during production paving. The Contractor must also supply a qualified technician during all paving operations to calibrate the gauge and obtain accurate density readings for all new HMA. These densities must be supplied to the Commissioner upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.

4.07 PREPARATION OF ASPHALT BINDER

A. The asphalt binder must be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt binder to the mixer at a uniform temperature. The temperature of unmodified asphalt binder delivered to the mixer must be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but must not exceed 325°F (160°C) when added to the aggregate. The temperature of modified asphalt binder must be no more than 350°F (175°C) when added to the aggregate.

4.08 PREPARATION OF MINERAL AGGREGATE

A. The aggregate for the HMA must be heated and dried. The maximum temperature and rate of heating must be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler must not exceed 350°F (175°C) when the asphalt binder is added. Particular care must be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature must 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.

4.09 PREPARATION OF HMA

A. The aggregates and the asphalt binder must be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials must be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time must be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants must be established by the Contractor,

based on the procedure for determining the percentage of coated particles described in ASTM D2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to achieve 95% of coated particles. For continuous mix plants, the minimum mixing time must be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all HMA upon discharge must not exceed 0.5%.

4.10 PREPARATION OF THE UNDERLYING SURFACE

A. Immediately before placing the HMA, the underlying course must be cleaned of all dust and debris. A prime coat and tack coat must be applied in accordance with Item P-602 and P-603, as shown on the plans.

4.11 LAYDOWN PLAN, TRANSPORTING, PLACING, AND FINISHING

A. Prior to the placement of the HMA, the Contractor must prepare a laydown plan for approval by the Commissioner. This is to minimize the number of cold joints in the pavement. The laydown plan must include the sequence of paving laydown by stations, width of lanes, temporary ramp locations, and laydown temperature. The laydown plan must also include estimated time of completion for each portion of the work (that is, milling, paving, rolling, cooling, etc.). Modifications to the laydown plan must be approved by the Commissioner.

1. The HMA must be transported from the mixing plant to the site in vehicles conforming to the requirements of paragraph 401-4.03. Deliveries must be scheduled so that placing and compacting of HMA is uniform with minimum stopping and starting of the paver. Hauling over freshly placed material must not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

2. The Contractor must use a material transfer vehicle to deliver HMA to the paver.

3. The alignment and elevation of the paver must be regulated from outside reference lines established for this purpose for the first lift of all runway and taxiway pavements. Successive lifts of HMA surface course may be placed using a ski, or laser control per paragraph 401-4.04B (1), provided grades of the first lift of HMA surface course meet the tolerances of paragraphs 401-5.02B(5) as verified by a survey. Contractor must survey each lift of HMA surface course and certify to Commissioner that every lot of each lift meets the grade tolerances of paragraph 401-5.02 B(5) before the next lift can be placed.

4. The initial placement and compaction of the HMA must occur at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 250°F (121°C).

5. Edges of existing HMA pavement abutting the new work must be saw cut and carefully removed as shown on the drawings and coated with asphalt tack coat before new material is placed against it.

6. Upon arrival, the HMA must be placed to the full width by a HMA paver. It must be struck off in a uniform layer of such depth that, when the work is completed, it must have the required thickness and conform to the grade and contour indicated. The speed of the paver must be regulated to eliminate pulling and tearing of the HMA mat. Unless otherwise permitted, placement of the HMA must begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The HMA must be placed in consecutive adjacent strips having a maximum width of 16 feet except where edge lanes require less width to complete the area. Additional screed sections must not be attached to widen paver to meet the minimum lane width requirements specified above unless additional auger sections are added to match. The longitudinal joint in one course must offset the longitudinal joint in the course immediately below by at least 1 foot (30 cm); however, the joint in the surface top course must be at the centerline of crowned pavements. Transverse joints in one course must be offset by at least 10 feet (3 m) from transverse joints in the previous course.

7. Transverse joints in adjacent lanes must be offset a minimum of 10 feet (3 m).

8. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the HMA may be spread and luted by hand tools.

9. Areas of segregation in the surface course, as determined by the Commissioner, must be removed and replaced at the Contractor's expense. The area must be removed by saw cutting and milling a minimum of 3 inches deep. The area to be removed and replaced must be a minimum width of the paver and a minimum of 20 feet long or as directed by the Commissioner.

4.12 COMPACTION OF HMA

A. After placing, the HMA must be thoroughly and uniformly compacted by power rollers. The surface must be compacted as soon as possible when the HMA has attained sufficient stability so that the rolling does

not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used must be at the discretion of the Contractor. The speed of the roller must, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, must be corrected at once.

1. Sufficient rollers must be furnished to handle the output of the plant. Rolling must continue until the surface is of uniform texture, true to grade and cross-section, and the required field density is obtained. To prevent adhesion of the HMA to the roller, the wheels must be equipped with a scraper and kept properly moistened but excessive water will not be permitted.

2. In areas not accessible to the roller, the mixture must be thoroughly compacted with approved power-driven tampers. Tampers must weigh not less than 275 pounds (125 kg), have a tamping plate width not less than 15 inches (38 cm), be rated at not less than 4,200 vibrations per minute, and be suitably equipped with a standard tamping plate wetting device.

3. Any HMA that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective must be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work must be done at the Contractor's expense. Skin patching must not be performed.

4.13 JOINTS

A. The formation of all joints must be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints must have the same texture as other sections of the course and meet the requirements for smoothness and grade.

1. The roller must not pass over the unprotected end of the freshly laid HMA except when necessary to form a transverse joint. When necessary to form a transverse joint, it must be made by means of placing a bulkhead or by tapering the course. The tapered edge must be cut back to its full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. In both methods, all contact surfaces must be coated with an asphalt tack coat before placing any fresh HMA against the joint.

2. Longitudinal joints which have been left exposed for more than four (4) hours; the surface temperature has cooled to less than 175°F (80°C); or are irregular, damaged, uncompacted or

otherwise defective must be cut back 3 inches (75 mm) to 6 inches (150 mm) to expose a clean, sound, uniform vertical surface for the full depth of the course. All cutback material must be removed from the project. Asphalt tack coat or other product approved by the Commissioner must be applied to the clean, dry joint, prior to placing any additional fresh HMA against the joint. Any laitance produced from cutting joints must be removed by vacuuming and washing. The cost of this work must be considered incidental to the cost of the HMA.

4.14 SAW-CUT GROOVING – NOT USED

4.15 DIAMOND GRINDING

A. When required, diamond grinding must be accomplished by sawing with saw blades impregnated with industrial diamond abrasive. The saw blades must be assembled in a cutting head mounted on a machine designed specifically for diamond grinding that will produce the required texture and smoothness level without damage to the pavement. The saw blades must be 1/8-inch (3-mm) wide and there must be a minimum of 55 to 60 blades per 12 inches (300 mm) of cutting head width; the actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Each machine must be capable of cutting a path at least 3 feet (0.9 m) wide. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the pavement will not be permitted. The depth of grinding must not exceed 1/2 inch (13mm) and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. Areas that have been ground will be sealed with an approved emulsified asphalt surface treatment as directed by the Commissioner. It may be necessary to seal a larger area to avoid surface treatment creating any conflict with runway or taxiway markings.

4.16 NIGHTTIME PAVING REQUIREMENTS

A. Paving during nighttime construction must require the following:

B. All paving machines, rollers, distribution trucks and other vehicles required by the Contractor for his operations must be equipped with artificial illumination sufficient to safely complete the work.

C. Minimum illumination level must be twenty (20) horizontal foot-candles and maintained in the following areas:

1. An area of 30 feet (9 m) wide by 30 feet (9 m) long immediately behind the paving machines during the operations of the machines.

2. An area of 15 feet (4.5 m) wide by 30 feet (9 m) long immediately in front and back of all rolling equipment, during operation of the equipment.

3. An area of 15 feet (4.5 m) wide by 15 feet (4.5 m) long at any point where an area is being tack coated prior to the placement of pavement.

D. As partial fulfillment of the above requirements, the Contractor must furnish and use, complete artificial lighting units with a minimum capacity of 3,000-watt electric beam lights, affixed to all equipment in such a way to direct illumination on the area under construction.

E. A lighting plan must be submitted by the Contractor and approved by the Commissioner prior to the start of any nighttime work.

F. If the Contractor places any out of specification mix in the project work area, the Contractor is required to remove it at its own expense, to the satisfaction of the Commissioner. If the Contractor has to continue placing non-payment HMA, as directed by the Commissioner, to make the surfaces safe for aircraft operations, the Contractor must do so to the satisfaction of the Commissioner. It is the Contractor's responsibility to leave the facilities to be paved in a safe condition ready for aircraft operations. No consideration for extended closure time of the area being paved will be given. As a first order of work for the next paving shift, the Contractor must remove all out of specification material and replace with approved material to the satisfaction of the Commissioner. When the above situations occur, there will be no consideration given for additional construction time or payment for extra costs.

PART 5 MATERIAL ACCEPTANCE

5.01 ACCEPTANCE SAMPLING AND TESTING

A. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Commissioner at no cost to the Contractor except that coring as required in this section must be completed and paid for by the Contractor.

B. Testing organizations performing these tests must be accredited in accordance with ASTM D3666. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods must be submitted to the Commissioner prior to start of construction. All equipment in Contractor furnished laboratories must be calibrated by an independent testing organization prior to the start of operations at the Contractor's expense.

1. Hot mixed asphalt. Plant-produced HMA must be tested for air voids on a lot basis. Sampling must be from material deposited into trucks at the plant or from trucks at the job site. Samples must be taken in accordance with ASTM D979.

   a. A standard lot must be equal to one day's production or 2000 tons (1814 metric tons) whichever is smaller. If the day's production is expected to exceed 2000 tons (1814 metric tons), but less than 4000 tons (3628 metric tons), the lot size must be 1/2 day's production. If the day's production exceeds 4000 tons (3628 metric tons), the lot size must be an equal sized fraction of the day's production, but must not exceed 2000 tons (1814 metric tons).

   b. Where more than one plant is simultaneously producing HMA for the job, the lot sizes must apply separately for each plant.

      (1) Sampling. Each lot will consist of four equal sublots. Sufficient HMA for preparation of test specimens for all testing will be sampled by the Commissioner on a random basis, in accordance with the procedures contained in ASTM D3665. Samples will be taken in accordance with ASTM D979.

      (2) The sample of HMA may be put in a covered metal tin and placed in an oven for not less than 30 minutes nor more than 60 minutes to stabilize to compaction temperature. The compaction temperature of the specimens must be as specified in the JMF.

      (3) Testing. Air voids will be determined by the Commissioner in accordance with ASTM D3203. One set of laboratory compacted specimens will be prepared for each sublot in accordance with ASTM D6925 at the number of gyrations required by paragraph 401-3.02, Table 1. Each set of laboratory compacted specimens will consist of three test specimens prepared from the same sample.

   c. Prior to testing, the bulk specific gravity of each test specimen must be measured by the Commissioner in accordance with ASTM D2726 using the procedure for laboratory-prepared thoroughly dry specimens for use in computing air voids and pavement density.

d. For air voids determination, the theoretical maximum specific gravity of the mixture must be measured one time for each sublot in accordance with ASTM D2041. The value used in the air voids computation for each sublot must be based on theoretical maximum specific gravity measurement for the sublot.

e. Acceptance. Acceptance of plant produced HMA for air voids must be determined by the Commissioner in accordance with the requirements of paragraph 401-5.02b.

2. In-place HMA. HMA placed in the field must be tested for mat and joint density on a lot basis. A standard lot must be equal to one day's production or 2000 tons (1814 metric tons) whichever is smaller. If the day's production is expected to exceed 2000 tons (1814 metric tons), but less than 4000 tons (3628 metric tons), the lot size must be 1/2 day's production. If the day's production exceeds 4000 tons (3628 metric tons), the lot size must be an equal sized fraction of the day's production but must not exceed 2000 tons (1814 metric tons).

a. Mat density. The lot size must be the same as that indicated in paragraph 401-5.01A and must be divided into four equal sublots. One core of finished, compacted HMA must be taken by the Contractor from each sublot. Core locations will be determined by the Commissioner on a random basis in accordance with procedures contained in ASTM D3665. Cores for mat density must not be taken closer than one foot (30 cm) from a transverse or longitudinal joint.

b. Joint density. The lot size must be the total length of longitudinal joints constructed by a lot of HMA as defined in paragraph 401-5.01A. The lot must be divided into four equal sublots. One core of finished, compacted HMA must be taken by the Contractor from each sublot. Core locations will be determined by the Commissioner on a random basis in accordance with procedures contained in ASTM D3665. All cores for joint density must be taken centered on the joint. The minimum core diameter for joint density determination must be 5 inches (125 mm).

c. Sampling. Samples must be neatly cut with a diamond core drill bit. Samples will be taken in accordance with ASTM D979. The minimum diameter of the sample must be 5 inches (125 mm). Samples that are clearly defective, as a result of sampling, must be discarded and another

sample taken. The Contractor must furnish all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Cored pavement must be cleaned and core holes must be filled in a manner acceptable to the Commissioner and within one day after sampling. Laitance produced by the coring operation must be removed immediately.

3. The top most lift of HMA must be completely bonded to the underlying layer. If any of the cores reveal that the surface is not bonded to the layer immediately below the surface then additional cores must be taken as directed by the Commissioner in accordance with paragraph 401-5.01B to determine the extent of any delamination. All delaminated areas must be completely removed by milling to the limits and depth and replaced as directed by the Commissioner at no additional cost.

4. Testing. The bulk specific gravity of each cored sample will be measured by the Commissioner in accordance with ASTM D2726. Samples will be taken in accordance with ASTM D979. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sublot sample by the average bulk specific gravity of all laboratory prepared specimens for the lot, as determined in paragraph 401-5.01A (2). The bulk specific gravity used to determine the joint density at joints formed between different lots must be the lowest of the bulk specific gravity values from the two different lots.

5. Acceptance. Acceptance of field placed HMA format density will be determined by the Commissioner in accordance with the requirements of paragraph 401-5.02B (1). Acceptance for joint density will be determined by the Commissioner in accordance with the requirements of paragraph 401-5.02B (2).

6. Partial lots. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and Commissioner agree in writing to allow overages or other minor tonnage placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

7. The last batch produced where production is halted will be sampled, and its properties must be considered as representative of the particular sublot from which it was taken. In addition, an agreed to minor placement will be sampled, and its properties must be considered as representative of the particular sublot from which it was taken. Where three sublots are produced, they must constitute a lot. Where one or two sublots are produced, they

must be incorporated into the next lot, and the total number of sublots must be used in the acceptance plan calculation, that is, n = 5 or n = 6, for example. Partial lots at the end of asphalt production on the project must be included with the previous lot. The lot size for field placed material must correspond to that of the plant material, except that, in no cases, must less than three (3) cored samples be obtained, that is, n = 3.

5.02 ACCEPTANCE CRITERIA

A. General. Acceptance will be based on the following characteristics of the HMA and completed pavement as well as the implementation of the Contractor Quality Control Program and test results:

1. Air voids
2. Mat density
3. Joint density
4. Thickness
5. Smoothness
6. Grade

a. Mat density and air voids will be evaluated for acceptance in accordance with paragraph 401-5.02B (1). Joint density will be evaluated for acceptance in accordance with paragraph 401-5.02B (2).

b. Thickness will be evaluated by the Commissioner for compliance in accordance with paragraph 401-5.02B (3). Acceptance for smoothness will be based on the criteria contained in paragraph 401-5.02B (4). Acceptance for grade will be based on the criteria contained in paragraph 401-5.02B (5).

c. The Commissioner may at any time, reject and require the Contractor to dispose of any batch of HMA which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or improper mix temperature. Such rejection may be based on only visual inspection or temperature measurements. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Commissioner, and if it can be demonstrated in the laboratory, in the presence of the Commissioner, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

B. ACCEPTANCE CRITERIA

1. Mat density and air voids. Acceptance of each lot of plant produced material for mat density and air voids must be based on the percentage of material within specification limits (PWL). If the PWL of the lot equals or exceeds 90%, the lot must be acceptable. Acceptance and payment must be determined in accordance with paragraph 401-8.01.

2. Joint density. Acceptance of each lot of plant produced HMA for joint density must be based on the PWL. If the PWL of the lot is equal to or exceeds 90%, the lot must be considered acceptable. If the PWL is less than 90%, the Contractor must evaluate the reason and act accordingly. If the PWL is less than 80%, the Contractor must cease operations and until the reason for poor compaction has been determined. If the PWL is less than 71%, the pay factor for the lot used to complete the joint must be reduced by five (5) percentage points. This lot pay factor reduction must be incorporated and evaluated in accordance with paragraph 401-8.01.

3. Thickness. Thickness of each lift of surface course must be evaluated by the Commissioner for compliance to the requirements shown on the plans. Measurements of thickness must be made by the Commissioner using the cores extracted for each sublot for density measurement. The maximum allowable deficiency at any point must not be more than 1/4 inch (6 mm) less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, must not be less than the indicated thickness. Where the thickness tolerances are not met, the lot or sublot must be corrected by the Contractor at his expense by removing the deficient area and replacing with new pavement. The Contractor, at his expense, may take additional cores as approved by the Commissioner to circumscribe the deficient area.

4. Smoothness. The final surface must be free from roller marks. After the final rolling, but not later than 24 hours after placement, the surface of each lot must be tested in both longitudinal and transverse directions for smoothness to reveal all surface irregularities exceeding the tolerances specified. The Contractor must furnish paving equipment and employ methods that produce a surface for each pavement lot, the finished surface course of the pavement must not vary more than 1/4 inch (6mm) when evaluated with a 12-foot (3.7m) straightedge. When the surface course smoothness exceeds specification tolerances which cannot be corrected by diamond grinding of the surface course, full depth removal and replacement of surface course corrections must be to the limit of the longitudinal placement. Corrections

involving diamond grinding will be subject to the final pavement thickness tolerances specified. The Contractor must apply a surface treatment per Item P-608R to all areas that have been subject to grinding as directed by the Commissioner.

a. Transverse measurements. Transverse measurements will be taken for each lot placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet (15m) or more often as determined by the Commissioner.

(1) Testing must be continuous across all joints, starting with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position must be adjusted to measure surface smoothness and not design grade or cross slope transitions. The amount of surface irregularity must be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. High spots on final surface course > 1/4 inch (6mm) in transverse direction must be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas must be retested after grinding.

(2) The joint between lots must be tested separately to facilitate smoothness between lots. The amount of surface irregularity must be determined by placing the freestanding (unleveled) straightedge on the pavement surface, with half the straightedge on one side of the joint and the other half of the straightedge on the other side of the joint. Measure the maximum gap between the straightedge and the pavement surface in the area between these

two high points. One measurement must be taken at the joint every 50 feet (15m) or more often if directed by the Commissioner. Deviations on final surface course > 1/4 inch (6mm) in transverse direction must be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course. Each measurement must be recorded and a copy of the data must be furnished to the Commissioner at the end of each days testing.

b. Longitudinal measurements. Longitudinal measurements will be taken for each lot placed. Longitudinal tests will be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet (6m); and at the third points of paving lanes when widths of paving lanes are 20 ft. (6m) or greater.

(1) Longitudinal Short Sections. Longitudinal Short Sections are when the longitudinal lot length is less than 200 feet (60m). When approved by the Commissioner, the first and last 15 feet (4.5m) of the lot can also be considered as short sections for smoothness. The finished surface must not vary more than 1/4 inch (6mm) when evaluated with a 12-foot (3.7m) straightedge. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position must be adjusted to measure surface smoothness and not design grade or cross slope transitions. Testing must be continuous across all joints, starting with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity must be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Deviations on final surface course > 1/4 inch (6mm) in longitudinal direction will be corrected with diamond grinding per paragraph 401-4.15 or by removing and replacing full depth of surface course.

Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas must be retested after grinding.

c. Smoothness testing indicated in the above paragraphs must be performed within 24 hours of placement of material. The primary purpose of smoothness testing is to identify areas that may be prone to ponding of water which could lead to hydroplaning of aircraft. If the contractor's machines and/or methods are producing significant areas that need corrective actions then production should be stopped until corrective measures can be implemented. If corrective measures are not implemented and when directed by the Commissioner, production must be stopped until corrective measures can be implemented.

5. Grade. Grade must be evaluated on the first day of placement and then as a minimum, every day of paving to allow adjustments to paving operations if measurements do not meet specification requirements. The Contractor must submit the survey data to the Commissioner by the following day after measurements have been taken. The finished surface of the pavement must not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm). The finished grade of each lot will be determined by running levels at intervals of 50 feet (15 m) or less longitudinally and all breaks in grade transversely (not to exceed 50 feet (15 m)) to determine the elevation of the completed pavement. The Contractor must pay the cost of surveying of the level runs that must be performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, must be provided by the Contractor to the Commissioner. The lot size must be 2000 square yards (m^2). When more than 15% of all the measurements within a lot are outside the specified tolerance, or if any one shot within the lot deviates 3/4 inch (19 mm) or more from planned grade, the Contractor must remove the deficient area to the depth of the final course plus 1/2 inch (12 mm) of pavement and replace with new material. Skin patching must not be permitted. Isolated high points may be ground off provided the course thickness complies with the thickness specified on the plans. The surface of the ground pavement must have a texture consisting of grooves between 0.090 and 0.130 inches (2 and 3.5 mm) wide. The peaks and ridges must be approximately 1/32 inch (1 mm) higher than the bottom of the grooves. The pavement must be left in a clean

condition. The removal of all of the slurry resulting from the grinding operation must be continuous. The grinding operation should be controlled so the residue from the operation does not flow across other lanes of pavement. High point grinding will be limited to 15 square yards (12.5 m^2). Areas in excess of 15 square yards (12.5 m^2) will require removal and replacement of the pavement in accordance with the limitations noted above. The Contractor must apply a surface treatment per P-608R to all areas that have been subject to grinding.

a. Percentage of material within specification limits (PWL). The PWL must be determined in accordance with procedures specified in Section Q-110. The specification tolerance limits (L) for lower and (U) for upper are contained in Table 5.

Table 5. Gyratory Acceptance Limits For Air Voids, Density

TEST PROPERTY	Specification Tolerance	
	L	**U**
Air Voids Total Mix (%)	2	5
Mat Density (%)	96.3	101.3
Joint Density (%)	93.3	-

b. Outliers. All individual tests for mat density and air voids must be checked for outliers (test criterion) in accordance with ASTM E178, at a significance level of 5%. Outliers must be discarded, and the PWL must be determined using the remaining test values. The criteria in Table 5 is based on production processes which have a variability with the following standard deviations: Surface Course Mat Density (%), 1.30; Base Course Mat Density (%), 1.55; Joint Density (%), 2.1.

c. The Contractor should note that (1) 90 PWL is achieved when consistently producing a surface course with an average mat density of at least 98% with 1.30% or less variability, (2) 90 PWL is achieved when consistently producing a base course with an average mat density of at least 97.5% with 1.55% or less variability, and (3) 90 PWL is achieved when consistently producing joints with an average joint density of at least 96% with 2.1% or less variability.

5.03 RESAMPLING PAVEMENT FOR MAT DENSITY.

A. General. Resampling of a lot of pavement will only be allowed for mat density, and then, only if the Contractor requests same, in writing, within 48 hours after receiving the written test results from the Commissioner. A retest will consist of all the sampling and testing procedures contained in paragraphs 401-5.01B and 401-5.02 B (1). Only one resampling per lot will be permitted.

1. A redefined PWL must be calculated for the resampled lot. The number of tests used to calculate the redefined PWL must include the initial tests made for that lot plus the retests.

2. The cost for resampling and retesting must be borne by the Contractor.

B. Payment for resampled lots. The redefined PWL for a resampled lot must be used to calculate the payment for that lot in accordance with Table 6.

C. Outliers. Check for outliers in accordance with ASTM E178, at a significance level of 5%.

PART 6 CONTRACTOR QUALITY CONTROL

6.01 GENERAL

A. The Contractor must develop a Quality Control Program in accordance with Section Q-100. The program must address all elements that affect the quality of the pavement including, but not limited to:

1. Mix design
2. Aggregate grading
3. Quality of materials
4. Stockpile management
5. Proportioning
6. Mixing and transportation
7. Placing and finishing
8. Joints
9. Compaction
10. Surface smoothness
11. Personnel
12. Laydown plan

B. The Contractor must perform quality control sampling, testing, and

inspection during all phases of the work and must perform them at a rate sufficient to ensure that the work conforms to the contract requirements, and at minimum test frequencies required by paragraph 401-6.03 and Section Q-100. As a part of the process for approving the Contractor's plan, the Commissioner may require the Contractor's technician to perform testing of samples to demonstrate an acceptable level of performance.

C. No partial payment will be made for materials that are subject to specific quality control requirements without an approved plan.

6.02 CONTRACTOR TESTING LABORATORY

A. The lab must meet the requirements of ASTM D3666 including all necessary equipment, materials, and current reference standards to comply with the specifications.

6.03 QUALITY CONTROL TESTING

A. The Contractor must perform all quality control tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved Quality Control Program. The testing program must include, but not necessarily be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, field compaction, and surface smoothness. A Quality Control Testing Plan must be developed as part of the Quality Control Program.

1. Asphalt content. A minimum of two asphalt content tests must be performed per lot in accordance with ASTM D6307 or ASTM D2172 if the correction factor in ASTM D6307 is greater than 1.0. The asphalt content for the lot will be determined by averaging the test results.

2. Gradation. Aggregate gradations must be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D5444, ASTM C136, and ASTM C117.

3. Moisture content of aggregate. The moisture content of aggregate used for production must be determined a minimum of once per lot in accordance with ASTM C566.

4. Moisture content of HMA. The moisture content must be determined once per lot in accordance with ASTM D1461 or AASHTO T329 moisture content testing procedure using a conventional oven or microwave.

5. Temperatures. Temperatures must be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the asphalt binder in the storage tank, the HMA at the plant, and the HMA at the job site.

6. In-place density monitoring. The Contractor must conduct any necessary testing to ensure that the specified density is being achieved. A nuclear gauge may be used to monitor the pavement density in accordance with ASTM D2950.

7. Additional testing. Any additional testing that the Contractor deems necessary to control the process may be performed at the Contractor's option.

8. Monitoring. The Commissioner reserves the right to monitor any or all of the above testing.

6.04 SAMPLING

A. When directed by the Commissioner, the Contractor must sample and test any material that appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling must be in accordance with standard procedures specified.

6.05 CONTROL CHARTS

A. The Contractor must maintain linear control charts both for individual measurements and range (that is, difference between highest and lowest measurements) for aggregate gradation, asphalt content, and VMA. The VMA for each sublot will be calculated and monitored by the Quality Control laboratory.

1. Control charts must be posted in a location satisfactory to the Commissioner and must be kept current. As a minimum, the control charts must identify the project number, the contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, and the Contractor's test results. The Contractor must use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the Commissioner may suspend production or acceptance of the material.

B. Individual measurements. Control charts for individual measurements must be established to maintain process control within tolerance for aggregate gradation, asphalt content, and VMA. The control charts must use the job mix formula target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

Control Chart Limits For Individual Measurements		
Sieve	**Action Limit**	**Suspension Limit**
3/4 inch (19 mm)	±6%	±9%
1/2 inch (12 mm)	±6%	±9%
3/8 inch (9 mm)	±6%	±9%
No. 4 (4.75 mm)	±6%	±9%
No. 16 (1.18 mm)	±5%	±7.5%
No. 50 (0.30 mm)	±3%	±4.5%
No. 200 (0.075 mm)	±2%	±3%
Asphalt Content	±0.45%	±0.70%
VMA	-1.00%	-1.50%

C. Range. Control charts for range must be established to control process variability for the test parameters and Suspension Limits listed below. The range must be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits must be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.

Control Chart Limits Based On Range (Based On n = 2)	
Sieve	**Suspension Limit**
1/2 inch (12 mm)	11%
3/8 inch (9 mm)	11%
No. 4 (4.75 mm)	11%
No. 16 (1.18 mm)	9%
No. 50 (0.30 mm)	6%
No. 200 (0.075 mm)	3.5%
Asphalt Content	0.8%

D. Corrective Action. The Contractor Quality Control Program must indicate that appropriate action must be taken when the process is believed to be out of tolerance. The Plan must contain sets of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process must be deemed out of control and production stopped and corrective action taken, if:

1. One point falls outside the Suspension Limit line for individual measurements or range; or

2. Two points in a row fall outside the Action Limit line for individual measurements.

6.06 QUALITY CONTROL REPORTS

A. The Contractor must maintain records and must submit reports of quality control activities daily, in accordance with the Contractor Quality Control Program described in Part Three of Three, Technical Specifications, Specification Section Q-100.

PART 7 METHOD OF MEASUREMENT

7.01 MEASUREMENT

A. HMA must be measured by the number of tons of HMA used in the accepted work. Recorded batch weights or truck scale weights will be used to determine the basis for the tonnage.

B. A test strip required for asphalt pavement will be measured as a lump sum, placed and accepted. Work includes the preparation, paving, and removal of each test strip for the associated pavement course. Failed test strips are to be repeated at no additional cost to the City.

PART 8 BASIS OF PAYMENT

8.01 PAYMENT

A. Payment for a lot of HMA meeting all acceptance criteria as specified in paragraph 401-5.02 will be made based on results of tests for smoothness, mat density and air voids. Payment for acceptable lots will be adjusted for mat density and air voids subject to the limitation that:

1. The total project payment for plant mix bituminous concrete pavement must not exceed 100 percent of the product of the contract unit price and the total number of tons of HMA used in the accepted work (See Note 1 under Table 6).

2. The price must be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

3. Basis of adjusted payment. The pay factor for each individual lot must be calculated in accordance with Table 6. A pay factor must be calculated for both mat density and air voids. The lot pay factor must be the higher of the two values when calculations for both mat density and air voids are 100% or higher. The lot pay factor must be the product of the two values when only one of the

calculations for either mat density or air voids is 100% or higher. The lot pay factor must be the lower of the two values when calculations for both mat density and air voids are less than 100%. If PWL for joint density is less than 71 percent then the lot pay factor must be reduced by 5% but be no higher than 95%.

B. For each lot accepted, the adjusted contract unit price will be the product of the lot pay factor for the lot and the contract unit price. Payment must be subject to the total project payment limitation specified in paragraph 401-8.01. Payment in excess of 100% for accepted lots of HMA will be used to offset payment for accepted lots of bituminous concrete pavement that achieve a lot pay factor less than 100%.

Table 6. Price Adjustment Schedule [1]

Percentage of Material Within Specification Limits (PWL)	Lot Pay Factor (Percent of Contract Unit Price)
93 – 100	103
90 – 93	PWL + 10
70 – 89	0.125 PWL + 88.75
40 – 69	0.75 PWL + 45
Below 40	Reject [2]

[1] Although it is theoretically possible to achieve a pay factor of 103% for each lot, actual payment above 100% must be subject to the total project payment limitation specified in paragraph 401-8.01.

[2] The lot must be removed and replaced. However, the Commissioner may decide to allow the rejected lot to remain. In that case, if the Commissioner and Contractor agree in writing that the lot must not be removed, it must be paid for at 50% of the contract unit price and the total project payment must be reduced by the amount withheld for the rejected lot.

C. Payment for Bituminous Concrete Testing – Test Strip will be made at the contract lump sum price. The work includes all preparation, mixing and placing of those materials, and for all labor, equipment, tools and all work necessary to complete the test strip for each course of pavement and for removal.

8.02 PAYMENT

A. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
P-401(FAA)-01	BITUMINOUS CONCRETE SURFACE COURSE (FAA)	TON
P-401(FAA)-02	BITUMINOUS CONCRETE TESTING - TEST STRIP	LS

TESTING REQUIREMENTS

ASTM C29	Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C183	Standard Practice for Sampling and the Amount of Testing of Hydraulic Cement
ASTM C566	Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D979	Standard Practice for Sampling Bituminous Paving Mixtures
ASTM D1073	Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
ASTM D2172	Standard Test Method for Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D1461	Standard Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D2041	Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2489	Standard Practice for Estimating Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D2726	Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D2950	Standard Test Method for Density of Bituminous Concrete in

	Place by Nuclear Methods
ASTM D3203	Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D3666	Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867	Standard Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D5444	Standard Test Method for Mechanical Size Analysis of Extracted Aggregate
ASTM D6084	Standard Test Method for Elastic Recovery of Bituminous Materials by Ductilometer
ASTM D6307	Standard Test Method for Asphalt Content of Hot Mix Asphalt by Ignition Method
ASTM D6752	Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method
ASTM D6925	Standard Test Method for Preparation and Determination of the Relative Density of Hot Mix Asphalt (HMA) Specimens by Means of the SuperPave Gyratory Compactor.
ASTM E11	Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
ASTM E178	Standard Practice for Dealing with Outlying Observations
ASTM E1274	Standard Test Method for Measuring Pavement Roughness Using a Profilograph
AASHTO T030	Standard Method of Test for Mechanical Analysis of Extracted Aggregate
AASHTO T110	Standard Method of Test for Moisture or Volatile Distillates in Hot Mix Asphalt (HMA)
AASHTO T275	Standard Method of Test for Bulk Specific Gravity (Gmb) of Compacted Hot Mix Asphalt (HMA) Using Paraffin-Coated Specimens

AASHTO M156 Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.

AASHTO T329 Standard Method of Test for Moisture Content of Hot Mix Asphalt (HMA) by Oven Method

Asphalt Institute Handbook MS-26, Asphalt Binder

Asphalt Institute MS-2 Mix Design Manual, 7th Edition

MATERIAL REQUIREMENTS

ASTM D242 Standard Specification for Mineral Filler for Bituminous Paving Mixtures

ASTM D4552 Standard Practice for Classifying Hot-Mix Recycling Agents

ASTM D6373 Standard Specification for Performance Graded Asphalt Binder

END OF SECTION P-401 (FAA)

WARM MIX ASPHALT CONCRETE PAVEMENTS
SECTION P-405 (WMA)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work under this Section is subject to the requirements of the Contract Documents.

B. This Section covers the production and installation of warm mix asphalt (WMA) flexible pavement using acceptable WMA Systems and Additives. The Contractor must define and submit with the bid, the proposed WMA System and Additive to be used in the Project with supporting data indicating that the Contractor/Subcontractor has successfully used the System/Additive or that the specified System/Additive has been successfully used on other airfield pavement projects including at least one reference with contact information of the airfield project(s). Acceptable WMA additives and/or processes include among others, Rediset WMX (AKZ0 Nobel), Sasolwax (Sasobit), Evotherm (MeadWestvaco), Double Barrel Green (Astec Industries), Green Machine (Gencor Industries), and Terex WMA System (Terex Roadbuilding).

C. The WMA must consist of mineral aggregate, reclaimed asphalt pavement (RAP) / fractionated RAP (FRAP) / reclaimed asphalt shingles (RAS), PG binders and additives mixed in a central mixing plant and placed as warm mix asphalt pavement in accordance with this Specification.

D. Per IDOT – S.S.R.B.C., Hot Mix Asphalt (HMA) Base course will be considered Hot Mix Asphalt Binder courses with an IL19.0 size.

E. Furnish and install all Bituminous Concrete Pavements as shown on the Drawings and as specified herein, including but not limited to the following:

Furnishing, placing and compacting bituminous base, leveling course, temporary ramps, and surface courses.

This work will apply to the base course under the PCC pavement and the bituminous components of the runway shoulders, and taxiway shoulders, and blast pads. This work also applies to roadways, parking areas, and temporary bituminous pavement.

1.02 RELATED WORK

A. Section P-603 – Bituminous Tack Coat

1.03 REFERENCES

A. "Standard Specifications for Road and Bridge Construction" (IDOT – S.S.R.B.C.), Illinois Department of Transportation, latest edition.

B. IDOT Special Provision *Reclaimed Asphalt Pavement and Reclaimed Asphalt Shingles (BDE)* Effective: November 1, 2012; Revised: April 1, 2014, or latest edition.

C. ASTM C566 – Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying

D. ASTM D1461 – Standard Test Method for Moisture of Volatile Distillates in Asphalt Mixtures

E. FAA-GL-918 – Specification for Construction of Terminal Navigational Aid Facilities

1.04 SUBMITTALS

A. Submit the following for review and approval by the Commissioner:

1. Warm Mix Asphalt (WMA) system and additives.

2. Data that the WMA System/Additive has been successfully used on an airfield pavement project(s) including at least one reference with contact information of the airport project(s).

3. Mix Designs for Base and Surface courses.

4. Current material certifications from IDOT.

5. Contractor QC Addendum in accordance with the IDOT – S.S.R.B.C. and the Special Requirements of this Specification.

1.05 SPECIAL REQUIREMENTS

A. Reference Standards - The Work is subject to the requirements of applicable portions of Section 355 (Base Course), Section 406 (Binder and Surface Courses), Section 1030, Section 1031 (RAP) and other

articles referenced within Sections 355, 406, 1030 or other Sections or Articles cited elsewhere in the Specifications of the following:

1. "Standard Specifications for Road and Bridge Construction" prepared by the Illinois Department of Transportation, latest edition, and the supplemental Specifications and recurring special provisions (separate book). The "Standard Specifications for Road and Bridge Construction" is referred to in the following Articles as the "Standard Specifications" and except as may be otherwise stated, the work to be done under this Section must conform to the requirements of said "Standard Specifications."

2. Where the "Standard Specifications" refer to the "Engineer" it will be understood to mean "Commissioner", except in cases where it is deemed to be QC testing by the Contractor.

3. This work is subject to applicable provisions of the latest IDOT special provision on requirements for Hamburg Wheel and Tensile Strength testing during the mix design and during production. Refer to the latest *IDOT Hot Mix Asphalt-Mix Design Verification and Production (BDE)* Effective November 1, 2013 for the Hamburg Wheel and Tensile Strength tests criteria.

4. This work is subject to provisions of the IDOT District 1 Special Provision on *Reclaimed Asphalt Pavement and Reclaimed Asphalt Shingles (BDE)* Effective: November 1, 2012; Revised: April 1, 2014 or latest edition.

5. Tack coat must be in accordance with Section P-603, respectively.

6. Standard Specifications articles referring to "Method of Measurement' and Basis of Payment" are not applicable.

7. Asphalt plants must meet the requirements of IDOT – S.S.R.B.C. Article 1102.01 for hot-mix asphalt (HMA) inclusive of policy memoranda and permissive use per mix Class I or otherwise, except as modified to allow use of Warm Mix Asphalt (WMA).

B. Requirements for Warm Mix Asphalt (WMA)

1. Grade Bump Reduction due to RAP – If the Contractor intends to use ≥ 20% RAP, the Contractor must indicate in the Mix Design and their QC Addendum, the proposed RAP % and the proposed PG binder grade bump reduction. The reduced grade

when combined with the RAP must result in the final effective PG as indicated in the Mix Design or the PG parameters on Table 1 of this Specification.

2. Mix Verification – For WMA technologies that cannot be replicated in the laboratory, the Contractor must indicate in their QC Addendum steps the Contractor will take to verify that the mix will be suitable for the proposed application.

3. Determination of Moisture Sensitivity – Contractor must indicate in their QC Addendum, actions the Contractor will take to ensure the WMA will not be susceptible to moisture damage.

   a. If the WMA system to be used is a system that incorporates water, the Contractor must submit in his Quality Control Plan, how the water will be controlled and monitored.

   b. The Contractor's Quality Control Plan must include monitoring of the moisture content of the aggregates used for production and the moisture content of the mixture.

      1) The moisture content of both fine and coarse aggregates used for production must be determined twice per day in accordance with ASTM C 566.

      2) The moisture content of the mixture must be determined once per lot or at least once per day, in accordance with ASTM D 1461. If it exceeds 0.5 percent by weight of dry mix, the Contractor must cease production until an action acceptable to the Commissioner is taken.

4. Proposed Mix Production Temperature – Contractor to determine what WMA technology is being proposed, what temperature reduction is expected and what production temperature range the Contractor anticipates running the WMA.

5. Anti-Strip (A-S) Additive – Anti-strip additives must be used. Only chemical additives are to be used between the months of November and April.

6. Manufacturer's Representative – Contractor must arrange for a representative of the WMA technology/equipment during the initial production at his own cost.

7. Opening to Traffic – The Contractor at the completion of the Mix Design and placement of the test section must determine the appropriate time/temperature of the pavement for opening to traffic to prevent rutting.

1.06 QUALITY CONTROL AND QUALITY ASSURANCE (QC/QA)

A. QC/QA for the work must be in accordance with IDOT – S.S.R.B.C. Article 1030.05 of the Standard Specifications.

1. Quality control of bituminous production and paving including providing testing laboratory at the plant, all QC tests and inspections at the plant and in the field, corrective actions, maintenance of QC plan and control charts and other quality control activities required in Article 1030.05 of the Standard Specifications will be performed by the Contractor. The cost for all QC testing will be borne by the Contractor and included in the price for the bituminous concrete pavements.

2. A test section of at least 500 tons must be performed to verify the mix parameters at the plant and laydown performance at the project site.

3. Quality assurance bituminous paving inspections and tests specified herein, or deemed required by the Commissioner, will be performed by a testing laboratory employed by the Commissioner. The Contractor must cooperate with said testing laboratory in every respect by providing samples for testing and necessary facilities at the job site for field tests and sample procurement. All sampling, coring including filling up of core holes, and delivering samples to the QA laboratory will be performed by the Contractor at the Contractor's cost. The cost for QA testing will be paid by the Commissioner.

4. Tests must include analysis and determination of the quality of various bituminous compositions, including air voids, VMA, density, etc., base material, and compaction of bituminous paving, verifying design as indicated or required.

1.07 WARRANTIES AND GUARANTEES

A. The Contractor must repair or replace defective materials and workmanship during the Contract Period and for one (1) year from the date of Substantial Completion of the Project.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials must be of the best quality throughout, using approved aggregates and bituminous materials.

1. Coarse and fine aggregates must be supplied from sources certified per the Aggregate Gradations Control System (AGCS) by the IDOT Bureau of Materials and Physical Research. Certifications must be submitted to the Commissioner.

2. Reclaimed Asphalt Pavement (RAP) will not be allowed in mixtures containing polymer modified asphalt binder. RAP must be in accordance with IDOT – S.S.R.B.C. Article 1031.

3. The WMA system and additives must be approved by the Commissioner.

It is the intent of the Specifications to indicate the standards of construction desired and the Contractor must, before starting this work, submit to the Commissioner for approval, mix proportions he intends to use and the means and methods of construction he intends to employ. The Contractor must provide a certified technician to monitor the rolling pattern and compaction of the bituminous courses and control the paving process to maintain the complete installation within Specifications.

B. Reclaimed Asphalt Pavement (RAP), Fractionated RAP (FRAP), and Reclaimed Shingles (RAS) may be used subject to the requirements of the IDOT Special Provision *Reclaimed Asphalt Pavement and Reclaimed Asphalt Shingles (BDE)* Effective: November 1, 2012; Revised: April 1, 2014 or latest edition:

1. Description, production, stockpiling, and testing of RAP, FRAP, and RAS (Type 1 and Type 2) must meet all requirements of the IDOT Special Provision.

2. The percentage virgin asphalt binder replacement when RAP is used alone or RAP is used in conjunction with RAS, must not exceed the amounts listed in the Table for RAP/RAS Maximum Asphalt Binder Replacement (ABR) Percentage for the given N Design, and base or surface course designations.

3. The percentage of virgin asphalt binder replacement when FRAP is used alone or FRAP is used in conjunction with RAS, must not exceed the amounts listed in the Table for FRAP/RAS Maximum Asphalt Binder Replacement (ABR) Percentage for the given N Design, and base or surface course designations.

4. If the production temperatures of the WMA technology do not exceed 275 F, the high and low virgin asphalt binder grades must each be reduced by one grade when the ABR exceeds 25 percent (i.e., 26 percent binder replacement will require a virgin asphalt binder grade of PG64-22 to be reduced to PG58-28).

C. Bituminous base course under runway, taxiway and taxilane concrete mainline pavements and shoulders must be in accordance with Section 355 of the “Standards Specifications.”

D. Bituminous surface course on runway shoulders and taxiway shoulders must be in accordance with Section 406 of the “Standards Specifications.”

E. Bituminous base course for roadways and parking areas must be as specified in Section 406 of the “Standards Specifications.”

F. Bituminous mixes for airside and landside roadways and pavements must be in accordance with Section 406 (for surface and base courses) and Section 355 (for base course) of the “Standard Specifications.”

G. Protection - Protect materials against damage from mechanical abuse, salts, acids, and other foreign matter by an approved means during transportation, storage and placement and until completion of construction work. All unsatisfactory materials must be removed from the premises, and all damaged materials replaced with new materials.

H. Asphalt Concrete Pavement for Terminal Navigational Facilities - Asphalt Concrete materials for FAA Terminal Navigational Aid Facilities installations or modifications must meet the requirements of Specification FAA GL-918 (latest version) Section 2C. These installations include, but are not limited to, all FAA sites/facility improvements and access roadways. This Specification is included in

the Appendix to these contract documents. No additional payment will be made for compliance with this Specification.

*Per IDOT – S.S.R.B.C., Hot Mix Asphalt (HMA) Base course will be considered Hot Mix Asphalt Binder course with an IL-19.0 size.

TABLE 1 - P-405 BITUMINOUS CONCRETE PAVEMENT MIX DESIGN PARAMETERS

LANDSIDE PAVEMENTS								
PAVEMENT USAGE	**ESAL**	**N DESIGN**	**IDOT MIX DESIGNATION**	**BAS / SURFACE COURSE**	**THICKNESS (Inches)**	**AIR VOIDS**	**ASPHALT BINDER**	**MAX. ABR for RAP, RAP/RAS, FRAP, FRAP/RAS (1)**
Parking Lot	High	70	IL-9.5	Surface	1 1/2	4%	PG 64-22	(1)
		70	IL-19.0	Base	2 1/2	4%	PG 64-22	(1)
		50	IL-19.0	Base	6	2%	PG 58-22	(1)
Service Road	High	70	IL-9.5 or IL-12.5	Surface	2	4%	PG 64-22	(1)
		70	IL-19.0	Base	3	4%	PG 64-22	(1)
		50	IL-19.0	Base	6	2%	PG 58-22	(1)
Access Road	Low	30	IL-9.5 or IL-12.5	Surface	1 1/2	3%	PG 58-22	(1)
		30	IL-19.0L	Base	2 1/2	4%	PG 58-22	(1)
(1) Maximum ABR for RAP, RAP/RAS, FRAP, FRAP/RAS as allowed per IDOT Special Provision *Reclaimed Asphalt Pavement and Reclaimed Asphalt Shingles (BDE)* Effective: November 1, 2012; Revised: April 1, 2014 or latest								

AIRFIELD (AIRSIDE) PAVEMENTS							
PAVEMENT USAGE	**N DESIGN**	**IDOT MIX DESIGNATION**	**BASE/ SURFACE COURSE**	**THICKNESS (Inches)**	**AIR VOIDS**	**ASPHALT BINDER**	**MAX. ABR forRAP, RAP/RAS, FRAP, FRAP/RAS (1)**
Runway Base Course Under PCC Pavement	50	IL-19.0	Base	6	4%	PG 58-22	(1)
Taxiway Base Course Under PCC Pavement	50	IL-19.0	Base	6	4%	PG 58-22	(1)
Runway/Taxiway Shoulders, Blast Pad	70	IL-9.5 or IL-12.5	Surface	3	4%	PG 64-22	(1)
	50	IL-19.0	Base	4	2%	PG 58-22	(1)
Airside Service Road	70	IL-9.5 or IL-12.5	Surface	2	4%	PG 64-22	(1)
	70	IL-19.0	Base	3	4%	PG 64-22	(1)
	50	IL-19.0	Base	6	2%	PG 58-22	(1)
Fire Rescue Road / Snow Equipment Staging Area	70	IL-9.5 or IL-12.5	Surface	3	4%	PG 64-22	(1)
	70	IL-19.0	Base	6	4%	PG 64-22	(1)
Perimeter Road	70	IL-9.5 or IL-12.5	Surface	1 1/2	4%	PG 64-22	(1)
	70	IL-19.0	Base	2 1/2	4%	PG 64-22	(1)
Access Road Within RSA and TSA (Incl. Access to FAA Facilities)	30	IL-9.5 or IL-12.5	Surface	2	3%	PG 58-22	(1)
(1) Maximum ABR for RAP, RAP/RAS, FRAP, FRAP/RAS as allowed per IDOT Special Provision *Reclaimed Asphalt Pavement and Reclaimed Asphalt Shingles (BDE)* Effective: November 1, 2012; Revised: April 1, 2014 or latest							

PART 3 EXECUTION

3.01 INSPECTION AND VISUAL EVALUATION OF PAVEMENT

A. The Contractor must not commence bituminous paving work in this Section until the underlying course has been accepted by the Commissioner. This must be agreed to in a written document by the Contractor and the Commissioner.

B. Visual evaluation of airfield pavements (runway shoulder, taxiway shoulder, base course under PCC pavement, and blast pad) – The Contractor and his/her paving subcontractor, Quality Control Testing Laboratory and WMA System/Additive manufacturer's representative are required to attend the joint visual evaluation of the installed pavement with the Commissioner (CM), the FAA AAS-100 Civil Engineer or designee, and the Consultant/Designer, at the following schedules:

1. Prior to opening of the bituminous pavement to traffic or placement of PCC.

2. One month after traffic if any locations are subjected to traffic.

3. Three or six months after traffic, whichever, if either, deemed needed at the time of the one-month review or if no areas trafficked, one year after placement.

The Commissioner (CM) will coordinate the joint visual evaluations.

3.02 MATERIAL TRANSFER DEVICE

A. The Material Transfer Device must be used for the placement of the WMA concrete base and surface courses on the Runways, Taxiways, and Shoulders. The Material Transfer Device speed must be adjusted to the speed of the paver to maintain a continuous, nonstop paving operation.

B. The Material Transfer Device must have a minimum surge capacity of 25 tons, must be self-propelled and capable of moving independently of the paver, and must be equipped with the following:

1. Front Dump Hopper and Conveyor. The conveyor must provide a positive restraint along the sides of the conveyor to prevent material spillage.

2. Paver Hopper Insert. The paver hopper insert must have a minimum capacity of 14 tons.

3. Mixer/Agitator Mechanism. This re-mixing mechanism must consist of a segmented, anti-segregation, re-mixing auger or two full length longitudinal paddle mixers designed for the purpose of re-mixing the bituminous material. The longitudinal paddle mixers must be located in the paver hopper insert.

3.03 INSTALLATION

A. The pavements must be finished to indicated grades, slopes and elevations and must meet existing or established grades as applicable. All work required to adapt to existing conditions to obtain proper transition between the new work and the existing must be performed. No depressions or waves will be permitted over 1/4 inch in 10 feet, non-cumulative. WMA concrete must not be placed upon a wet surface or when the temperature of the underlying course is less than specified in Table 2. The temperature requirements may be waived by the Commissioner, if requested in writing and a cold weather paving plan has been submitted and approved; however, all other requirements including compaction must be met.

TABLE 2
Base Temperature Limitations

Mat Thickness	Base Temperature Deg. F
3 in. or greater	40
Greater than 1 in. but less than 3 in.	45
1 in. or less	50

B. The underlying course must have been previously placed and compacted as specified in the applicable Sections of the Specifications. Before proceeding, the Contractor must carefully examine the underlying course and must perform any minor grading, shaping, filling or other preparatory work required, in the opinion of the testing laboratory or the Commissioner, to properly install the bituminous pavement.

C. Bituminous concrete base course under runway shoulders, taxiway and taxilane shoulders must be placed as Specified in Section 355 of the "Standard Specifications."

D. Bituminous concrete base and surface courses must be placed as specified in Section 406 of the "Standard Specifications." Rolling must be done on each of the separate courses by utilizing a test strip to determine the maximum obtainable density and must be continued until the required density is obtained. If there is any doubt as to the adequacy of the bituminous courses, cores must be taken and density checked as specified in Section 406 of the Standard Specifications to determine if the placed mix conforms to the approved mix.

E. Protection - Adequate barriers must be provided to prevent the movement of traffic over the bituminous pavement until it has set for at least 24 hours. Also, the Contractor must be responsible for any damage to adjacent pavements caused by the paving operations.

F. Inspection - All thicknesses shown on the Plans are measured after compaction and are subject to inspection and approval. The Contractor must patch any core holes and cuts made for inspection and density tests, as part of the work. Tolerances in surface must be as specified.

3.04 GENERAL CLEAN-UP

A. All rubbish and debris resulting from the Work of this Section must be collected, removed from Airport Property and disposed of legally.

B. All work areas must be left in a broom clean condition.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. WMA Concrete Pavements will be measured by the number of tons of each bituminous mixture used in the accepted work in accordance with IDOT – S.S.R.B.C. Article 406.13. Recorded truck scale weights will be used to determine the basis for the tonnage. However, payment will not be made for bituminous mixture in excess of 100% of the theoretical weight in tons as computed by the Commissioner. For locations with pavement replacement following utility installation, the maximum pavement area for payment will be the maximum trench width plus 2 feet.

B. A test strip required for asphalt pavement will be measured as a lump sum, placed and accepted. Work includes the preparation, paving, and removal of each test strip for the associated pavement course.

Failed test strips are to be repeated at no additional cost to the Commissioner.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

A. Payment for WMA Concrete Pavements will be made at the Contract unit price per ton for each bituminous mixture placed and accepted by the Commissioner. The price will be full compensation for furnishing all materials, for all preparation, mixing and placing of those materials, and for all labor, equipment, tools and all work necessary to complete the item.

B. Payment for Bituminous Concrete Testing – Test Strip will be made at the contract lump sum price. The work includes all preparation, mixing and placing of those materials, and for all labor, equipment, tools and all work necessary to complete the test strip for each course of pavement and for removal.

C. Payment will be made under the following items:

ITEM NO.	DESCRIPTION	UOM
P-405(WMA)-01	BITUMINOUS CONCRETE SURFACE COURSE, IL-9.5, N70 (WMA)	TON
P-405(WMA)-02	BITUMINOUS CONCRETE BASE COURSE, IL-19.0, N50 (WMA) (2% OR 4% AIR VOIDS)	TON
P-405(WMA)-03	BITUMINOUS CONCRETE TESTING - TEST STRIP	LS

END OF SECTION P-405(WMA)

PLANT MIX BITUMINOUS PAVEMENTS (TORSION MIX) SECTION P-406

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item must consist of a surface and a 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 must conform to the lines, grades, thicknesses, and typical cross sections shown on the Plans. The work under this Section is subject to the requirements of the Contract Documents.

1.02 REFERENCES

A. Illinois Department of Transportation, Standard Specification for Road and Bridge Construction (SSRBC), latest edition.

1.03 RELATED WORK

A. As specified in the following Section:

1. Section P-603 – Bituminous Tack Coat (Trackless)

2. Section P-617 – Pavement Scarification

PART 2 - MATERIALS

2.01 AGGREGATE

A. Aggregates must consist of crushed stone or crushed gravel with or without sand or other inert finely divided mineral aggregate conforming to the requirements of the Illinois Department of Transportation, Standard Specifications for Road and Bridge Construction (SSRBC), latest edition. The portion of materials retained on the No. 8 sieve is coarse aggregate. The portion passing the No. 8 sieve and retained on the No. 200 sieve is fine aggregate, and the portion passing the No. 200 sieve is mineral filler. All aggregate property tests must be conducted by an accredited laboratory that meets the requirements of Section 406-3.05. Aggregate test results must not be greater than six months old. If test results are provided on the combined blend, the Commissioner reserves the right to require tests on individual aggregates should a major change in the Job Mix Formula percentages occur.

B. Coarse Aggregate: Coarse aggregate must consist of sound, tough, durable particles, free from adherent films of matter that would prevent thorough coating and bonding with the bituminous material and be free from organic matter and other deleterious substances. Coarse aggregate must be quality Class B or better, or as modified by this Specification, conforming to the requirements of Article 1004 of the SSRBC. The percentage of wear must not be greater than 40 percent when tested in accordance with ASTM C 131. The sodium sulfate soundness loss must not exceed 10 percent, or the magnesium sulfate soundness loss must not exceed 13 percent, after five cycles, when tested in accordance with ASTM C 88.

1. The combined coarse aggregate material must contain at least 85 percent by weight having at least one fractured face and 80 percent by weight having a minimum of two (2) fractured faces. The fractured face percentage for any crushed gravel aggregate material, retained on the No. 8 sieve after crushing, must be determined in accordance with ASTM D 5821. The area of each face must be equal to at least 75 percent of the smallest midsectional area of the piece. When two fractured faces are contiguous, the angle between the planes of fractures must be at least 30 degrees to count as two fractured faces. Fractured faces must be obtained by crushing.

2. The aggregate must not contain more than 8 percent, by weight, of flat or elongated pieces, when tested in accordance with ASTM D 4791 using a ratio of 5:1.

C. Fine Aggregate: Fine aggregate must consist of clean, sound, durable, angular shaped particles produced by crushing stone or gravel that meets the requirements for wear and soundness specified for coarse aggregate. Fine aggregate must be quality Class B or better, or as modified by this Specification, conforming to the requirements of Article 1003 of the SSRBC. The aggregate particles must be free from coatings of clay, silt, or other objectionable matter and must contain no clay balls. The fine aggregate, including any blended material for the fine aggregate, must have a plasticity index of not more than 6 and a liquid limit of not more than 25 when tested in accordance with ASTM D 4318.

1. Natural (non-manufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. The amount of sand to be added must be adjusted to produce mixtures conforming to requirements of this Specification. The addition of natural sand must be limited such that the total combined material passing the #8 sieve does not contain more than 50% natural sand.

2. The fine aggregate must have sand equivalent value of 43 or greater when tested in accordance with ASTM D 2419. The fine aggregate material must have a Fine Aggregate Angularity of not less than 45 when tested in accordance with AASHTO T304, Method A.

D. Sampling: ASTM D 75 must be used in sampling coarse and fine aggregate, and ASTM C 183 must be used in sampling mineral filler.

2.02 MINERAL FILLER

A. If filler, in addition to that naturally present in the aggregate, is necessary, it must meet the requirements of ASTM D 242.

2.03 BITUMINOUS MATERIAL

A. The bituminous material must be PG 46-34 or 58-28 or 70-28 Ground Tire Rubber (GTR)+12, plus 5% Evoflex CA07 by total weight of AC. A certificate of compliance from the manufacturer must be included with the mix design submittal.

B. The Contractor must furnish vendor's certified test reports for each lot of bituminous material shipped to the Project. The vendor's certified test report for the bituminous material can be used for acceptance or the bituminous material may be tested independently by the Commissioner.

2.04 PRELIMINARY MATERIAL ACCEPTANCE

A. Prior to delivery of materials to the job site, the Contractor must submit independent certified test reports, not more than 30 days old, to the Commissioner for the following materials:

1. Coarse Aggregate

2. Percent of wear.

3. Soundness.

4. Coarse Aggregate Fractured Faces Determination (Coarse Aggregate Angularity).

5. Percent Absorption.

6. Percent flat and elongated particles.

a. Fine Aggregate

(1) Liquid limit.

(2) Plastic index.

(3) Sand equivalent.

(4) Fine Aggregate Angularity.

b. Mineral Filler

(1) Bituminous Material: The certification(s) must show the appropriate AASHTO test(s) for each material, the test results, and a statement that the material meets the Specification requirement.

c. The Contractor must submit independent certified test reports for all material under this Specification for every 10,000 tons of material placed. These test reports must not be more than 10 days old and are to be submitted to the Commissioner within 5 days of exceeding the 10,000 ton requirement.

PART 3 - COMPOSITION

3.01 COMPOSITION OF MIXTURE

A. The bituminous plant mix must be composed of a mixture of well graded aggregate, filler if required, and bituminous material. The several aggregate fractions must be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF).

3.02 JOB MIX FORMULA

A. No bituminous mixture for payment will be produced until a job mix formula has been approved in writing by the Commissioner. The bituminous mixture must be designed using procedures contained in Chapter 5, Superpave™ Mix Design of the Asphalt Institute's Manual Superpave™ Series No. 2 (SP-2), Superpave™ Mix Design, and must meet the requirements outlined below.

B. The Tensile Strength Ratio (TSR) of the composite mixture must be greater than or equal to 80 when tested in accordance with ASTM D 4867 including the freeze-thaw conditioning cycle. Test specimens must have an air void content of 7 percent (+/- 0.5%) and a degree of

saturation of 70 percent (+/- 5%). An anti-stripping agent is required, it must be provided by the Contractor.

C. The mixture will be tested and must exceed the requirements of AASHTO T324, Hamburg Test.

D. Hamburg Wheel Test Criteria. The maximum allowable net depth must be ½" at 5,000 wheel passes.

E. Fracture Energy Requirements for Crack Resistance.

F. Determination of Minimum Fracture Energy, $G_{f,min}$. Fracture energy must be determined using Illinois Modified ASTM D 7313. Testing must be conducted both during mix design phase and during pre- production based on cores taken from a paved test strip.
Torsion Mix: $G_{f,min}$ = 850 J/m^2 minimum, at test temperature of -12ºC.

G. The job mix formula must be submitted in writing by the Contractor to the Commissioner at least 30 days prior to the start of paving operations. The Job Mix Formula must have been developed no more than 3 months prior to submittal and must include as a minimum:

1. Percent passing each sieve size for total combined gradation, individual gradation of all aggregate stockpiles and percentage by weight of each stockpile used in the JMF.

2. Percent of asphalt cement.

3. Asphalt Performance Grade.

4. Number of gyrations and air voids for N_{des}

5. Mixing temperature.

6. Compaction temperature.

7. Temperature of mix when discharged from the mixer.

8. Temperature-viscosity relationship of the asphalt cement.

9. Plot of the combined gradation on the Federal Highway Administration (FHWA) 45 power gradation curve.

10. Graphical plots of percentG_{mm} @ N_{design}, air voids, voids in the mineral aggregate, and unit weight versus asphalt content.

11. Percent natural sand contained in material passing the number 8 sieve.

12. Coarse Aggregate Angularity.

13. Percent elongated particles.

14. Tensile Strength Ratio (TSR).

15. Antistrip agent.

16. Sand equivalent value of the fine aggregate for the combined blend.

17. Fine aggregate angularity of the combined blend.

18. Dust to asphalt ratio.

19. Wet mixing time to achieve the required minimum percentage of coated particles.

H. The Contractor must submit samples to the Commissioner, for job mix formula verification testing.

I. The job mix formula for each mixture must be in effect until modified in writing by the Commissioner. Should a change in sources or properties of materials be made, a new job mix formula must be approved by the Commissioner before the new material is used.

TABLE 1

Superpave™ Design Criteria for IL-4.75 Nominal Maximum Aggregate Size

Test Property	IL-4.75 Nom.
Design Number of Gyrations (N_{des})	50
Air Voids @ N_{des}	3.5
Voids in Mineral Aggregate @ N_{des}, percent	18.5 min.
Voids filled with Asphalt @ N_{des}, percent	75-85
Total Dust to Asphalt Ratio	1.5 Max
Fine Aggregate Angularity	45 min.

J. The mineral aggregate must be of such size that the percentage composition by weight, as determined by laboratory screens, must

conform to the gradation or gradations specified in Table 3 when tested in accordance with ASTM Standard C 136 and C 117. Optimum gradations are approximately parallel to the Specification bands.

K. The gradations in Table 3 represent the limits which must determine the suitability of aggregate for use from the sources of supply. The aggregate, as selected (and used in the JMF), must have a gradation within the limits designated in Table 3 and must not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but must be well graded from coarse to fine.

L. Deviations from the final approved mix design for bitumen content and gradation of aggregates must be within the action limits for individual measurements as specified in paragraph 406-6.05.C, provided deviations fall inside the control points in Table 3.

TABLE 3

Aggregate – Bituminous Pavements IL-4.75 Nominal Maximum Size Aggregate

Runway/Taxiway/Apron Pavements

Gradation Limits

Sieve Size	Min.	Max.	
1in.	100	100	
3/4 in.	100	100	
1/2 in.	100	100	
3/8 in.	100	100	
No. 4	90	100	
No. 8	70	90	
No. 16	50	85	
No. 30	35	55	
No. 50	15	30	
No. 100	10	18	
No. 200	7	9	
Asphalt Cement Content (percent)	7.0	9.0	

M. The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves must be corrected when the specific gravity varies by 10 percent or more.

3.03 RECYCLED ASPHALT CONCRETE

A. Reclaimed asphalt pavement will not be permitted to be used.

3.04 TEST SECTION (DELETED)

3.05 TESTING LABORATORY

A. The laboratory used to develop the job mix formula must meet the requirements of ASTM D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements must be submitted to the Commissioner prior to the start of construction. The certification must contain as a minimum:

1. Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.

2. A listing of equipment to be used in developing the job mix.

3. A copy of the laboratory's quality control system.

4. Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program.

5. Evidence that the laboratory is accredited, for the test methods required herein by a nationally recognized laboratory accreditation organization.

PART 4 - CONSTRUCTION METHODS

4.01 PAVING PLAN

A. The Contractor must submit a paving plan, for information only, to the Commissioner which outlines the means and methods to be utilized by the Contractor in meeting the requirements of Section 406 Part 4.

4.02 WEATHER LIMITATIONS

A. The bituminous mixture must 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 by the Commissioner, if requested in writing and a cold weather paving plan

has been submitted and approved by the Commissioner; however, all other requirements including compaction must be met.

TABLE 4

Base Temperature Limitations

Mat Thickness	Base Temperature Deg. F(Min)
3 in. or greater	40
Greater than 1 in. but less than 3 in.	45
1 in. or less	50

4.03 BITUMINOUS MIXING PLANT

A. Plants must meet the requirements or the SSRBC (IDOT) Article 1102, inclusive of all Policy Memorandums thereof.

B. Additionally, Plants used for the preparation of bituminous mixtures must conform to the requirements of ASTM D 995 with the following changes:

1. Requirements for All Plants.

a. Truck Scales: The bituminous mixture must be weighed on approved scales furnished by the Contractor. Scales must be inspected and sealed as often as the Commissioner deems necessary to assure their accuracy.

b. Testing Facilities: The Contractor must provide laboratory facilities at the plant for the use of the Commissioner's acceptance testing and the Contractor's quality control testing, in accordance with paragraph 406-6.02.

c. Inspection of Plant: The Commissioner, or Commissioner's authorized representative, must have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

d. Storage Bins and Surge Bins: Paragraph 3.9 of ASTM D 995 is deleted. Instead, the following applies. Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted as follows:

(1) The bituminous mixture may be stored in surge bins for period of time not to exceed 3 hours.

(2) The bituminous mixture may be stored in insulated storage bins for a period of time not to exceed 24 hours.

(3) The bins must be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

(4) If the Commissioner determines that there is an excessive amount of heat loss, segregation or oxidation of the mixture due to temporary storage, no overnight storage will be allowed.

(5) Surge bin weight will not be accepted for payment purposes.

4.04 HAULING EQUIPMENT

A. Trucks used for hauling bituminous mixtures must have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds must be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. The Contractor must submit the method of coating. Each truck must have and use a tarp cover to protect the mixture at all times. To ensure that the mixture must be delivered to the site at the specified temperature, truck beds must be insulated or heated and covers must be securely fastened during transport.

4.05 BITUMINOUS PAVERS

A. Bituminous pavers must be self-propelled, with an activated screed, heated as necessary, and must be capable of spreading and finishing courses of bituminous plant mix material which will meet the specified thickness, smoothness, and grade. The paver must have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

B. The Paver must not exceed a width of 16 feet.

C. The paver must have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper must be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed must effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. The screed must be equal to the width of the

pavement being placed. The use of extended screeds will not be permitted.

D. An automatic grade control device must be used. The paver must be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system must be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which must maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller must be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

E. The controls must be capable of working in conjunction with any of the following attachments:

1. Manufacturer recommended Ski-type device of not less than 30 feet in length.

2. Taut stringline (wire) set to grade.

3. Laser control.

4. Short ski or shoe.

4.06 MATERIAL TRANSFER DEVICE

A. The Material Transfer Device must be used for the placement of the bituminous concrete base and bituminous concrete surface courses on the Runways and Taxiways. The Material Transfer Device speed must be adjusted to the speed of the paver to maintain a continuous, non-stop paving operation.

B. The Material Transfer Device must have a minimum surge capacity of 25 tons, must be self-propelled and capable of moving independently of the paver, and must be equipped with the following:

1. Front Dump Hopper and Conveyor. The conveyor must provide a positive restraint along the sides of the conveyor to prevent material spillage.

2. Paver Hopper Insert. The paver hopper insert must have a minimum capacity of 14 tons.

3. Mixer/Agitator Mechanism. This re-mixing mechanism must consist of a segmented, anti-segregation, re-mixing auger or two full length longitudinal paddle mixers designed for the purpose of

re-mixing the bituminous material. The longitudinal paddle mixers must be located in the paver hopper insert.

4.07 ROLLERS

A. Rollers of the vibratory, steel wheel type must be used. They must be in good condition, capable of operating at slow speeds to avoid displacement of the bituminous mixture. The number, type, and weight of rollers must be detailed in the Construction Operations plan required by Section P-406-4.01 and must be sufficient to compact the mixture to the required density while it is still in a workable condition. Vibratory rollers, in the dynamic mode, must be operated at a minimum frequency of at least 1600 vpm and a minimum roller speed to produce at least 10 impacts per foot.

B. The use of equipment which causes excessive crushing of the aggregate will not be permitted.

4.08 PREPARATION OF BITUMINOUS MATERIAL

A. The bituminous material must be heated 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 must be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but must not exceed 325 degrees F, unless otherwise required by the manufacturer.

4.09 PREPARATION OF MINERAL AGGREGATE

A. The aggregate for the mixture must be heated and dried prior to introduction into the mixer. The maximum temperature and rate of heating must be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler must not exceed 350 degrees F when the asphalt is added. Particular care must be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature must 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.

4.10 PREPARATION OF BITUMINOUS MIXTURE

A. The aggregates and the bituminous material must be weighed or metered and introduced into the mixer in the amount specified by the job mix formula.

B. The combined materials must be mixed until the aggregate obtains a uniform coating of bitumen and is thoroughly distributed throughout the mixture. Wet mixing time must be the shortest time that will produce a satisfactory mixture, but not less than 25 seconds for batch plants. The wet mixing time for all plants must be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. For continuous mix plants, the minimum mixing time must be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all bituminous mix upon discharge must not exceed 0.5 percent.

4.11 PREPARATION OF THE UNDERLYING SURFACE

A. Immediately before placing the bituminous mixture, the underlying course must be cleaned of all dust and debris. A prime coat or tack coat must be applied in accordance with Item P-603, as shown on the Plans or as directed by the Commissioner.

B. Concrete or HMA Base. The base must be cleaned of all dust, debris and any substance that will prevent the tack coat from adhering to the base. Cleaning must be accomplished by sweeping with a Regenerating sweeper or sweeping and air blasting methods, as approved by the Commissioner. The tack coat must be applied uniformly and at a rate that will provide a residual asphalt on the prepared surface of 0.05 lb/sq.ft.

4.12 TRANSPORTING, PLACING, AND FINISHING

A. The bituminous mixture must be transported from the mixing plant to the site in vehicles conforming to the requirements of paragraph 406-4.04. Deliveries must be scheduled so that placing and compacting of mixture is uniform with no stopping and starting of the paver. Adequate artificial lighting must be provided for night placements in accordance with Specification N-100. Hauling over freshly placed material will not be permitted until the material has been compacted, as specified, and allowed to cool to atmospheric temperature.

B. The initial placement and compaction of the mixture must occur at a temperature suitable for obtaining density, surface smoothness, and other specified requirements but not less than 280 degrees

C. Upon arrival, the mixture must be placed to the full width by a bituminous paver. It must be struck off in a uniform layer of such depth that, when the work is completed, it must have the required thickness

and conform to the grade and contour indicated. The Contractor may place base course lifts of not more than 4 inches thick when compacted except that the top lift must have a minimum of 2 $^{1}/_{4}$ inch compacted thickness. The surface course must be placed to achieve a compacted thickness of 2 $^{1}/_{4}$ inches. The speed of the paver must be regulated to eliminate pulling and tearing of the bituminous mat but in no case must the speed of the paver exceed 40 feet per minute. Unless otherwise permitted, placement of the mixture must begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The longitudinal joint in one course must offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface top course must be at the centerline of the pavement. Transverse joints in one course must be offset by at least 10 feet from transverse joints in the previous course.

D. Paving lanes should not exceed 16 feet.

E. Transverse joints in adjacent lanes must be offset a minimum of 10 feet.

F. Continuous paving using the Material Transfer Device is required. No stopping during paving operations will be permitted.

G. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

4.13 COMPACTION OF MIXTURE:

A. After placing, the mixture must be thoroughly and uniformly compacted by rolling. The surface must be compacted as soon as possible when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used must be at the discretion of the Contractor but the type and rolling pattern must be as established and approved by the Commissioner during placement of the test sections.

B. The speed of the roller must, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, must be corrected at once. Vibratory rollers in the dynamic mode, must be operated at a minimum frequency of at least 1600 VPM and a minimum roller speed to produce at least 10 impacts per foot.

C. Sufficient rollers must be furnished to handle the output of the plant. Rolling must continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained.

D. To prevent adhesion of the mixture to the roller, the wheels must be kept properly moistened (and scrapers used), but excessive water will not be permitted. Rollers are not allowed to sit stationary on the hot mat.

E. In areas not accessible to the roller, the mixture must be thoroughly compacted with hand tampers.

F. All roller lines must be removed.

G. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective must be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work must be done at the Contractor's expense. Skin patching will not be allowed.

4.14 JOINTS

A. The formation of all joints must be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints must have the same texture as other sections of the course and meet the requirements for smoothness and grade.

B. The roller must 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 must be made by means of placing a bulkhead or by tapering the course. The edge of all joints must be cut back to their full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. All contact surfaces must be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

C. Longitudinal joints which are irregular, damaged, uncompacted, or otherwise defective must be cut back to expose a clean, sound surface for full depth of the course. All contact surfaces must be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

PART 5 - MATERIAL ACCEPTANCE

5.01 ACCEPTANCE SAMPLING AND TESTING

A. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this Section will be performed by the Commissioner at no cost to the Contractor. Testing organizations performing these tests must meet the requirements of ASTM D 3666. All equipment in Contractor furnished laboratories must be calibrated by the Contractor, and verified by the testing organization prior to the start of operations to meet the minimum ASTM requirements. The Contractor must be required to submit evidence of recalibration of all equipment in the Contractor furnished laboratory for every 25,000 tons of material placed. The calibration will be witnessed by the Commissioner's testing organization and must be documented. All Contractor personnel preparing laboratory compacted acceptance specimens must be state certified Superpave™ Field Testing Technicians or equivalent acceptable to the Commissioner.

B. Plant-Produced Material: Plant-produced material must be tested for air voids on a lot basis. Sampling must be by the Contractor from material deposited into trucks at the plant in accordance with paragraph 406-5.01.B.1 Sampling. Acceptance samples, for each lot, will not be obtained from the first 50 tons of plant-produced material unless multiple lots occur in one day of production. The first 50 tons of plant-produced material must be included in the requirements of paragraph 406-5.01.C. A lot must consist of:

1. One day's production not to exceed 2,000 tons, but not less than 500 tons. Production runs less than 500 tons must be tested as a sublot and combined with and into the next production lot; or

2. A half day's production where a day's production is expected to consist of between 2,000 and 4,000 tons; or

3. Similar subdivisions for tonnages over 4,000 tons.

    a. Adjustments for lot size due to increases/decreases of estimated tonnage received from the Contractor must be at the Commissioner's discretion. The Contractor must notify the Commissioner, 12 hours in advance of placement, as to anticipated production time and tonnage.

b. Where more than one plant is simultaneously producing material for the job, the lot sizes must apply separately for each plant.

4. Sampling. Each lot must consist of four equal sublots. Sufficient material for preparation of test specimens for all testing must be sampled by the Contractor on a random basis, as provided by the Commissioner, in accordance with the procedures contained in ASTM D 3665, or a computer based program approved by the Commissioner. All samples must be obtained in accordance with ASTM D979. The Contractor must prepare, under the supervision of the Commissioner, the laboratory compacted test specimens and provide the Commissioner with a printout of all data generated by the gyratory compaction equipment. One set of laboratory compacted specimens must be prepared, at the design number of gyrations required by paragraph 406- 3.02, Table 1, for each sublot, in accordance with the compaction procedures outlined in Chapter 5, Superpave™ Level 1 Mix Design, of the Asphalt Institute's Manual Superpave™ Series No. 2(SP-2) Superpave Mix Design. Each set of laboratory compacted specimens must consist of two test specimens prepared from the same sample increment. The Contractor is responsible for obtaining, splitting and transporting to the Commissioner's representative, at the Contractor's Laboratory, all samples required for acceptance testing. All samples will be transferred with a Chain of Custody form provided by the Commissioner.

   a. The sample of bituminous mixture must be maintained at a temperature at or above the specified compaction temperature for a period of no less than 30 minutes. For mixtures containing aggregates with absorption values greater than 1.5 percent, the mixture must be maintained at a temperature at or above the specified compaction temperature for a period of no less than 60 minutes. If necessary, the sample must be placed in an oven for not more than 60 to 90 minutes to bring the samples to the proper compaction temperature. The compaction temperatures must be as specified in the job mix formula.

   b. Lighting of the sampling area must meet the requirements of the N-100 Section.

5. Testing. Air voids will be determined by the Commissioner in accordance with ASTM D 3203 for acceptance only. The

Contractor must perform all quality control testing in accordance with the Specifications or as directed by the Commissioner.

a. Prior to testing for air voids, the bulk specific gravity of each test specimen will be measured by the Commissioner in accordance with ASTM D 2726 using the procedure for laboratory-prepared thoroughly dry specimens, or ASTM D 1188, whichever is applicable, for use in computing air voids.

b. For air voids and pavement density, the theoretical maximum specific gravity of the mixture must be measured for each sublot in accordance with ASTM D 2041, Type C, D, or E container. The value used in the air voids computation for each sublot must be based on maximum specific gravity measurement for the sublot.

6. Acceptance. Acceptance of plant produced material for air voids will be determined by the Commissioner in accordance with the requirements of paragraph 406-5.02.

C. Field Placed Material: Material placed in the field must be tested for mat and joint density on a lot basis.

1. Mat Density. The lot size must be the same as that indicated in paragraph 406-5.01.B and must be divided into four equal sublots. One 4-inch diameter core of finished, compacted materials must be taken by the Contractor from each sublot. Core locations will be determined by the Commissioner on a random basis in accordance with procedures contained in ASTM D 3665. Cores must not be taken closer than one foot from a transverse or longitudinal joint.

2. Joint Density. The lot size must be the total length of longitudinal joints constructed by a lot of material as defined in paragraph 406-5.01.B. The lot must be divided into four equal sublots. One 4-inch diameter core of finished, compacted materials must be taken by the Contractor from each sublot. Core locations will be determined by the Commissioner on a random basis in accordance with procedures contained in ASTM D 3665. All coring must be centered on the joint.

3. Sampling. Samples must be neatly cut with a core drill within 72 hours of paving. The cutting edge of the core drill bit must be of hardened steel or other suitable material with diamond chips embedded in the metal cutting edge. The minimum diameter of

the sample must be four inches. Samples that are clearly defective, as a result of sampling, must be discarded and another sample taken. The Contractor, by submission of the cores to the Commissioner for testing, acknowledges that the cores are not defective unless otherwise noted on the Chain of Custody form provided by the Commissioner. The Contractor must furnish all tools, labor, and materials for cutting samples and filling the cored pavement. Cored holes must be filled in a manner acceptable to the Commissioner immediately following the coring operation.

4. Testing. The bulk specific gravity of each cored sample will be measured by the Commissioner in accordance with ASTM D 2726 or ASTM D 1188, whichever is applicable. The percent compaction (density) of each sample must be determined by dividing the bulk specific gravity of each cored sublot sample by the maximum theoretical specific gravity for that sublot, as determined in paragraph 406-5.01.B.2. The maximum theoretical specific gravity used to determine the joint density at joints between two different lots must be the lower of the specific gravity values from the two different lots.

5. Acceptance. Acceptance of field placed material for mat density will be determined by the Commissioner in accordance with the requirements of paragraph 406-5.02. Acceptance for joint density will be determined in accordance with the requirements of paragraph 406-5.02.

D. Partial Lots - Plant-Produced Material. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and Commissioner agree in writing to allow overages or other minor tonnage placements to be considered as partial lots, the following procedure must be used to adjust the lot size and the number of tests for the lot.

1. The last batch produced where production is halted must be sampled and its properties must be considered as representative of the particular sublot from which it was taken. Where three sublots are produced, they must constitute a lot. Where one or two sublots are produced, they must be incorporated into the next lot and the total number of sublots must be used in the acceptance plan calculation, i.e., n = 5 or n= 6, for example.

E. Partial Lots - Field Placed Material. The lot size for field placed material must correspond to that of the plant material, except that, in no cases,

less than (3) cored samples must be obtained for the acceptance plan calculations, i.e., n = 3.

5.02 ACCEPTANCE CRITERIA:

A. General: Acceptance will be based on the following characteristics of the bituminous mixture and completed pavement as well as the implementation of the Contractor's Quality Control plan and test results:

TABLE 5

Acceptance Limits

Specification Tolerance Limits

Test Property	Lower	Upper
Air Voids, (percent @ N_{des})	2.5	4.5
Mat Density (percentG_{mm})	92.8	
Joint Density (percentG_{mm})	90.5	

5.03 RESAMPLING PAVEMENT (DELETED)

PART 6 - CONTRACTOR QUALITY CONTROL

6.01 GENERAL

A. The Contractor must develop a Quality Control Program in accordance with Section Q-100 of these Specifications. The program will address all elements which affect the quality of the pavement including, but not limited to:

1. Mix Design
2. Aggregate Grading
3. Quality of Materials
4. Stockpile Management
5. Proportioning
6. Mixing and Transportation
7. Placing and Finishing

8. Joints

9. Compaction

10. Surface smoothness

11. Assignment of Personnel

6.02 TESTING LABORATORY

A. The Contractor must provide a fully equipped asphalt laboratory located at the plant. It will be available for joint use by the Contractor for quality control testing and by the Commissioner for acceptance testing and must have adequate calibrated equipment for the performance of the tests required by these Specifications. The Commissioner will have priority in use of the equipment necessary for acceptance testing.

B. The effective working area of the laboratory must be a minimum of 250 square feet with a ceiling height of not less than 7.5 feet (2.3 meters). Lighting must be adequate to illuminate all working areas. It must be equipped with heating and air conditioning units to maintain a temperature of 70 degrees F + 5 degrees. Toilet facilities must be provided. A desk with a suitable chair must be provided. Exterior Lighting must meet the requirements of Section N-100. Restroom facilities must be provided as well as a supply of drinking water.

C. Laboratory facilities must be kept clean and dry, and all equipment must be maintained in proper working condition by the Contractor. The Commissioner will be permitted unrestricted access to inspect the Contractor's laboratory facility and witness quality control activities. The Commissioner will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to be adversely affecting test results, the incorporation of the materials into the work must be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

6.03 QUALITY CONTROL TESTING

A. The Contractor must perform all quality control tests necessary to control the production and construction processes applicable to these Specifications and as set forth in the Quality Control Program or as requested by the Commissioner. The testing program must include, but not necessarily be limited to, tests for the control of asphalt content, voids, aggregate gradation, temperatures, aggregate moisture, field

compaction, and surface smoothness. A Quality Control Testing Plan must be developed as part of the Quality Control Program.

B. Asphalt Content: A minimum of two extraction tests must be performed per lot in accordance with ASTM D 2172 or ASTM D 6307 for determination of asphalt content. The weight of ash portion of the extraction test, as described in ASTM D 2172, must be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained must be used in the calculation of the asphalt content for the mixture.

1. The use of a binder ignition oven for determining asphalt content in accordance with ASTM D 6307 (formerly PS90) is permitted, provided that it is calibrated in accordance with ASTM D 6307 or IDOT requirements for the specific mix being used. The calibration must be done on laboratory specimens only. This calibration must be provided to the Commissioner and approved prior to the start of production. The Commissioner reserves the right to verify the calibration of any equipment and refuse the use of the ignition oven if calibration is not consistent with a reflux verification run weekly.

C. Gradation: Aggregate gradations must be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with AASHTO T 30 and ASTM C 136 (Dry Sieve). Two (2) gradations per lot must be run from the combined cold belt in accordance with ASTM C 136. If the asphalt content is determined by the ignition method, aggregate gradations must be determined from a mechanical analysis of the combined virgin aggregate, taken just prior to introduction into the dryer drum or mixer, and tested in accordance with ASTM C117 and ASTM C136 (Dry Sieve).

D. Air Voids: For quality control, the Contractor must determine air voids in accordance with ASTM D3203 at a frequency indicated below.

1. The bulk specific gravity of gyratory specimen must be determined one per half day of production for the first 2 days and one per day thereafter (first specimen of the day) in accordance with ASTM D2726.

2. The maximum specific gravity of the mixture must be determined one per half day of production for the first 2 days and one per day thereafter (first specimen of the day) in accordance with ASTM D2041.

E. Fine Aggregate Angularity: The fine aggregate angularity of the fine aggregate used for production must be determined with the Job Mix Formula submittal in accordance with AASHTO T304, Method A.

F. Moisture Content of Aggregate: The moisture content of the aggregate used for production must be determined once per day, prior to production, in accordance with ASTM C 566.

G. Moisture Content of Mixture: The moisture content of the mixture must be determined once per day, on the first lot, in accordance with ASTM D 1461. If it exceeds 0.5 percent by weight of dry mix, the Contractor must cease production until an action acceptable to the Commissioner is taken.

H. Temperatures: Temperatures must be checked, at least four times per lot, at necessary locations to determine the temperatures of the dryer, the bitumen in the storage tank, the mixture at the plant, and the mixture at the job site.

I. In-Place Density Monitoring: The Contractor must conduct any necessary testing to ensure that the specified density is being achieved. A correlated nuclear gauge must be used to monitor the pavement density in accordance with ASTM D 2950.

J. Monitoring: The Commissioner reserves the right to monitor any or all of the above testing.

K. Aggregate Quality: The Contractor must perform specific gravity and absorption tests on all aggregates used. These tests will be run at least one per week. If the specific gravity parameters vary more than plus or minus 10 percent of the values obtained in the mix design, the Contractor will be required to submit a new job mix formula.

6.04 SAMPLING

A. When directed by the Commissioner, the Contractor must sample and test any material which appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling must be in accordance with standard procedures specified.

6.05 CONTROL CHARTS

A. The Contractor must maintain computerized linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation and asphalt content.

B. Control charts must be posted on the wall at the plant laboratory and at other locations satisfactory to the Commissioner and must be submitted daily with the Quality Control Test Reports and kept current. As a minimum, the control charts must identify the project number, the Contract item number, the test number, each test parameter, the Action and Suspension Limits applicable to each test parameter, date printed and the Contractor's test results. The Contractor must use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a problem and the Contractor is not taking satisfactory corrective action, the Commissioner may suspend production or acceptance of the material.

C. Individual Measurements: Control charts for individual measurements must be established to maintain process control within tolerance for aggregate gradation and asphalt content. The control charts must use the job mix formula target values as indicators of central tendency for the following test parameters with associated Action and Suspension Limits:

Control Chart Limits for Individual Measurements
Surface Course and Base Course

Sieve	Action Limit	Suspension Limit
1 inch	0%	0%
3/4 inch	=/-6%	=/-9%
1/2 inch	=/-6%	=/-9%
3/8 inch	=/-6%	=/-9%
No. 4	=/-6%	=/-9%
No. 16	=/-5%	=/-7.5%
No. 50	=/-3%	=/-4.5%
No. 200	=/-2%	=/-3%
Asphalt Content	=/-0.40%	=/-0.60%

D. Range: Control charts for range must be established to control process variability for the test parameters and Suspension Limits listed below. The range must be computed for each lot as the difference between the two test results for each control parameter. The Suspension Limits specified below are based on a sample size of n = 2. Should the Contractor elect to perform more than two tests per lot, the Suspension Limits must be adjusted by multiplying the Suspension Limit by 1.18 for n = 3 and by 1.27 for n = 4.

Control Chart Limits Based on Range (Based on n=2) Surface Course and Base Course	
Sieve	Suspension Limit
3/4 inch	11%
1/2 inch	11%
3/8 inch	11%
No. 4	11%
No. 16	9%
No. 50	6%
No. 200	3.5%
Asphalt Content	0.8%

E. Corrective Action: The Quality Control Plan must indicate that appropriate action must be taken when the process is out of tolerance. The Plan must contain sets of rules to gauge when a process is out of control and detail what action will be taken to bring the process into control. As a minimum, a process must be deemed out of control and production stopped and corrective action taken, if:

1. One point falls outside the Suspension Limit line for individual measurements or range; or

2. Two points in a row fall outside the Action Limit line for individual measurements; or

3. Any Limit that falls outside the control points in Table 3.

PART 7 - METHOD OF MEASUREMENT

7.01 MEASUREMENT

A. Bituminous Concrete Surface Course – Torsion Resistant for Crack Repairs will be measured by the square yards of bituminous mixture used in the accepted work, which includes milling of existing bituminous or concrete pavement, tack coat, cleaning and preparation of existing pavement, disposal of removed material, and all other appurtenances required for completion of the work.

PART 8 - BASIS OF PAYMENT

8.01 PAYMENT

A. Payment for Bituminous Concrete Surface Course – Torsion Resistant pavement will be made at the Contract unit price per square yard for bituminous mixture placed. The price will be compensation for furnishing all materials, for all preparation, mixing, and placing of these materials, and for all labor, equipment, tools, and all work necessary to complete the item as shown in the plans, including, but not limited to: pavement milling, tack coat, surface cleaning and preparation.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
P-406-01	BITUMINOUS CONCRETE SURFACE COURSE - TORSION RESISTANT FOR CRACK REPAIRS	SY

END OF SECTION P-406

PORTLAND CEMENT CONCRETE (PCC) PAVEMENT SECTION P-501

PART 1 DESCRIPTION

1.01 GENERAL

A. This work consists of pavement composed of Portland cement concrete (PCC), with reinforcement or without reinforcement, constructed on a prepared underlying surface in accordance with these specifications and must conform to the lines, grades, thickness, and typical cross-sections shown on the Plans.

B. This work consists of pavement patch composed of Portland cement concrete (PCC), with reinforcement or without reinforcement, constructed on a prepared underlying surface in accordance with these specifications. Part 5 Material Acceptance and Part 6 Contractor Quality Control Section 6.03 and Section 6.04 are not applicable to the Pavement Patch – Portland Cement Concrete work.

1.02 RELATED WORK

A. Related Specification Sections include the following:

1. Section P-605 – Joint Sealing Filler

PART 2 MATERIALS

2.01 AGGREGATES

A. Reactivity. Fine and Coarse aggregates to be used in all concrete must be evaluated and tested by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and ASTM C1567. Aggregate and mix proportion reactivity tests must be performed for each project.

1. Coarse and fine aggregate must be tested separately in accordance with ASTM C1260. The aggregate must be considered innocuous if the expansion of test specimens, tested in accordance with ASTM C1260, does not exceed 0.10% at 28 days (30 days from casting).

2. Combined coarse and fine aggregate must be tested in accordance with ASTM C1567, modified for combined aggregates, using the proposed mixture design proportions of aggregates, cementitious materials, and/or specific reactivity reducing chemicals. If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates

must be tested in accordance with Corps of Commissioners (COE) Concrete Research Division (CRD) C662. If lithium nitrate admixture is used, it must be nominal 30% ±0.5% weight lithium nitrate in water.

3. If the expansion of the proposed combined materials test specimens, tested in accordance with ASTM C1567, modified for combined aggregates, or COE CRD C662, does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion of the proposed combined materials test specimens is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the combined materials mixture can reduce the expansion to less than 0.10% at 28 days, or new aggregates must be evaluated and tested.

B. Fine aggregate. Fine aggregate must conform to the requirements of ASTM C33. Grading of the fine aggregate, as delivered to the mixer, must conform to the requirements of ASTM C33 and must have a fineness modulus of not less than 2.50 nor more than 3.40. The soundness loss must not exceed 10% when sodium sulfate is used or 15% when magnesium sulfate is used, after five cycles, when tested per ASTM C88.

The amount of deleterious material in the fine aggregate must not exceed the following limits:

Limits for Deleterious Substances in Fine Aggregate for Concrete

Deleterious material	**ASTM**	**Percentage by Mass**
Clay Lumps and friable particles	ASTM C142	1.0
Material finer than 0.075mm (No. 200 sieve)	ASTM C117	3.0
Lightweight particles	ASTM C123 using a medium with a density of Sp. Gr. of 2.0	0.5
Total of all deleterious Material		3.0

C. Coarse aggregate. Gradation, within the separated size groups, must meet the coarse aggregate grading requirements of ASTM C33 when tested in accordance with ASTM C136. When the nominal maximum size of the aggregate is greater than one inch (25 mm), the aggregates must be furnished in two size groups.

Aggregates delivered to the mixer must consist of crushed stone, crushed or uncrushed gravel, air-cooled iron blast furnace slag, crushed recycled concrete pavement, or a combination. The aggregates should be free of ferrous sulfides, such as pyrite, that would cause “rust” staining that can bleed through pavement markings. Steel blast furnace slag must not be permitted. The aggregate must be composed of clean, hard, uncoated particles. Dust and other coating must be removed from the aggregates by washing.

The percentage of wear must be no more than 40 percent when tested in accordance with ASTM C131.

The quantity of flat, elongated, and flat and elongated particles in any size group coarser than 3/8 sieve (9 mm) must not exceed 8% by weight when tested in accordance with ASTM D4791. A flat particle is defined as one having a ratio of width to thickness greater than 5. An elongated particle is one having a ratio of length to width greater than 5.

The soundness loss must not exceed 12% when sodium sulfate is used or 18% when magnesium sulfate is used, after five cycles, when tested per ASTM C88.

The amount of deleterious material in the coarse aggregate must not exceed the following limits:

Limits for Deleterious Substances in Coarse Aggregate for Concrete

Deleterious material	**ASTM**	**Percentage by Mass**
Clay Lumps and friable particles	ASTM C142	1.0
Material finer than No. 200 sieve (0.075mm)	ASTM C117	1.0
Lightweight particles	ASTM C123 using a medium with a density of Sp. Gr. of 2.0	0.5
Chert (less than 2.40 Sp Gr.)	ASTM C123 using a medium with a density of Sp. Gr. of 2.0)	1.0
Total of all deleterious Material		3.5

Table 1. Gradation For Coarse Aggregate

(ASTM C33)

Sieve Designations (square openings)		Percentage by Weight Passing Sieves	
		From 1-½ inch to No. 4 (38mm – 4.75mm)	
		#4 1-½ inch – ¾ inch	#67 ¾ inch – No. 4
inch	**mm**		
2-1/2	60	---	---
2	50	100	---
1-1/2	38	90-100	---
1	25	20-55	100
3/4	19	0-15	90-100
1/2	13	---	---
3/8	9	0-5	20-55
No. 4	4.75	---	0-10
No. 8	2.36	---	0-5

Aggregate susceptibility to durability (D) cracking. Aggregates that have a history of D-cracking must not be used.

Coarse aggregate may be accepted from sources that have a 20-year service history for the same gradation to be supplied with no durability issues. Aggregates that do not have a record of 20 years of service without major repairs (less than 5% of slabs replaced) in similar conditions without D-cracking must not be used unless it meets the following:

1. Material currently being produced must have a durability factor ≥ 95 using ASTM C666 procedure B. Coarse aggregates that are crushed granite, calcite cemented sandstone, quartzite, basalt, diabase, rhyolite or trap rock are considered to meet the D-cracking test but must meet all other quality tests. Aggregates meeting State Highway Department material specifications may be acceptable.
2. The Contractor must submit a current certification that the aggregate does not have a history of D-cracking and that the aggregate meets the state specifications for use in PCC pavement for use on interstate highways. Certifications, tests and any history reports must be for the same gradation as being proposed for use on the project. Certifications which are not dated or which are over one (1) year old or which are for different gradations will not be accepted. Test results will only

be accepted when tests were performed by a State Department of Transportation (DOT) materials laboratory or an accredited laboratory.

D. Combined aggregate gradation. If substituted for the grading requirements specified for coarse aggregate and for fine aggregate and when approved by the Commissioner, the combined aggregate grading must meet the following requirements:

1. The materials selected and the proportions used must be such that when the Coarseness Factor (CF) and the Workability Factor (WF) are plotted on a diagram as described in d. below, the point thus determined must fall within the parallelogram described therein.

2. The CF must be determined from the following equation:

   CF = (cumulative percent retained on the 3/8 in. sieve) (100) / (cumulative percent retained on the No. 8 sieve)

3. The Workability Factor WF is defined as the percent passing the No. 8 (2.36 mm) sieve based on the combined gradation. However, WF must be adjusted, upwards only, by 2.5 percentage points for each 94 pounds (42 kg) of cementitious material per cubic meter yard greater than 564 pounds per cubic yard (335 kg per cubic meter).

4. A diagram must be plotted using a rectangular scale with WF on the Y-axis with units from 20 (bottom) to 45 (top), and with CF on the X-axis with units from 80 (left side) to 30 (right side). On this diagram, a parallelogram must be plotted with corners at the following coordinates (CF-75, WF-28), (CF-75, WF-40), (CF-45, WF-32.5), and (CF-45, WF-44.5). If the point determined by the intersection of the computed CF and WF does not fall within the above parallelogram, the grading of each size of aggregate used and the proportions selected must be changed as necessary.

2.02 CEMENT

A. Cement must conform to the requirements of ASTM C150 Type I.

B. If aggregates are deemed innocuous when tested and accepted in accordance with 501-2.01, higher equivalent alkali content in the cement may be allowed if approved by the Commissioner and FAA. If cement becomes partially set or contains lumps of caked cement, it must be rejected. Cement salvaged from discarded or used bags must not be used.

2.03 CEMENTITIOUS MATERIALS

A. Fly ash. Fly ash must meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum must be less than 6%. Fly ash for use in mitigating alkali-silica reactivity must have a Calcium Oxide (CaO) content of less than 13% and a total available alkali content less than 3% per ASTM C311. Fly ash produced in furnace operations using liming materials or soda ash (sodium carbonate) as an additive must not be acceptable. The Contractor must furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the mix design, and must furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the Commissioner.

B. Slag cement (ground granulated blast furnace (GGBF). Slag cement must conform to ASTM C989, Grade 100 or Grade 120. Slag cement must be used only at a rate between 25% and 55% of the total cementitious material by mass.

C. Raw or calcined natural pozzolan. Natural pozzolan must be raw or calcined and conform to ASTM C618, Class N, including the optional requirements for uniformity and effectiveness in controlling Alkali-Silica reaction and must have a loss on ignition not exceeding 6%. Class N pozzolan for use in mitigating Alkali-Silica Reactivity must have a total available alkali content less than 3%.

D. Ultrafine fly ash and ultrafine pozzolan. UltraFine Fly Ash (UFFA) and UltraFine Pozzolan (UFP) must conform to ASTM C618, Class F or N, and the following additional requirements:

1. The strength activity index at 28 days of age must be at least 95% of the control specimens.

2. The average particle size must not exceed 6 microns.

2.04 JOINT SEAL

A. The joint seal for the joints in the concrete pavement must meet the requirements of Item P-605 and must be of the type specified in the plans.

2.05 ISOLATION JOINT FILLER

A. Premolded joint filler for isolation joints must conform to the requirements of ASTM D1752, Type II or III and must be where shown on the plans. The filler for each joint must be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the Commissioner. When the use of more than one piece is required for a joint, the abutting ends must be fastened

securely and held accurately to shape by stapling or other positive fastening means satisfactory to the Commissioner.

2.06 STEEL REINFORCEMENT

A. Reinforcing must consist of welded steel wire fabric conforming to the requirements of ASTM A 185. Welded wire fabric must be furnished in flat sheets only.

2.07 DOWEL AND TIE BARS

A. Dowel bars must be plain steel bars conforming to ASTM A615 and must be free from burring or other deformation restricting slippage in the concrete. Before delivery to the construction site each dowel bar must be epoxy coated per ASTM A1078. The dowels must be coated with a bond-breaker recommended by the manufacturer. Dowel sleeves or inserts are not permitted. Grout retention rings must be fully circular metal or plastic devices capable of supporting the dowel until the grout hardens.

B. Tie bars must be deformed steel bars and conform to the requirements of ASTM A615. Tie bars designated as Grade 60 in ASTM A615 or ASTM A706 must be used for construction requiring bent bars.

2.08 WATER

A. Water used in mixing or curing must be potable, clean, free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product, except that non-potable water, or water from concrete production operations, may be used if it meets the requirements of ASTM C1602.

2.09 MATERIAL FOR CURING CONCRETE

A. Curing materials must conform to one of the following specifications:

1. Liquid membrane-forming compounds for curing concrete must conform to the requirements of ASTM C309, Type 2, Class B, or Class A if wax base only.

2. White polyethylene film for curing concrete must conform to the requirements of ASTM C171.

3. White burlap-polyethylene sheeting for curing concrete must conform to the requirements of ASTM C171.

4. Waterproof paper for curing concrete must conform to the requirements of ASTM C171.

2.10 ADMIXTURES

A. The Contractor must submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the Commissioner 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 may be made of samples taken by the Commissioner 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.

1. Air-entraining admixtures. Air-entraining admixtures must meet the requirements of ASTM C260 and must consistently entrain the air content in the specified ranges under field conditions. The air-entrainment agent and any water reducer admixture must be compatible.

2. Water-reducing admixtures. Water-reducing admixture must meet the requirements of ASTM C494, Type A, B, or D. ASTM C494, Type F and G high range water reducing admixtures and ASTM C1017 flowable admixtures must not be used.

3. Other admixtures. The use of set retarding, and set-accelerating admixtures must be approved by the Commissioner. Retarding must meet the requirements of ASTM C494, Type A, B, or D and set-accelerating must meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride must not be used.

4. Lithium Nitrate. The lithium admixture must be a nominal 30% aqueous solution of Lithium Nitrate, with a density of 10 pounds/gallon (1.2 kg/L), and must have the approximate chemical form as shown below:

Constituent	Limit (Percent by Mass)
LiNO3 (Lithium Nitrate)	30 ±0.5
SO4 (Sulfate Ion)	0.1 (max)
Cl (Chloride Ion)	0.2 (max)
Na (Sodium Ion)	0.1 (max)
K (Potassium Ion)	0.1 (max)

Provide a trained manufacturer's representative to supervise the lithium nitrate admixture dispensing and mixing operations.

2.11 EPOXY-RESIN

A. All epoxy-resin materials must be two-component materials conforming to the requirements of ASTM C881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials must meet the following requirements:

1. Material for use for embedding dowels and anchor bolts must be Type IV, Grade 3.

2. Material for use as patching materials for complete filling of spalls and other voids and for use in preparing epoxy resin mortar must be Type III, Grade as approved.

3. Material for use for injecting cracks must be Type IV, Grade 1.

4. Material for bonding freshly mixed Portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete must be Type V, Grade as approved.

2.12 MATERIAL ACCEPTANCE

A. Prior to use of materials, the Contractor must submit certified test reports to the Commissioner for those materials proposed for use during construction. The certification must show the appropriate ASTM test for each material, the test results, and a statement that the material passed or failed.

B. The Commissioner may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

PART 3 MIX DESIGN

3.01 GENERAL

A. No concrete must be placed until the mix design has been submitted to the Commissioner for review and the Commissioner has taken appropriate action. The Commissioner's review must not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

3.02 PROPORTIONS

A. The laboratory preparing the mix design must be accredited in accordance with ASTM C1077. The mix design for all Portland cement concrete placed under P-501 must be stamped or sealed by the responsible professional Engineer of the laboratory. Concrete must be proportioned to achieve a 28-day flexural strength of 625 psi per ASTM C78. The mix must be developed using the procedures contained in the Portland Cement Association's (PCA) publication, "Design and Control of Concrete Mixtures".

B. The minimum cementitious material must be adequate to ensure a workable, durable mix. The minimum cementitious material (cement plus fly ash, or slag cement) must be 517 pounds per cubic yard. The ratio of water to cementitious material, including free surface moisture on the aggregates but not including moisture absorbed by the aggregates must not be more than 0.45 by weight.

C. Flexural strength test specimens must be prepared in accordance with ASTM C192 and tested in accordance with ASTM C78. The mix determined must be workable concrete having a maximum allowable slump between one and two inches as determined by ASTM C143. For slip-form concrete, the slump must be between ½ inch and 1-½ inch. At the start of the project, the Contractor must determine a maximum allowable slump for slip-form pavement which will produce in-place pavement to control the edge slump. The selected slump must be applicable to both pilot and fill-in lanes.

D. Before the start of paving operations and after approval of all material to be used in the concrete, the Contractor must submit a mix design showing the proportions and flexural strength obtained from the concrete at seven (7) and 28 days. The mix design must include copies of test reports, including test dates, and a complete list of materials including type, brand, source, and amount of cement, fly ash, ground slag, coarse aggregate, fine aggregate, water, and admixtures. The mix design must be submitted to the Commissioner at least 30 days prior to the start of operations. The submitted mix design must not be more than 90 days old. Production must not begin until the mix design is approved in writing by the Commissioner.

E. If a change in sources is made, or admixtures added or deleted from the mix, a new mix design must be submitted to the Commissioner for approval.

F. The results of the mix design must include a statement giving the maximum nominal coarse aggregate size and the weights and volumes of each ingredient proportioned on a one (1) cubic yard (meter) basis. Aggregate quantities must be based on the mass in a saturated surface dry condition. The recommended mixture proportions must be accompanied by test results demonstrating that the proportions selected will produce concrete of the qualities indicated. Trial mixtures having proportions, slumps, and air content suitable for the work must be based on methodology described in PCA's publication, Design and Control of Concrete Mixtures, modified as necessary to accommodate flexural strength.

G. The submitted mix design must be stamped or sealed by the responsible professional Engineer of the laboratory and must include the following items as a minimum:

1. Coarse, fine, and combined aggregate gradations and plots including fineness modulus of the fine aggregate.

2. Reactivity Test Results.

3. Coarse aggregate quality test results, including deleterious materials.

4. Fine aggregate quality test results, including deleterious materials.

5. Mill certificates for cement and supplemental cementitious materials.

6. Certified test results for all admixtures, including Lithium Nitrate if applicable.

7. Specified flexural strength, slump, and air content.

8. Recommended proportions/volumes for proposed mixture and trial water-cementitious materials ratio, including actual slump and air content.

9. Flexural and compressive strength summaries and plots, including all individual beam and cylinder breaks.

10. Correlation ratios for acceptance testing and Contractor Quality Control testing, when applicable.

11. Historical record of test results documenting production standard deviation, when applicable.

3.03 CEMENTITIOUS MATERIALS.

A. Fly ash. When fly ash is used as a partial replacement for cement, the replacement rate must be determined from laboratory trial mixes and must be between 20 and 30% by weight of the total cementitious material. If fly ash is used in conjunction with slag cement the maximum replacement rate must not exceed 10% by weight of total cementitious material.

B. Slag cement (ground granulated blast furnace (GGBF)). Slag cement may be used. The slag cement, or slag cement plus fly ash if both are used, may constitute between 25 to 55% of the total cementitious material by weight. If the concrete is to be used for slipforming operations and the air temperature is expected to be lower than 55°F (13°C) the percent slag cement must not exceed 30% by weight.

C. Raw or calcined natural pozzolan. Natural pozzolan may be used in the mix design. When pozzolan is used as a partial replacement for cement, the replacement rate must be determined from laboratory trial mixes, and must be between 20 and 30% by weight of the total cementitious material. If pozzolan is used in conjunction with slag cement the maximum replacement rate must not exceed 10% by weight of total cementitious material.

D. Ultrafine fly ash (UFFA) and ultrafine pozzolan (UFP). UFFA and UFP may be used in the mix design with the Commissioner's approval.

When UFFA and UFP is used as a partial replacement for cement, the replacement rate must be determined from laboratory trial mixes and must be between seven (7) and 16% by weight of the total cementitious material.

3.04 ADMIXTURES

A. Air-entraining admixtures. Air-entraining admixture are to be added in such a manner that will ensure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete must 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 in the mix must be 6.0 percent. Air content must be determined by testing in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag and other highly porous coarse aggregate.

B. Water-reducing admixtures. Water-reducing admixtures must be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests must be conducted on trial mixes, with the materials to be used in the work, in accordance with ASTM C494.

C. Other admixtures. Set controlling, and other approved admixtures must be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests must be conducted on trial mixes, with the materials to be used in the work, in accordance with ASTM C494.

D. Lithium nitrate. Lithium nitrate must be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements in accordance with paragraph 501-2.10A4.

3.05 CONCRETE MIX DESIGN LABORATORY

A. The Contractor's laboratory used to develop the concrete mix design must be accredited in accordance with ASTM C1077. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for developing the concrete mix design must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods must be submitted to the Commissioner prior to start of construction

PART 4 CONSTRUCTION METHODS

4.01 EQUIPMENT

A. Equipment necessary for handling materials and performing all parts of the work must be approved by the Commissioner, but does not relieve

the Contractor of the responsibility for the proper operation of equipment and maintaining the equipment in good working condition. The equipment must be at the jobsite sufficiently ahead of the start of paving operations to be examined thoroughly and approved.

B. The batch plant and equipment must conform to the requirements of ASTM C94.

C. Mixers and transportation equipment**.**

1. General. Concrete may be mixed at a central plant, or wholly or in part in truck mixers. Each mixer must 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.

2. Central plant mixer. Central plant mixers must conform to the requirements of ASTM C94. The mixer must be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades must be replaced when they have worn down 3/4 inch (19 mm) or more. The Contractor must 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 must conform to the requirements of ASTM C94.

4. Nonagitator trucks. Nonagitating hauling equipment must conform to the requirements of ASTM C94.

5. Transfer and spreading equipment. Equipment for transferring concrete from the transporting equipment to the paving lane in front of the paver must be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will transfer and spread it evenly across the paving lane in front of the paver and strike off the surface evenly to a depth which permits the paver to operate efficiently.

D. Finishing equipment. The standard method of constructing concrete pavements must be with an approved slip-form paving equipment designed and operated to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine so that the end result is a dense and homogeneous pavement which is achieved with a minimum of hand finishing. The paver-finisher must be a heavy duty, self-propelled machine designed specifically for paving and finishing high quality concrete pavements. It must weigh at least

2,200 lbs. per foot (3274 kg/m) of paving lane width and powered by an engine having at least 6.0 horsepower per foot of lane width.

On projects requiring less than 500 square yard (418 sq m) of cement concrete pavement or requiring individual placement areas of less than 500 square yard (418 sq m), or irregular areas at locations inaccessible to slip-form paving equipment, concrete pavement may be placed with approved placement and finishing equipment using stationary side forms. Hand screeding and float finishing may only be used on small irregular areas as allowed by the Commissioner.

E. Vibrators. Vibrator must be the internal type. Operating frequency for internal vibrators must be between 8,000 and 12,000 vibrations per minute. Average amplitude for internal vibrators must be 0.025-0.05 inch (0.06 - 0.13 cm).

The number, spacing, and frequency must be as necessary to provide a dense and homogeneous pavement and meet the recommendations of American Concrete Institute (ACI) 309, Guide for Consolidation of Concrete. Adequate power to operate all vibrators must be available on the paver. The vibrators must be automatically controlled so that they must be stopped as forward motion ceases. The Contractor must provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status must occur a minimum of two times per day or when requested by the Commissioner.

Hand held vibrators may be used in irregular areas only, but must meet the recommendations of ACI 309R, Guide for Consolidation of Concrete.

F. Concrete saws. The Contractor must provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions. The Contractor must provide at least one standby saw in good working order and a supply of saw blades at the site of the work at all times during sawing operations. Early-entry saws may be used, subject to demonstration and approval of the Commissioner.

G. Side forms. Straight side forms must be made of steel and must be furnished in sections not less than 10 feet (3 m) in length. Forms must have a depth equal to the pavement thickness at the edge, and a base width equal to or greater than the depth. Flexible or curved forms of proper radius must be used for curves of 100-foot (31 m) radius or less. Forms must 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. Forms with battered top surfaces and bent, twisted or broken forms must not be used. Built-up forms must not be used, except as approved by the Commissioner. The top face of the form must not vary from a true plane more than 1/8 inch (3 mm) in 10

feet (3 m), and the upstanding leg must not vary more than 1/4 inch (6 mm). The forms must contain provisions for locking the ends of abutting sections together tightly for secure setting. Wood forms may be used under special conditions, when approved by the Commissioner.

H. Pavers. The paver must 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 must 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 must be equipped with electronic or hydraulic horizontal and vertical control devices.

4.02 FORM SETTING

A. Forms must be set sufficiently in advance of the concrete placement to ensure continuous paving operation. After the forms have been set to correct grade, the underlying surface must be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms must be staked into place sufficiently to maintain the form in position for the method of placement.

B. Form sections must be tightly locked and must be free from play or movement in any direction. The forms must not deviate from true line by more than 1/8 inch (3 mm) at any joint. Forms must be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms must be cleaned and oiled prior to the placing of concrete.

C. The alignment and grade elevations of the forms must be checked and corrections made by the Contractor immediately before placing the concrete.

4.03 CONDITIONING OF UNDERLYING SURFACE

A. The compacted underlying surface on which the pavement will be placed must be widened approximately 3 feet (1 m) to extend beyond the paving machine track to support the paver without any noticeable displacement. After the underlying surface has been placed and compacted to the required density, the areas that will support the paving machine and the area to be paved must be trimmed or graded to the plan grade elevation and profile by means of a properly designed machine. The grade of the underlying surface must be controlled by a positive grade control system using lasers, stringlines, or guide wires. If the density of the underlying surface is disturbed by the trimming operations, it must be corrected by additional compaction and retested at the option of the Commissioner before the concrete is

placed except when stabilized subbases are being constructed. If damage occurs on a stabilized subbase, it must be corrected full depth by the Contractor. If traffic is allowed to use the prepared grade, the grade must be checked and corrected immediately before the placement of concrete. The prepared grade must be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from concrete. The underlying surface must be protected so that it will be entirely free of frost when concrete is placed.

4.04 CONDITIONING OF UNDERLYING SURFACE, SIDE-FORM AND FILL-IN LANE CONSTRUCTION.

A. The prepared underlying surface must be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from the concrete. Damage caused by hauling or usage of other equipment must be corrected and retested at the option of the Commissioner. If damage occurs to a stabilized subbase, it must be corrected full depth by the Contractor. A template must be provided and operated on the forms immediately in advance of the placing of all concrete. The template must be propelled only by hand and not attached to a tractor or other power unit. Templates must be adjustable so that they may be set and maintained at the correct contour of the underlying surface. The adjustment and operation of the templates must be such as will provide an accurate retest of the grade before placing the concrete thereon. All excess material must be removed and wasted. Low areas must be filled and compacted to a condition similar to that of the surrounding grade. The underlying surface must 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 surface must not be permitted.

B. The template must be maintained in accurate adjustment, at all times by the Contractor, and must be checked daily.

4.05 HANDLING, MEASURING, AND BATCHING MATERIAL

A. The batch plant site, layout, equipment, and provisions for transporting material must assure a continuous supply of material to the work. Stockpiles must be constructed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources must be stockpiled, weighed and batched separately at the concrete batch plant.

B. Aggregates that have become segregated or mixed with earth or foreign material must not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, must 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.

C. Batching plants must 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 must 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 must be arranged to provide positive assurance that the cement content specified is present in each batch.

4.06 MIXING CONCRETE

A. The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer must be of an approved type and capacity. Mixing time must be measured from the time all materials, except water, are emptied into the drum. All concrete must be mixed and delivered to the site in accordance with the requirements of ASTM C94.

B. Mixed concrete from the central mixing plant must be transported in truck mixers, truck agitators, or non-agitating trucks. The elapsed time from the addition of cementitious material to the mix until the concrete is deposited in place at the work site must not exceed 30 minutes when the concrete is hauled in non-agitating 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. With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements provided the addition of water is performed within 45 minutes after the initial mixing operations and provided the water/cementitious ratio specified in the approved mix design is not exceeded, and approved by the Commissioner.

4.07 LIMITATIONS ON MIXING AND PLACING

A. No concrete must be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

1. Cold weather**.** Unless authorized in writing by the Commissioner, mixing and concreting operations must be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40°F (4°C) and must not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35°F (2°C).

The aggregate must be free of ice, snow, and frozen lumps before entering the mixer. The temperature of the mixed concrete must not be less than 50°F (10°C) at the time of placement. Concrete must not be placed on frozen material nor must frozen aggregates be used in the concrete.

When concreting is authorized during cold weather, water and/or the aggregates may be heated to not more than 150°F (66°C). The apparatus used must heat the mass uniformly and must be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

2. Hot weather**.** During periods of hot weather when the maximum daily air temperature exceeds 85°F (30°C), the following precautions must be taken.

   The forms and/or the underlying surface must be sprinkled with water immediately before placing the concrete. The concrete must be placed at the coolest temperature practicable, and in no case must the temperature of the concrete when placed exceed 90°F (32°C). The aggregates and/or mixing water must be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

   The finished surfaces of the newly laid pavement must be kept damp by applying a water-fog or mist with approved spraying equipment until the pavement is covered by the curing medium. When necessary, wind screens must be provided to protect the concrete from an evaporation rate in excess of 0.2 psf (0.98 kg/m^2 per hour) per hour. When conditions are such that problems with plastic cracking can be expected, and particularly if any plastic cracking begins to occur, the Contractor must immediately take such additional measures as necessary to protect the concrete surface. Such measures must consist of wind screens, more effective fog sprays, and similar measures commencing immediately behind the paver. If these measures are not effective in preventing plastic cracking, paving operations must be immediately stopped.

3. Temperature management program. Prior to the start of paving operation for each day of paving, the Contractor must provide the Commissioner with a Temperature Management Program for the concrete to be placed to assure that uncontrolled cracking is avoided. As a minimum, the program must address the following items:

   (a) Anticipated tensile strains in the fresh concrete as related to heating and cooling of the concrete material.

(b) Anticipated weather conditions such as ambient temperatures, wind velocity, and relative humidity; and anticipated evaporation rate using Figure 11-8, PCA, Design and Control of Concrete Mixtures.

(c) Anticipated timing of initial sawing of joint.

(d) Anticipated number and type of saws to be used.

4.08 PLACING CONCRETE

A. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface must not exceed 3 feet. The finished concrete product must be dense and homogeneous, without segregation and conforming to the standards in this specification. Backhoes and grading equipment must not be used to distribute the concrete in front of the paver. Front end loaders will not be used. All concrete must be consolidated without voids or segregation, including under and around all load-transfer devices, joint assembly units, and other features embedded in the pavement. Hauling equipment or other mechanical equipment can be permitted on adjoining previously constructed pavement when the concrete strength reaches a flexural strength of 550 psi, based on the average of four field cured specimens per 2,000 cubic yards of concrete placed. Also, subgrade and sub-base planers, concrete pavers, and concrete finishing equipment may be permitted to ride upon the edges of previously constructed pavement when the concrete has attained a minimum flexural strength of 400 psi.

B. The Contractor must have available materials for the protection of the concrete during inclement weather. Such protective materials must 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 must stop and all available personnel must begin covering the surface of the unhardened concrete with the protective covering.

C. Slip-form construction:

1. The concrete must be distributed uniformly into final position by a self-propelled slip-form paver without delay. The alignment and elevation of the paver must be regulated from outside reference lines established for this purpose. The paver must vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration must be adequate to provide a consistency of concrete that will stand normal to the surface with sharp well-defined edges. The sliding forms must

be rigidly held together laterally to prevent spreading of the forms. The plastic concrete must be effectively consolidated by internal vibration with transverse vibrating units for the full width of the pavement and/or a series of equally placed longitudinal vibrating units. The space from the outer edge of the pavement to longitudinal unit must not exceed 9 inches (23 cm) for slipform and at the end of the dowels for the fill-in lanes. The spacing of internal units must be uniform and must not exceed 18 inches (0.5 m).

2. The term internal vibration means vibrating units located within the specified thickness of pavement section.

3. The rate of vibration of each vibrating unit must be within 8000 to 12000 cycles per minute and the amplitude of vibration must be sufficient to be perceptible on the surface of the concrete along the entire length of the vibrating unit and for a distance of at least one foot (30 cm). The frequency of vibration or amplitude must vary proportionately with the rate of travel to result in a uniform density and air content. The paving machine must be equipped with a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

4. The concrete must be held at a uniform consistency. The slip-form paver must be operated with as nearly a continuous forward movement as possible and all operations of mixing, delivering, and spreading concrete must be coordinated to provide uniform progress with stopping and starting of the paver held to a minimum. If for any reason, it is necessary to stop the forward movement of the paver, the vibratory and tamping elements must also be stopped immediately. No tractive force must be applied to the machine, except that which is controlled from the machine.

5. When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement must be equipped with protective pads on crawler tracks or rubber-tired wheels on which the bearing surface is offset to run a sufficient distance from the edge of the pavement to avoid breaking the pavement edge.

6. Not more than 15% of the total free edge of each 500 foot (150 m) segment of pavement, or fraction thereof, must have an edge slump exceeding 1/4 inch (6 mm), and none of the free edge of the pavement must have an edge slump exceeding 3/8 inch (9 mm). (The total free edge of 500 feet (150 m) of pavement will be considered the cumulative total linear measurement of pavement edge originally constructed as

nonadjacent to any existing pavement; that is, 500 feet (150 m) of paving lane originally constructed as a separate lane will have 1,000 feet (300 m) of free edge, 500 feet (150 m) of fill-in lane will have no free edge, etc.). The area affected by the downward movement of the concrete along the pavement edge must be limited to not more than 18 inches (0.5 m) from the edge. When excessive edge slump cannot be corrected before the concrete has hardened, the area with excessive edge slump must be removed and replaced at the expense of the Contractor as directed by the Commissioner.

D. Side-form construction:

1. Side form sections must be straight, free from warps, bends, indentations, or other defects. Defective forms must be removed from the work. Metal side forms must be used except at end closures and transverse construction joints where straight forms of other suitable material may be used.

2. Side forms may be built up by rigidly attaching a section to either top or bottom of forms. If such build-up is attached to the top of metal forms, the build-up must also be metal.

3. Width of the base of all forms must be equal to or greater than the specified pavement thickness.

4. Side forms must be of sufficient rigidity, both in the form and in the interlocking connection with adjoining forms, that springing will not occur under the weight of subgrading and paving equipment or from the pressure of the concrete. The Contractor must provide sufficient forms so that there will be no delay in placing concrete due to lack of forms.

5. Before placing side forms, the underlying material must be at the proper grade. Side forms must have full bearing upon the foundation throughout their length and width of base and must be placed to the required grade and alignment of the finished pavement. They must be firmly supported during the entire operation of placing, compacting, and finishing the pavement.

6. Forms must be drilled in advance of being placed to line and grade to accommodate tie bars where these are specified.

7. Immediately in advance of placing concrete and after all subbase operations are completed, side forms must be trued and maintained to the required line and grade for a distance sufficient to prevent delay in placing.

8. Side forms must remain in place at least 12 hours after the concrete has been placed, and in all cases until the edge of the

pavement no longer requires the protection of the forms. Curing compound must be applied to the concrete immediately after the forms have been removed.

9. Side forms must be thoroughly cleaned and oiled each time they are used and before concrete is placed against them.

10. Concrete must be spread, screeded, shaped and consolidated by one or more self-propelled machines. These machines must uniformly distribute and consolidate concrete without segregation so that the completed pavement will conform to the required cross-section with a minimum of handwork.

11. The number and capacity of machines furnished must be adequate to perform the work required at a rate equal to that of concrete delivery.

12. Concrete for the full paving width must be effectively consolidated by internal vibrators without causing segregation. Internal type vibrators' rate of vibration must be not less than 7,000 cycles per minute. Amplitude of vibration must be sufficient to be perceptible on the surface of the concrete more than one foot (30 cm) from the vibrating element. The Contractor must furnish a tachometer or other suitable device for measuring and indicating frequency of vibration.

13. Power to vibrators must be connected so that vibration ceases when forward or backward motion of the machine is stopped.

14. The provisions relating to the frequency and amplitude of internal vibration must be considered the minimum requirements and are intended to ensure adequate density in the hardened concrete.

E. Consolidation:

1. Concrete must be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. The vibrators must be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than inches (50 mm). Excessive vibration must not be permitted. If the vibrators cause visible tracking in the paving lane, the paving operation must be stopped and equipment and operations modified to prevent it. Concrete in small, odd-shaped slabs or in isolated locations inaccessible to the gang-mounted vibration equipment must be vibrated with an approved hand-operated immersion vibrator operated from a bridge spanning the area. Vibrators must not be used to

transport or spread the concrete. Hand-operated vibrators must not be operated in the concrete at one location for more than 20 seconds. Insertion locations for hand-operated vibrators must be between 6 to 15 inches (150 to 400 mm) on centers. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators must be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) must require the immediate stopping of the paving operation and adjustment of the equipment or procedures as approved by the Commissioner.

2. If a lack of consolidation of the concrete is suspected by the Commissioner, referee testing may be required. Referee testing of hardened concrete will be performed by the Commissioner by cutting cores from the finished pavement after a minimum of 24 hours curing. Density determinations will be made by the Commissioner based on the water content of the core as taken. ASTM C642 must be used for the determination of core density in the saturated-surface dry condition. When required, referee cores will be taken at the minimum rate of one for each 500 cubic yards (382 m^2) of pavement, or fraction. The Contractor must be responsible for all referee testing cost if they fail to meet the required density.

3. The average density of the cores must be at least 97% of the original mix design density, with no cores having a density of less than 96% of the original mix design density. Failure to meet the referee tests will be considered evidence that the minimum requirements for vibration are inadequate for the job conditions. Additional vibrating units or other means of increasing the effect of vibration must be employed so that the density of the hardened concrete conforms to the above requirements.

4.09 STRIKE-OFF OF CONCRETE AND PLACEMENT OF REINFORCEMENT

A. Following the placing of the concrete, it must be struck off to conform to the cross-section shown on the plans and to an elevation that when the concrete is properly consolidated and finished, the surface of the pavement must be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer must 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 must then be placed directly upon the concrete, after which the top layer of the concrete must 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 must 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.

B. Reinforcing steel, at the time concrete is placed, must 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.

4.10 JOINTS

A. Joints must be constructed as shown on the plans and in accordance with these requirements. All joints must be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on the plans. Joints must not vary more than 1/2-inch (12 mm) from their designated position and must be true to line with not more than 1/4-inch (6 mm) variation in 10 feet (3 m). The surface across the joints must be tested with a 12 feet (3 m) straightedge as the joints are finished and any irregularities in excess of 1/4 inch (6 mm) must be corrected before the concrete has hardened. All joints must be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on the plans.

B. Construction. Longitudinal construction joints must be slip-formed or formed against side forms as shown in the plans.

Transverse construction joints must 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. The installation of the joint must be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor must remove the excess concrete back to the previous planned joint.

C. Contraction. Contraction joints must be installed at the locations and spacing as shown on the plans. Contraction joints must be installed to the dimensions required 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. When the groove is formed in plastic concrete the sides of the grooves must be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish must be according to the manufacturer's

instructions. The groove must be finished or cut clean so that spalling will be avoided at intersections with other joints. Grooving or sawing must produce a slot at least 1/8 inch (3 mm) wide and to the depth shown on the plans.

D. Isolation (expansion). Isolation joints must be installed as shown on the plans. The premolded filler of the thickness as shown on the plans, must 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 must be securely staked or fastened into position perpendicular to the proposed finished surface. A cap must 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 must be carefully withdrawn leaving the space over the premolded filler. The edges of the joint must be finished and tooled while the concrete is still plastic. Any concrete bridging the joint space must be removed for the full width and depth of the joint.

E. Tie bars. Tie bars must consist of deformed bars installed in joints as shown on the plans. Tie bars must be placed at right angles to the centerline of the concrete slab and must be spaced at intervals shown on the plans. They must be held in position parallel to the pavement surface and in the middle of the slab depth. When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. Tie bars must not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed.

F. Dowel bars. Dowel bars or other load-transfer units of an approved type must be placed across joints as shown on the plans. They must 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 must be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. The dowels must be coated with a bond-breaker or other lubricant recommended by the manufacturer and approved by the Commissioner.

   Dowels bars at longitudinal construction joints must be bonded in drilled holes.

G. Placing dowels and tie bars. The method used in installing and holding dowels in position must ensure that the error in alignment of any dowel from its required horizontal and vertical alignment after the pavement has been completed will not be greater than 1/8 inch per feet. Except as otherwise specified below, horizontal spacing of dowels must be

within a tolerance of ±5/8 inch. The vertical location on the face of the slab must be within a tolerance of ±1/2 inch. The vertical alignment of the dowels must be measured parallel to the designated top surface of the pavement, except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes must be measured to a level surface. Horizontal alignment must be checked perpendicular to the joint edge. The horizontal alignment must be checked with a framing square. Dowels must not be placed closer than 0.6 times the dowel bar length to the planned joint line. If the last regularly spaced longitudinal dowel is closer than that dimension, it must be moved away from the joint to a location 0.6 times the dowel bar length, but not closer than 6 inches to its nearest neighbor. Alternate methods to place the dowels in plastic concrete, such as a dowel bar inserter, must be tested with an MIT Scan-2 device to verify placement within tolerance. Additionally, the Contractor must perform a 100 foot by 20 foot test strip with joints every 10 feet for the largest thickness to be paved to demonstrate the ability to achieve the required dowel bar placement. No additional payment will be made for this test strip. The portion of each dowel intended to move within the concrete or expansion cap must be wiped clean and coated with a thin, even film of lubricating oil or light grease before the concrete is placed. Dowels must be installed as specified in the following subparagraphs.

1. Contraction joints. Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane must be held securely in place, as indicated, by means of rigid metal frames or basket assemblies of an approved type. The basket assemblies must be held securely in the proper location by means of suitable pins or anchors. Do not cut or crimp the dowel basket tie wires. At the Contractor's option, in lieu of the above, dowels and tie bars in contraction joints must be installed near the front of the paver by insertion into the plastic concrete using approved equipment and procedures. Approval will be based on the results of a preconstruction demonstration, showing that the dowels and tie bars are installed within specified tolerances.

2. Construction joints. Install dowels and tie bars by the cast-in-place or the drill-and-dowel method. Installation by removing and replacing in preformed holes will not be permitted. Dowels and tie bars must be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms. The

spacing of dowels and tie bars in construction joints must be as indicated.

3. Dowels installed in isolation joints and other hardened concrete. Install dowels for isolation joints and in other hardened concrete by bonding the dowels into holes drilled into the hardened concrete. The concrete must have cured for seven (7) days or reached a minimum flexural strength of 450 psi before drilling commences. Holes 1/8 inch greater in diameter than the dowels must be drilled into the hardened concrete using rotary-core drills. Rotary-percussion drills may be used, provided that excessive spalling does not occur to the concrete joint face. Modification of the equipment and operation must be required if, in the Commissioner's opinion, the equipment and/or operation is causing excessive damage. Depth of dowel hole must be within a tolerance of ±1/2 inch of the dimension shown on the drawings. On completion of the drilling operation, the dowel hole must be blown out with oil-free, compressed air. Dowels must be bonded in the drilled holes using epoxy resin. Epoxy resin must be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel will not be permitted. The dowels must be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic grout retention ring fitted around the dowel. Dowels required to be installed in any joints between new and existing concrete must be grouted in holes drilled in the existing concrete, all as specified above.

H. Sawing of joints. Joints must be cut as shown on the plans. Equipment must be as described in paragraph 501-4.01. The circular cutter must be capable of cutting a groove in a straight line and must produce a slot at least 1/8 inch (3 mm) wide and to the depth shown on the plans. The top of the slot must be widened by sawing to provide adequate space for joint sealers as shown on the plans. Sawing must commence, without regard to day or night, as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing and before uncontrolled shrinkage cracking of the pavement occurs and must continue without interruption until all joints have been sawn. The joints must be sawn at the required spacing. All slurry and debris produced in the sawing of joints must be removed by vacuuming and washing. Curing compound or system must be reapplied in the initial sawcut and maintained for the remaining cure period.

4.11 FINISHING

A. Finishing operations must be a continuing part of placing operations starting immediately behind the strike-off of the paver. Initial finishing must be provided by the transverse screed or extrusion plate. The sequence of operations must be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Finishing must be by the machine method. The hand method must be used only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement must be kept to an absolute minimum. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, must be immediately stopped and proper adjustments made or the equipment replaced. Any operations which produce more than 1/8 inch (3 mm) of mortar-rich surface (defined as deficient in plus U.S. No. 4 (4.75 mm) sieve size aggregate) must be halted immediately and the equipment, mixture, or procedures modified as necessary. Compensation must be made for surging behind the screeds or extrusion plate and settlement during hardening and care must be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Finishing equipment and tools must be maintained clean and in an approved condition. At no time must water be added to the surface of the slab with the finishing equipment or tools, or in any other way, except for fog (mist) sprays specified to prevent plastic shrinkage cracking.

1. Machine finishing with slipform pavers. The slipform paver must be operated so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Any equipment or procedure that fails to meet these specified requirements must immediately be replaced or modified as necessary. A self-propelled non-rotating pipe float may be used while the concrete is still plastic, to remove minor irregularities and score marks. Only one pass of the pipe float must be allowed. If there is concrete slurry or fluid paste on the surface that runs over the edge of the pavement, the paving operation must be immediately stopped and the equipment, mixture, or operation modified to prevent formation of such slurry. Any slurry which does run down the vertical edges must be immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar must be used to build up along the edges of the pavement to

compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

2. Machine finishing with fixed forms. The machine must be designed to straddle the forms and must be operated to screed and consolidate the concrete. Machines that cause displacement of the forms must be replaced. The machine must make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation must be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

3. Other types of finishing equipment. Clary screeds, other rotating tube floats, or bridge deck finishers are not allowed on mainline paving, but may be allowed on irregular or odd-shaped slabs, and near buildings or trench drains, subject to the Commissioner's approval.

   Bridge deck finishers must have a minimum operating weight of 7500 pounds (3400 kg) and must have a transversely operating carriage containing a knock-down auger and a minimum of two immersion vibrators. Vibrating screeds or pans must be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.

4. Hand finishing. Hand finishing methods will not be permitted, except under the following conditions: (1) in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade and (2) in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical. Use hand finishing operations only as specified below.

   (a) Equipment and screed. In addition to approved mechanical internal vibrators for consolidating the concrete, provide a strike-off and tamping screed and a longitudinal float for hand finishing. The screed must be at least one foot (30 cm) longer than the width of pavement being finished, of an approved design, and sufficiently rigid to retain its shape, and must be constructed of metal or other suitable material shod with metal. The longitudinal float must be at least 10 feet (3 m) long, of approved design, and rigid and substantially braced, and must maintain a plane surface on the bottom. Grate tampers (jitterbugs) must not be used.

   (b) Finishing and floating. As soon as placed and vibrated, the concrete must be struck off and screeded to the

crown and cross-section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. In addition to previously specified complete coverage with handheld immersion vibrators, the entire surface must be tamped with the strike-off and tamping template, and the tamping operation continued until the required compaction and reduction of internal and surface voids are accomplished. Immediately following the final tamping of the surface, the pavement must be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete must be placed, consolidated and screeded, and the float operated until a satisfactory surface has been produced. The floating operation must be advanced not more than half the length of the float and then continued over the new and previously floated surfaces.

5. Straightedge testing and surface correction**.** After the pavement has been struck off and while the concrete is still plastic, it must be tested for trueness with a Contractor furnished 12-foot (3.7-m) straightedge swung from handles 3 feet (1 m) longer than one-half the width of the slab. The straightedge must 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 must be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance in excess of 1/8 inch (3 mm) thick must be removed from the surface of the pavement and wasted. Any depressions must be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas must be cut down and refinished. Special attention must be given to assure that the surface across joints meets the smoothness requirements of paragraph 501-5.02e(3). Straightedge testing and surface corrections must 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 must be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment. This straight-edging is not a replacement for the straightedge testing of paragraph 501-5.02e(3), Smoothness.

4.12 SURFACE TEXTURE

A. The surface of the pavement must be finished with either a brush or broom, burlap drag, or artificial turf finish for all newly constructed

concrete pavements. 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 must be corrected to the satisfaction of the Commissioner.

B. Brush. If the pavement surface texture is to be a type of brush, it must be applied when the water sheen has practically disappeared. The equipment must operate transversely across the pavement surface, providing corrugations that are uniform in appearance and approximately 1/16 inch (2 mm) in depth.

4.13 CURING

A. Immediately after finishing operations are completed and marring of the concrete will not occur, the entire surface of the newly placed concrete must be cured for a 7-day cure period in accordance with one of the methods below. 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, must be cause for immediate suspension of concreting operations. The concrete must not be left exposed for more than 1/2 hour during the curing period.

B. When a two-sawcut method is used to construct the contraction joint, the curing compound must be applied to the sawcut immediately after the initial cut has been made. The sealant reservoir must not be sawed until after the curing period has been completed. When the one cut method is used to construct the contraction joint, the joint must be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets must be kept moist for the duration of the curing period.

C. Impervious membrane method. The entire surface of the pavement must be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound must not be applied during rainfall. Curing compound must be applied by mechanical sprayers under pressure at the rate of one gallon (4 liters) to not more than 150 sq ft (14 sq m). The spraying equipment must be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound must be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application the compound must be stirred continuously by mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. When hand spraying is approved by the Commissioner, a double application rate must be used to ensure coverage. The curing compound must be of such character that the film will harden within 30 minutes after application. Should the film become damaged from any cause, including sawing

operations, within the required curing period, the damaged portions must be repaired immediately with additional compound or other approved means. Upon removal of side forms, the sides of the exposed slabs must be protected immediately to provide a curing treatment equal to that provided for the surface. Curing must be applied immediately after the bleed water is gone from the surface.

D. White burlap-polyethylene sheets. The surface of the pavement must be entirely covered with the sheeting. The sheeting used must 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 must be placed so that the entire surface and both edges of the slab are completely covered. The sheeting must be placed and weighted to remain in contact with the surface covered, and the covering must be maintained fully saturated and in position for seven (7) days after the concrete has been placed.

E. Water method. The entire area must be covered with burlap or other water absorbing material. The material must be of sufficient thickness to retain water for adequate curing without excessive runoff. The material must be kept wet at all times and maintained for seven (7) days. When the forms are stripped, the vertical walls must also be kept moist. It will be the responsibility of the Contractor to prevent ponding of the curing water on the subbase.

F. Concrete protection for cold weather. The concrete must be maintained at an ambient temperature of at least 50°F (10°C) for a period of 72 hours after placing and at a temperature above freezing for the remainder of the curing time. The Contractor must be responsible for the quality and strength of the concrete placed during cold weather; and any concrete damaged must be removed and replaced at the Contractor's expense.

G. Concrete protection for hot weather. Concrete should be continuous moisture cured for the entire curing period and must commence as soon as the surfaces are finished and continue for at least 24 hours. However, if moisture curing is not practical beyond 24 hours, the concrete surface must be protected from drying with application of a liquid membrane-forming curing compound while the surfaces are still damp. Other curing methods may be approved by the Commissioner.

4.14 REMOVING FORMS

A. Unless otherwise specified, forms must not be removed from freshly placed concrete until it has hardened sufficiently to permit removal without chipping, spalling, or tearing. After the forms have been removed, the sides of the slab must be cured as per the methods indicated in paragraph 501-4.13. Major honeycombed areas must be considered as defective work and must be removed and replaced in accordance with paragraph 501-5.02F.

4.15 SAW-CUT GROOVING – NOT USED

4.16 SEALING JOINTS

A. The joints in the pavement must be sealed in accordance with Section P-605.

4.17 PROTECTION OF PAVEMENT

A. The Contractor must protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents until accepted by the Commissioner. This must include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, crossovers, and protection of unsealed joints from intrusion of foreign material, etc. Any damage to the pavement occurring prior to final acceptance must be repaired or the pavement replaced at the Contractor's expense.

Aggregates, rubble, or other similar construction materials must not be placed on airfield pavements. Traffic must be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least seven (7) days old, or for a longer period if directed by the Commissioner.

In paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment will be permitted on the new pavement after the pavement has been cured for seven (7) days and the joints have been sealed or otherwise protected, and the concrete has attained a minimum field cured flexural strength of 550 psi and approved means are furnished to prevent damage to the slab edge.

All new and existing pavement carrying construction traffic or equipment must be continuously kept completely clean, and spillage of concrete or other materials must be cleaned up immediately upon occurrence.

Damaged pavements must be removed and replaced at the Contractor's expense. Slabs must be removed to the full depth, width, and length of the slab.

4.18 OPENING TO CONSTRUCTION TRAFFIC

A. The pavement must not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a flexural strength of 550 lb / square inch when tested in accordance with ASTM C78. If such tests are not conducted, the pavement must not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints must 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.

4.19 REPAIR, REMOVAL, OR REPLACEMENT OF SLABS

A. General. New pavement slabs that are broken or contain cracks or are otherwise defective or unacceptable must be removed and replaced or repaired, as directed by the Commissioner and as specified hereinafter at no cost to the Commissioner. Spalls along joints must be repaired as specified. Removal of partial slabs is not permitted. Removal and replacement must be full depth, must be full width of the slab, and the limit of removal must be normal to the paving lane and to each original transverse joint. The Commissioner will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores must be 4-inch (100 mm) diameter, must be drilled by the Contractor and must be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin, using approved procedures. Drilling of cores and refilling holes must be at no expense to the Commissioner. All epoxy resin used in this work must conform to ASTM C881, Type V. Repair of cracks as described in this section must not be allowed if in the opinion of the Commissioner the overall condition of the pavement indicates that such repair is unlikely to achieve an acceptable and durable finished pavement. No repair of cracks must be allowed in any panel that demonstrates segregated aggregate with an absence of coarse aggregate in the upper 1/8 inch (3 mm) of the pavement surface.

B. Shrinkage cracks. Shrinkage cracks, which do not exceed 4 inches (100 mm) in depth, must be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1, using procedures as approved by the Commissioner. Care must be taken to assure that the crack is not widened during epoxy resin injection. All epoxy resin injection must take place in the presence of the Commissioner. Shrinkage cracks,

which exceed 4 inches (100 mm) in depth, must be treated as full depth cracks in accordance with paragraphs 4.19B and 4.19C.

C. Slabs with cracks through interior areas. Interior area is defined as that area more than 6 inches (150 mm) from either adjacent original transverse joint. The full slab must be removed and replaced at no cost to the Commissioner, when there are any full depth cracks, or cracks greater than 4 inches (100 mm) in depth, that extend into the interior area.

D. Cracks close to and parallel to joints. All cracks essentially parallel to original joints, extending full depth of the slab, and lying wholly within 6 inches (150 mm) either side of the joint must be treated as specified here. Any crack extending more than 6 inches (150 mm) from the joint must be treated as specified in 4.19C.

1. Full depth cracks present, original joint not opened. When the original un-cracked joint has not opened, the crack must be sawed and sealed, and the original joint filled with epoxy resin as specified below. The crack must be sawed with equipment specially designed to follow random cracks. The reservoir for joint sealant in the crack must be formed by sawing to a depth of 3/4 inches (19 mm), ±1/16 inch (2 mm), and to a width of 5/8 inch (16 mm), ±1/8 inch (3 mm). Any equipment or procedure which causes raveling or spalling along the crack must be modified or replaced to prevent such raveling or spalling. The joint sealant must be a liquid sealant as specified. Installation of joint seal must be as specified for sealing joints or as directed. If the joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible must be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures.

   If only the original narrow saw cut has been made, it must be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. If filler type material has been used to form a weakened plane in the transverse joint, it must be completely sawed out and the saw cut pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. Where a parallel crack goes part way across paving lane and then intersects and follows the original joint which is cracked only for the remained of the width, it must be treated as specified above for a parallel crack, and the cracked original joint must be prepared and sealed as originally designed.

2. Full depth cracks present, original joint also cracked. At a joint, if there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, the entire slab

containing the crack must be removed and replaced for the full lane width and length.

E. Removal and replacement of full slabs. Where it is necessary to remove full slabs, unless there are dowels present, all edges of the slab must be cut full depth with a concrete saw. All saw cuts must be perpendicular to the slab surface. If dowels, or tie bars are present along any edges, these edges must be sawed full depth just beyond the end of the dowels or tie bars. These joints must then be carefully sawed on the joint line to within one inch (25 mm) of the depth of the dowel or tie bar.

The main slab must be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. Suitable equipment must be used to provide a truly vertical lift, and approved safe lifting devices used for attachment to the slabs. The narrow strips along doweled edges must be carefully broken up and removed using light, hand-held jackhammers, 30 lb (14 kg) or less, or other approved similar equipment.

Care must be taken to prevent damage to the dowels, tie bars, or to concrete to remain in place. The joint face below dowels must be suitably trimmed so that there is not abrupt offset in any direction greater than 1/2-inch (12 mm) and no gradual offset greater than one inch (25 mm) when tested in a horizontal direction with a 12-foot (3.7-m) straightedge.

No mechanical impact breakers, other than the above hand-held equipment must be used for any removal of slabs. If underbreak between 1-1/2 and 4 inches (38 and 100 mm) deep occurs at any point along any edge, the area must be repaired as directed before replacing the removed slab. Procedures directed will be similar to those specified for surface spalls, modified as necessary.

If underbreak over 4 inches (100 mm) deep occurs, the entire slab containing the underbreak must be removed and replaced. Where there are no dowels or tie bars, or where they have been damaged, dowels or tie bars of the size and spacing as specified for other joints in similar pavement must be installed by epoxy grouting them into holes drilled into the existing concrete using procedures as specified. Original damaged dowels or tie bars must be cut off flush with the joint face. Protruding portions of dowels must be painted and lightly oiled. All four (4) edges of the new slab must contain dowels or original tie bars.

Placement of concrete must be as specified for original construction. Prior to placement of new concrete, the underlying material (unless it is stabilized) must be re-compacted and shaped as specified in the appropriate section of these specifications. The surfaces of all four joint

faces must be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker. Care must be taken to prevent any curing compound from contacting dowels or tie bars. The resulting joints around the new slab must be prepared and sealed as specified for original construction.

F. Repairing spalls along joints. Where directed, spalls along joints of new slabs, and along parallel cracks used as replacement joints, must be repaired by first making a vertical saw cut at least one inch (25 mm) outside the spalled area and to a depth of at least 2 inches (50 mm). Saw cuts must be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, must be chipped out to remove all unsound concrete and at least 1/2 inch (12 mm) of visually sound concrete. The cavity thus formed must be thoroughly cleaned with high-pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat of epoxy resin, Type III, Grade I, must be applied to the dry, cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat must be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Pooling of epoxy resin must be avoided. The cavity must be filled with low slump Portland cement concrete or mortar or with epoxy resin concrete or mortar. Concrete must be used for larger spalls, generally those more than 1/2 cu. ft. (0.014 m^3) in size, and mortar must be used for the smaller ones. Any spall less than 0.1 cu. ft. (0.003 m^3) must be repaired only with epoxy resin mortar or a Grade III epoxy resin. Portland cement concrete and mortar mixtures must be proportioned as directed and must be mixed, placed, consolidated, and cured as directed. Epoxy resin mortars must be made with Type III, Grade 1, epoxy resin, using proportions and mixing and placing procedures as recommended by the manufacturer and approved by the Commissioner. The epoxy resin materials must be placed in the cavity in layers not over 2 inches (50 mm) thick. The time interval between placement of additional layers must be such that the temperature of the epoxy resin material does not exceed 140°F (60°C) at any time during hardening. Mechanical vibrators and hand tampers must be used to consolidate the concrete or mortar. Any repair material on the surrounding surfaces of the existing concrete must be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium must be used to prevent bond at the joint face. A reservoir for the joint sealant must be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir must be thoroughly cleaned and sealed with the sealer specified for the joints. If any spall penetrates half the depth of the slab or more, the entire slab must be removed and replaced as previously specified. If any spall would require over 25% of the length

of any single joint to be repaired, the entire slab must be removed and replaced. Repair of spalls as described in this section must not be allowed if in the opinion of the Commissioner the overall condition of the pavement indicates that such repair is unlikely to achieve an acceptable and durable finished pavement. No repair of spalls must be allowed in any panel that demonstrates segregated aggregate with a significant absence of coarse aggregate in the upper one-eight (1/8th) inch of the pavement surface.

G. Diamond grinding of PCC surfaces. Diamond grinding of the hardened concrete with an approved diamond grinding machine should not be performed until the concrete is 14 days or more old and concrete has reached full minimum strength. When required, diamond grinding must be accomplished by sawing with saw blades impregnated with industrial diamond abrasive. The saw blades must be assembled in a cutting head mounted on a machine designed specifically for diamond grinding that will produce the required texture and smoothness level without damage to the pavement. The saw blades must be 1/8-inch (3-mm) wide and there must be a minimum of 55 to 60 blades per 12 inches (300 mm) of cutting head width; the actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Each machine must be capable of cutting a path at least 3 feet (0.9 m) wide. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints will not be permitted. The area corrected by diamond grinding the surface of the hardened concrete should not exceed 10% of the total area of any sublot. The depth of diamond grinding must not exceed 1/2 inch (13 mm) and all areas in which diamond grinding has been performed will be subject to the final pavement thickness tolerances specified. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. All pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified above, may require removing and replacing in conformance with paragraph 501-4.19.

4.20 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

A. All operations must be carefully controlled to prevent damage to the concrete pavement and to the underlying material to remain in place. All saw cuts must be made perpendicular to the slab surface.

B. Removal of existing pavement slab. When it is necessary to remove existing concrete pavement, and leave adjacent concrete in place, the joint between the removal area and adjoining pavement to stay in place, including dowels or tie bars, must first be cut full depth with a standard diamond-type concrete saw. If dowels are present at this joint, the saw cut must be made full depth just beyond the end of dowels. The edge must then be carefully sawed on the joint line to

within one inch of the top of the dowel. Next, a full depth saw cut must be made parallel to the joint at least 24 inches from the joint and at least 12 inches from the end of any dowels. All pavement between this last saw cut and the joint line must be carefully broken up and removed using hand-held jackhammers, 30 lb. or less, or the approved light-duty equipment which will not cause stress to propagate across the joint saw cut and cause distress in the pavement which is to remain in place. Where dowels are present, care must be taken to produce an even, vertical joint face below the dowels. If the Contractor is unable to produce such a joint face, or if underbreak or other distress occurs, the Contractor must saw the dowels flush with the joint. The Contractor must then install new dowels, of the size and spacing used for other similar joints, by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph 501-4.10G. All this must be at no additional cost to the Commissioner. Dowels of the size and spacing indicated must be installed as shown on the drawings by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph 501-4.10 G. The joint face must be sawed or otherwise trimmed so that there is no abrupt offset in any direction greater than 1/2 inches and no gradual offset greater than one inch when tested in a horizontal direction with a 12-foot straightedge.

C. Edge repair. The edge of existing concrete pavement against which new pavement abuts must be protected from damage at all times. Areas that are damaged during construction must be repaired at no cost to the Commissioner.

1. Spall repair. Spalls must be repaired where indicated and where directed by the Commissioner. Repair materials and procedures must be as previously specified in subparagraph 501-4.19F.

2. Underbreak repair. All underbreak must be repaired. First, all delaminated and loose material must be carefully removed. Next, the underlying material must be recompacted, without addition of any new material. Finally, the void must be completely filled with paving concrete, thoroughly consolidated. Care must be taken to produce an even joint face from top to bottom. Prior to placing concrete, the underlying material must be thoroughly moistened. After placement, the exposed surface must be heavily coated with curing compound.

3. Underlying material. The underlying material adjacent to the edge and under the existing pavement which is to remain in place must be protected from damage or disturbance during removal operations and until placement of new concrete, and must be shaped as shown on the drawings or as directed. Sufficient material must be kept in place outside the joint line to

prevent disturbance (or sloughing) of material under the pavement that is to remain in place. Any material under the portion of the concrete pavement to remain in place, which is disturbed or loses its compaction must be carefully removed and replaced with concrete as specified in paragraph 501-4.20C(2). The underlying material outside the joint line must be thoroughly compacted and moist when new concrete is placed.

D. Existing Pavement Removal. Pavement Patch – Portland Cement Concrete and saw kerf concrete associated with the pavement patch, and pavement milling will require hand-work removal as not to disturb the existing saw kerf concrete.

PART 5 MATERIAL ACCEPTANCE

5.01 ACCEPTANCE SAMPLING AND TESTING

A. All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section, with the exception of coring for thickness determination, will be performed by the Commissioner at no cost to the Contractor. The Contractor must bear the cost of providing curing facilities for the strength specimens, per paragraph 501-5.01C(3), and coring and filling operations, per paragraph 501-5.01D(1). Testing organizations performing these tests must be accredited in accordance with ASTM C1077. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods must be submitted to the Commissioner prior to start of construction.

Concrete must be accepted for strength and thickness on a lot basis.

B. A lot must consist of a day's production not to exceed 4,000 square yards.

C. Flexural strength.

1. Sampling. Each lot must be divided into four equal sublots. One sample must be taken for each sublot from the plastic concrete delivered to the job site. Sampling locations must be determined by the Commissioner in accordance with random sampling procedures contained in ASTM D3665. The concrete must be sampled in accordance with ASTM C172.

2. Testing. Two (2) specimens must be made from each sample. Specimens must be made in accordance with ASTM C31 and the flexural strength of each specimen must be determined in accordance with ASTM C78. The flexural strength for each

sublot must be computed by averaging the results of the two test specimens representing that sublot.

Immediately prior to testing for flexural strength, the beam must be weighed and measured for determination of a sample unit weight. Measurements must be made for each dimension; height, depth, and length, at the mid-point of the specimen and reported to the nearest 1/10 inch (3 mm). The weight of the specimen must be reported to the nearest 0.1 pound (45 gm). The sample unit weight must be calculated by dividing the sample weight by the calculated volume of the sample. This information must be reported as companion information to the measured flexural strength for each specimen.

The samples will be transported while in the molds. The curing, except for the initial cure period, will be accomplished using the immersion in saturated lime water method.

Slump, air content, and temperature tests will also be conducted by the quality assurance laboratory for each set of strength test samples, per ASTM C31.

3. Curing. The Contractor must provide adequate facilities for the initial curing of beams. During the 24 hours after molding, the temperature immediately adjacent to the specimens must be maintained in the range of 60° to 80°F (16° to 27°C), and loss of moisture from the specimens must be prevented. The specimens may be stored in tightly constructed wooden boxes, damp sand pits, temporary buildings at construction sites, under wet burlap in favorable weather, or in heavyweight closed plastic bags, or using other suitable methods, provided the temperature and moisture loss requirements are met.

4. Acceptance. Acceptance of pavement for flexural strength will be determined by the Commissioner in accordance with paragraph 5.02B.

D. Pavement thickness.

1. Sampling. Each lot must be divided into four equal sublots and one core must be taken by the Contractor for each sublot. Sampling locations must be determined by the Commissioner in accordance with random sampling procedures contained in ASTM D3665. Areas, such as thickened edges, with planned variable thickness, must be excluded from sample locations.

Cores must be neatly cut with a core drill. The Contractor must furnish all tools, labor, and materials for cutting samples and filling the cored hole. Core holes must be filled by the Contractor

with a non-shrink grout approved by the Commissioner within one day after sampling.

2. Testing. The thickness of the cores must be determined by the Commissioner by the average caliper measurement in accordance with ASTM C174.

3. Acceptance. Acceptance of pavement for thickness must be determined by the Commissioner in accordance with paragraph 5.02C.

E. Partial lots. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and Commissioner agree in writing to allow overages or minor placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

Where three sublots have been produced, they must constitute a lot. Where one or two sublots have been produced, they must be incorporated into the next lot or the previous lot and the total number of sublots must be used in the acceptance criteria calculation, that is, n=5 or n=6.

F. Outliers. All individual flexural strength tests within a lot must be checked for an outlier (test criterion) in accordance with ASTM E178, at a significance level of 5%. Outliers must be discarded, and the percentage of material within specification limits (PWL) must be determined using the remaining test values.

5.02 ACCEPTANCE CRITERIA

A. General. Acceptance will be based on the following characteristics of the completed pavement discussed in paragraph 501-5.02E:

1. Flexural strength
2. Thickness
3. Smoothness
4. Grade
5. Edge slump

Flexural strength and thickness must be evaluated for acceptance on a lot basis using the method of estimating PWL. Acceptance using PWL considers the variability (standard deviation) of the material and the testing procedures, as well as the average (mean) value of the test results to calculate the percentage of material that is above the lower specification tolerance limit (L).

Acceptance for flexural strength will be based on the criteria contained in accordance with paragraph 5.02 E 1. Acceptance for thickness will be based on the criteria contained in paragraph 5.02 E 2. Acceptance for smoothness will be based on the criteria contained in paragraph 5.02 E 3. Acceptance for grade will be based on the criteria contained in paragraph 5.02 E 4.

The Commissioner may at any time, notwithstanding previous plant acceptance, reject and require the Contractor to dispose of any batch of concrete mixture which is rendered unfit for use due to contamination, segregation, or improper slump. Such rejection may be based on only visual inspection. In the event of such rejection, the Contractor may take a representative sample of the rejected material in the presence of the Commissioner, and if it can be demonstrated in the laboratory, in the presence of the Commissioner, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

B. Flexural strength. Acceptance of each lot of in-place pavement for flexural strength must be based on PWL. The Contractor must target production quality to achieve 90 PWL or higher.

C. Pavement thickness. Acceptance of each lot of in-place pavement must be based on PWL. The Contractor must target production quality to achieve 90 PWL or higher.

D. Percentage of material within limits (PWL). The PWL must be determined in accordance with procedures specified in Section Q-110 of Part Three of Three, Technical Specifications.

The lower specification tolerance limit (L) for flexural strength and thickness must be:

Lower Specification Tolerance Limit (L)

Flexural Strength	0.93 × strength specified in paragraph 501-3.01
Thickness	Lot Plan Thickness in inches, - 0.50 in

E. Acceptance criteria.

1. Flexural Strength. If the PWL of the lot equals or exceeds 90%, the lot must be acceptable. Acceptance and payment for the lot must be determined in accordance with paragraph 501-8.01.

2. Thickness. If the PWL of the lot equals or exceeds 90%, the lot must be acceptable. Acceptance and payment for the lot must be determined in accordance with paragraph 501-8.01.

3. Smoothness. As soon as the concrete has hardened sufficiently, but not later than 48 hours after placement, the surface of each

lot must be tested in both longitudinal and transverse directions for smoothness to reveal all surface irregularities exceeding the tolerances specified. The Contractor must furnish paving equipment and employ methods that produce a surface for each section of pavement having an average profile index meeting the requirements of paragraph 501-8.01C when evaluated with a profilograph; and the finished surface of the pavement must not vary more than 1/4 inch (6mm) when evaluated with a 12-foot straightedge. When the surface smoothness exceeds specification tolerances which cannot be corrected by diamond grinding of the pavement, full depth removal and replacement of pavement must be to the limit of the longitudinal placement. Corrections involving diamond grinding will be subject to the final pavement thickness tolerances specified.

a. Transverse measurements. Transverse measurements will be taken for each lot placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet or more often as determined by the Commissioner.

(1) Testing must be continuous across all joints, starting with one-half the length of the straight edge at the edge of pavement section being tested and then moved ahead one-half the length of the straight edge for each successive measurement. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position must be adjusted to measure surface smoothness and not design grade or cross slope transitions. The amount of surface irregularity must be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Deviations on final pavement > 1/4 inch (6mm) in transverse direction must be corrected with diamond grinding per paragraph 501-4.19G or by removing and replacing full depth of pavement. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by

grinding should not exceed 10% of the total area and these areas must be retested after grinding.

(2) The joint between lots must be tested separately to facilitate smoothness between lots. The amount of surface irregularity must be determined by placing the freestanding (unleveled) straightedge on the pavement surface, with half the straightedge on one side of the joint and the other half of the straightedge on the other side of the joint. Measure the maximum gap between the straightedge and the pavement surface in the area between these two high points. One measurement must be taken at the joint every 50 feet or more often if directed by the Commissioner. Maximum gap on final pavement surface > 1/4 inch in transverse direction must be corrected with diamond grinding per paragraph 501-4.19G or by removing and replacing full depth of surface. Each measurement must be recorded and a copy of the data must be furnished to the Commissioner at the end of each days testing.

b. Longitudinal measurements. Longitudinal measurements will be taken for each lot placed. Longitudinal tests will be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet; and at the one third points of paving lanes when widths of paving lanes are 20 ft. or greater.

(1) Longitudinal Short Sections. Longitudinal Short Sections are when the longitudinal lot length is less than 200 feet and areas not requiring a profilograph. When approved by the Commissioner, the first and last 15 feet of the lot can also be considered as short sections for smoothness. The finished surface must not vary more than 1/4 inch when evaluated with a 12-foot straightedge. Smoothness readings will not be made across grade changes or cross slope transitions, at these transition areas, the straightedge position must be adjusted to measure surface smoothness and not design grade or cross slope transitions. Testing must be continuous across all joints, starting with one-half the length of the straight edge at the edge of pavement section being tested and then moved ahead one-half the

length of the straight edge for each successive measurement. The amount of surface irregularity must be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Deviations on final pavement surface > 1/4 inch in longitudinal direction will be corrected with diamond grinding per paragraph 501-4.19G or by removing and replacing full depth of surface. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas must be retested after grinding.

(2) Profilograph Testing. Profilograph testing must be performed by the contractor using approved equipment and procedures as described as ASTM E1274. The equipment must utilize electronic recording and automatic computerized reduction of data to indicate “must grind” bumps and the Profile Index for the pavement using a 0.2-inch blanking band. The bump template must span one inch with an offset of 0.4 inches. The profilograph must be calibrated prior to use and operated by a factory or State DOT approved operator. Profilograms must be recorded on a longitudinal scale of one inch equals 25 feet and a vertical scale of one inch equals one inch. A copy of the reduced tapes must be furnished to the Commissioner at the end of each days testing.

The pavement must have an average profile index meeting the requirements of paragraph 501-8.01C. Deviations on final surface in longitudinal direction must be corrected with diamond grinding per paragraph 501-4.19G or by removing and replacing full depth of pavement. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas must be retested after grinding.

Where corrections are necessary, second profilograph runs must be performed to verify that the corrections produced an average profile index of 15 inches per mile or less. If the initial average profile index was less than 15 inches, only those areas representing greater than 0.4-inch deviation will be re-profiled for correction verification.

(3) Final profilograph of runway. Final profilograph, full length of runway, must be performed to facilitate testing of smoothness between lots. Profilograph testing must be performed by the contractor using approved equipment and procedures as described as ASTM E1274. The pavement must have an average profile index meeting the requirements of paragraph 501-8.01C. The equipment must utilize electronic recording and automatic computerized reduction of data to indicate “must grind” bumps and the Profile Index for the pavement using a 0.2-inch blanking band. The bump template must span one inch (25 mm) with an offset of 0.4 inches. The profilograph must be calibrated prior to use and operated by a factory or State DOT approved, trained operator. Profilograms must be recorded on a longitudinal scale of one inch equals 25 feet and a vertical scale of one inch equals one inch. A copy of the reduced tapes must be furnished to the Commissioner at the end of each days testing. Profilograph of final runway must be performed one foot right and left of runway centerline and 15 feet right and left of centerline. Any areas that indicate “must grind” will be corrected as directed by the Commissioner.

Smoothness testing indicated in the above paragraphs must be performed within 48 hours of placement of material. The primary purpose of smoothness testing is to identify areas that may be prone to ponding of water which could lead to hydroplaning of aircraft. If the contractor’s machines and/or methods are producing significant areas that need corrective actions then production should be stopped until corrective measures can be implemented. If corrective measures are not implemented and when directed

by the Commissioner, production must be stopped until corrective measures can be implemented.

4. Grade**.** An evaluation of the surface grade must be made by the Commissioner for compliance to the tolerances contained below. The finish grade will be determined by running levels at intervals of 50 feet or less longitudinally and all breaks in grade transversely (not to exceed 50 feet to determine the elevation of the completed pavement. The Contractor must pay the costs of surveying the level runs, and this work must be performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, must be provided by the Contractor to the Commissioner.

   a. Lateral deviation. Lateral deviation from established alignment of the pavement edge must not exceed ±0.10 feet in any lane.

   b. Vertical deviation. Vertical deviation from established grade must not exceed ±0.04 feet at any point.

5. Edge slump**.** When excessive edge slump cannot be corrected before the concrete has hardened, the area with excessive edge slump must be removed and replaced at the expense of the Contractor as directed by the Commissioner in accordance with paragraph 501-4.08A.

F. Removal and replacement of concrete. Any area or section of concrete that is removed and replaced must be removed and replaced back to planned joints. The Contractor must replace damaged dowels and the requirements for doweled longitudinal construction joints in paragraph 501-4.10 must apply to all contraction joints exposed by concrete removal. Removal and replacement must be in accordance with paragraph 501-4.20.

PART 6 CONTRACTOR QUALITY CONTROL

6.01 QUALITY CONTROL PROGRAM.

The Contractor must develop a Quality Control Program in accordance with Section Q-100. The program must address all elements that affect the quality of the pavement including but not limited to:

A. Mix Design

B. Aggregate Gradation

C. Quality of Materials

D. Stockpile Management

E. Proportioning

F. Mixing and Transportation

G. Placing and Consolidation

H. Joints

I. Dowel Placement and Alignment

J. Flexural or Compressive Strength

K. Finishing and Curing

L. Surface Smoothness

6.02 QUALITY CONTROL TESTING

A. The Contractor must perform all quality control tests necessary to control the production and construction processes applicable to this specification and as set forth in the Quality Control Program. The testing program must include, but not necessarily be limited to, tests for aggregate gradation, aggregate moisture content, slump, and air content.

A Quality Control Testing Plan must be developed as part of the Quality Control Program.

B. Fine aggregate.

1. Gradation. A sieve analysis must be made at least twice daily in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

2. Moisture content. If an electric moisture meter is used, at least two direct measurements of moisture content must be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests must be made per day. Tests must be made in accordance with ASTM C70 or ASTM C566.

C. Coarse Aggregate.

1. Gradation. A sieve analysis must be made at least twice daily for each size of aggregate. Tests must be made in accordance with ASTM C136 from randomly sampled material taken from the discharge gate of storage bins or from the conveyor belt.

2. Moisture content. If an electric moisture meter is used, at least two direct measurements of moisture content must be made per week to check the calibration. If direct measurements are made

in lieu of using an electric meter, two tests must be made per day. Tests must be made in accordance with ASTM C566.

D. Slump. Four slump tests must be performed for each lot of material produced in accordance with the lot size defined in paragraph 501-5.01. One test must be made for each sublot. Slump tests must be performed in accordance with ASTM C143 from material randomly sampled from material discharged from trucks at the paving site. Material samples must be taken in accordance with ASTM C172.

E. Air content. Four air content tests, must be performed for each lot of material produced in accordance with the lot size defined in paragraph 501-5.01. One test must be made for each sublot. Air content tests must be performed in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag or other porous coarse aggregate, from material randomly sampled from trucks at the paving site. Material samples must be taken in accordance with ASTM C172.

F. Four unit weight and yield tests must be made in accordance with ASTM C138. The samples must be taken in accordance with ASTM C172 and at the same time as the air content tests.

6.03 CONTROL CHARTS

A. The Contractor must maintain linear control charts for fine and coarse aggregate gradation, slump, moisture content and air content.

Control charts must be posted in a location satisfactory to the Commissioner and must be kept up to date at all times. As a minimum, the control charts must identify the project number, the contract item number, the test number, each test parameter, the Action and suspension Limits, or Specification limits, applicable to each test parameter, and the Contractor's test results. The Contractor must use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the Contractor's projected data during production indicates a potential problem and the Contractor is not taking satisfactory corrective action, the Commissioner may halt production or acceptance of the material.

B. Fine and coarse aggregate gradation. The Contractor must record the running average of the last five gradation tests for each control sieve on linear control charts. Specification limits contained in the Lower Specification Tolerance Limit (L) table above and the Control Chart Limits table below must be superimposed on the Control Chart for job control.

C. Slump and air content. The Contractor must maintain linear control charts both for individual measurements and range (that is, difference

between highest and lowest measurements) for slump and air content in accordance with the following Action and Suspension Limits.

Control Chart Limits

Control Parameter	Individual Measurements		Range Suspension Limit
	Action Limit	Suspension Limit	
Slip Form:			
Slump	+0 to -1 inch (0-25 mm)	+0.5 to -1.5 inch (13-38 mm)	±1.5 inch (38 mm)
Air Content	±1.2%	±1.8%	±2.5%
Side Form:			
Slump	+0.5 to -1 inch (13-25 mm)	+1 to -1.5 inch (25-38 mm)	±1.5 inch (38 mm)
Air Content	±1.2%	±1.8%	±2.5%

The individual measurement control charts must use the mix design target values as indicators of central tendency.

6.04 CORRECTIVE ACTION

A. The Contractor Quality Control Program must indicate that appropriate action must be taken when the process is believed to be out of control. The Contractor Quality Control Program must detail what action will be taken to bring the process into control and must contain sets of rules to gauge when a process is out of control. As a minimum, a process must be deemed out of control and corrective action taken if any one of the following conditions exists.

B. Fine and coarse aggregate gradation. When two consecutive averages of five tests are outside of the specification limits in paragraph 501-2.01, immediate steps, including a halt to production, must be taken to correct the grading.

C. Fine and coarse aggregate moisture content. Whenever the moisture content of the fine or coarse aggregate changes by more than 0.5%, the scale settings for the aggregate batcher and water batcher must be adjusted.

D. Slump. The Contractor must halt production and make appropriate adjustments whenever:

1. one point falls outside the Suspension Limit line for individual measurements or range

OR

2. two points in a row fall outside the Action Limit line for individual measurements.

E. Air content. The Contractor must halt production and adjust the amount of air-entraining admixture whenever:

1. one point falls outside the Suspension Limit line for individual measurements or range

OR

2. two points in a row fall outside the Action Limit line for individual measurements.

Whenever a point falls outside the Action Limits line, the air-entraining admixture dispenser must be calibrated to ensure that it is operating correctly and with good reproducibility.

PART 7 METHOD OF MEASUREMENT

7.01 MEASUREMENT

A. Measurement for Portland cement concrete pavement patches will be measure by each.

PART 8 BASIS OF PAYMENT

8.01 PAYMENT

A. Payment for concrete pavement meeting all acceptance criteria as specified in paragraph 5.02 Acceptance Criteria will be based on results of smoothness, strength and thickness tests. Payment for acceptable lots of concrete pavement will be adjusted, subject to the limitation that:

The total project payment for concrete pavement will not exceed 100 percent of the product of the contract unit price and the total number of square yards of concrete pavement used in the accepted work (See Note 1 under the Price Adjustment Schedule table below).

Payment will be full compensation for all labor, materials, tools, equipment, and incidentals required to complete the work as specified herein and on the drawings for Pavement Patch – Portland Cement Concrete.

B. Payment. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
P-501-01	PAVEMENT PATCH - PORTLAND CEMENT CONCRETE	EA

C. Testing Requirements:

ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C70	Standard Test Method for Surface Moisture in Fine Aggregate
ASTM C78	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C143	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C174	Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C227	Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C289	Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
ASTM C295	Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C114	Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete
ASTM C566	Standard Test Method for Total Evaporable Moisture Content of Aggregates by Drying
ASTM C642	Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM E178	Standard Practice for Dealing With Outlying Observations
ASTM E1274	Standard Test Method for Measuring Pavement Roughness Using a Profilograph
U.S. Army Corps of Commissioners (USACE) Concrete Research Division (CRD) C662	Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

MATERIAL REQUIREMENTS

ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A704	Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A714	Standard Specification for High-Strength Low-Alloy Welded and Seamless Steel Pipe
ASTM A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A996	Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1078	Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C171	Standard Specification for Sheet Materials for Curing Concrete
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C595	Standard Specification for Blended Hydraulic Cements
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete

ASTM C989	Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	Standard Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 305R	Guide to Hot Weather Concreting
ACI 306R	Guide to Cold Weather Concreting
ACI 309R	Guide for Consolidation of Concrete
AC 150/5320-6	Airport Pavement Design and Evaluation
PCA	Design and Control of Concrete Mixtures

END OF SECTION P-501

BITUMINOUS PRIME COAT
SECTION P-602

PART 1 DESCRIPTION

1.01 GENERAL

A. This item must consist of an application of bituminous material on the prepared base course in accordance with these Specifications and in reasonably close conformity to the lines shown on the Plans.

1.02 REFERENCES

A. Asphalt Institute's Manual MS-6.

B. Illinois Department of Transportation Standard Specifications for Road and Bridge Construction (SSRBC), latest edition.

C. ASTM D1250 – Standard Guide for Use of the Petroleum Measurement Tables

PART 2 MATERIALS

2.01 BITUMINOUS MATERIALS

A. The bituminous material must conform to the requirements of Table 1.

TABLE 1
Bituminous Material

		Application Temperature	
Type and Grade	**Specification**	**Degree Fahrenheit**	**Degree Celsius**
Emulsified Asphalt			
SS-1, SS-1h	ASTM D977	75 – 130	25 – 55
CSS-1, CSS-1h	ASTM D2397	75 – 130	25 – 55
Cutback Asphalt			
RC-70	ASTM D2028	120 – 160	50 – 70

B. The prime coat material must be selected according to Section 403.02 of the IDOT SSRBC.

PART 3 CONSTRUCTION METHODS

3.01 WEATHER LIMITATIONS

A. The prime coat must be applied only when the existing surface is dry or contains sufficient moisture to get uniform distribution of the bituminous material, when the atmospheric temperature is above 60 degrees Fahrenheit and when the weather is not foggy or rainy. The temperature requirements may be waived, but only when so directed by the Commissioner. At temperatures below 60 degrees Fahrenheit, RC-70 may be applied at an application temperature of 150-200 degrees Fahrenheit.

3.02 EQUIPMENT

A. The equipment used by the Contractor must include a self-powered pressure bituminous material distributor and equipment for heating bituminous material.

B. The distributor must be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate of application must not exceed 10 percent (10%). The distributor must have pneumatic tires of such width and number that the load produced on the surface must not exceed 650 pounds per square inch of tire width. Distributor equipment must include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor must be self-powered and must be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

C. If the distributor is not equipped with an operable quick shut off valve, the prime operations must be started and stopped on building paper. The Contractor must remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the Commissioner.

D. A power broom and/or blower must be provided for any required cleaning of the surface to be treated.

3.03 APPLICATION OF BITUMINOUS MATERIAL

A. Immediately before applying the prime coat, the full width of the surface to be primed must be swept with a power broom to remove all loose dirt and other objectionable material.

B. The bituminous material including solvent must be uniformly applied with a bituminous distributor at the rate of 0.15 to 0.30 gallons per square yard depending on the base course surface texture. The type of bituminous material and application rate will be approved by the Commissioner prior to application.

C. Following the application, the primed surface must be allowed to dry without being disturbed until the prime coat has broken and all free moisture has evaporated or drained off the surface that it will not be picked up by traffic or equipment. This period will be determined by the Commissioner. The surface must then be maintained by the Contractor until the surfacing has been placed. Suitable precautions must be taken by the Contractor to protect the primed surface against damage during this interval, including supplying and spreading any sand necessary to blot up excess bituminous material.

3.04 BITUMINOUS MATERIAL CONTRACTOR'S RESPONSIBILITY

A. 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 must 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, will be acceptable.

B. The Contractor must furnish vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the Project. The report must be delivered to the Commissioner before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material must not be interpreted as basis for final acceptance. All such test reports must be subject to verification by testing samples of materials received for use on the Project.

3.05 FREIGHT AND WEIGHT BILLS

A. Before the final estimate is allowed, the Contractor must file with the Commissioner 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 must not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Commissioner, nor must the car or tank be released until the final outage has been taken by the Commissioner.

B. Copies of freight bills and weigh bills must be furnished to the Commissioner during the progress of the work.

PART 4 METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. The bituminous prime coat will be measured by the gallon. Volume will be corrected to the volume at 50 degrees Fahrenheit in accordance with Table IV-3 of the Asphalt Institute's Manual MS-6 for emulsified asphalt. Water added to emulsified asphalt will not be measured for payment. Volume must be corrected to the volume at 60 degrees Fahrenheit in accordance with ASTM D1250 for cutback asphalt.

B. The bituminous prime coat paid for will be the measured quantities used in the accepted work, provided that the measured quantities are not 10 percent (10%) over the specified application rate. Any amount of bituminous material more than 10 percent (10%) over the specified application rate for each application will be deducted from the measured quantities, except for irregular areas where hand spraying is necessary.

PART 5 BASIS OF PAYMENT

5.01 PAYMENT

A. Payment will be made at the Contract unit price per gallon for bituminous prime coat. This price will be full compensation for furnishing all materials and for all preparation, delivering, and applying the materials, and for all labor, equipment, tools, and all work necessary to complete this item.

B. Payment will be made under the following item:

ITEM NO.	DESCRIPTION	UOM
P-602-01	BITUMINOUS PRIME COAT	GAL

END OF SECTION P-602

BITUMINOUS TACK COAT (TRACKLESS)
SECTION P-603

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item consist of preparing and treating a bituminous or concrete surface with bituminous material with a trackless tack coat in accordance with these Specifications and in reasonably close conformity to the line shown on the Plans. This item is intended for use underneath only P-401 surface course bituminous pavement. This item must only be used when directed by the Commissioner.

1.02 REFERENCES

A. The Work shall conform to all applicable portions of Section 406, Hot-Mix Asphalt and Surface Course, and any related referenced Article(s)/Section(s) of the Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, current version (SSRBC).

B. IDOT Special Provision for Hot-Mix Asphalt – Prime Coat (BDE) Effective November 1, 2014. See Appendix A.

C. Supplemental Specifications and Recurring Special Provisions, adopted January 1, 2015 and any subsequent revisions Published by the Illinois Department of Transportation.

PART 2 - MATERIALS

2.01 BITUMINOUS MATERIALS

A. The bituminous material must be in accordance with Article 406.02 and Section 1032 and as revised by the IDOT Special Provision for Hot-Mix Asphalt – Prime Coat (BDE) Effective November 1, 2014. Special attention is drawn to the added and revised articles 1032.04 and 1032.06 provided in by the IDOT Special Provision for Hot-Mix Asphalt – Prime Coat (BDE).

PART 3 - CONSTRUCTION METHODS

3.01 WEATHER LIMITATIONS

A. When emulsified asphalt is used, the tack coat must be applied only when the existing surface is dry and the atmospheric temperature is above 60 degrees Fahrenheit (15 degrees Celsius). The temperature requirements may be waived, but only when so directed by the Commissioner. At temperatures below 60 degrees Fahrenheit, RC-70 may be applied at an application temperature of 150-200 degrees Fahrenheit.

3.02 EQUIPMENT

A. The Contractor must provide equipment for heating and applying the bituminous material.

B. The equipment must be in accordance with Article 406.03 and 1101.01 and as revised by the IDOT Special Provision for Hot-Mix Asphalt – Prime Coat (BDE) Effective November 1, 2014.

C. The distributor must be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate must not exceed 10 percent. The distributor must have pneumatic tires of such width and number that the load produced on the surface must not exceed 65 pounds per square inch of tire width. Distributor equipment must include a tachometer, pressure gages, volume-measuring devices or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor must be self-powered and must be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.

D. If the distributor is not equipped with an operable quick shut off valve, the prime operations must be started and stopped on building paper. The Contractor must remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the Commissioner.

E. A power broom and/or blower must be provided for any required cleaning of the surface to be treated.

3.03 APPLICATION OF BITUMINOUS MATERIAL

A. Immediately before applying the tack coat, the full width of surface to be treated must be swept with a power broom and/or airblast to remove all loose dirt and other objectionable material.

B. The bituminous material including vehicle or solvent must be uniformly applied with a bituminous distributor in accordance with Section 406.05.(b).(1) and as revised by the IDOT Special Provision for Hot- Mix Asphalt – Prime Coat (BDE) Effective November 1, 2014 except the Residual Asphalt Rate should be 0.08 Gallons/Square Yard. The application rate will be approved by the Commissioner prior to application.

C. Following the application, the surface must 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. This period will be determined by the Commissioner. The surface must then be maintained by the Contractor until the next course has been placed. Suitable precautions must be taken by the Contractor to protect the surface against damage during this interval.

3.04 BITUMINOUS MATERIAL-CONTRACTOR'S RESPONSIBILITY

A. 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 must 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 will be acceptable.

B. The Contractor must furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the Project. The report will be delivered to the Commissioner before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material must not be interpreted as a basis for final acceptance. All such test reports must be subject to verification by testing samples of material received for use on the Project.

3.05 FREIGHT AND WEIGHT BILLS

A. Before the final estimate is allowed, the Contractor must file with the Commissioner receipted bills when railroad shipments are made, and certified weight bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the Contract. The Contractor must not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Commissioner, nor must the car or tank be released until the final outage has been taken by the Commissioner. Copies of freight bills and weight bills will be furnished to the Commissioner during the progress of the work.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENTS

A. The bituminous material for tack coat will be measured by the gallon. Volume will be corrected to the volume at 50 degrees Fahrenheit (15 degrees C) in accordance with Table IV-3 of the Asphalt Institute's Manual MS-6 for emulsified asphalt. Water added to emulsified asphalt will not be measured for payment. Volume must be corrected to the volume at 60 degrees Fahrenheit in accordance with ASTM D 1250 for cutback asphalt.

B. The bituminous material paid for will be the measured quantities used in the accepted work, provided that the measured quantities are not 10 percent over the specified application rate. Any amount of bituminous material more than 10 percent over the specified application rate for each application will be deducted from the measured quantities, except for irregular areas where hand spraying is necessary.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENTS

A. Payment will be made at the Contract unit price per gallon for bituminous material. This price will be full compensation for furnishing all materials, for all preparation, delivery, and application of these materials, and for all labor, equipment, tools, and all work necessary to complete the item.

ITEM NO.	DESCRIPTION	UOM
P-603-01	BITUMINOUS TACK COAT	GAL

END OF SECTION P-603

JOINT SEALING FILLER
SECTION P-605

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item consists of providing and installing a resilient and adhesive joint sealing filler to effectively seal joints and cracks in pavements. The work under this Section is subject to the requirements of the Contract Documents.

1.02 RELATED WORK

A. Section P-623 – Sawcut and Seal, 2”

PART 2 - MATERIALS

2.01 JOINT SEALING MATERIALS

A. The joint sealing materials must conform to one or more of the following types, as required by these Specifications and the details as shown on the Project Plans:

1. Silicone Sealants: Joint sealant will be a one-part silicone material that cures to low-modulus rubber upon exposure to atmospheric moisture. The sealant must be recommended by its manufacturer for sealing portland cement concrete, bituminous and asphaltic Airport pavements. The cured material must be capable of withstanding repeated cyclic movements of 100-percent extension and 50-percent compression without permanent damage or failure. Cyclic movement test must be similar to ASTM C 719 or as approved by the Commissioner.

2. For Portland cement concrete-bituminous pavement joints, the joint sealant (Type A) must be manufactured by Dow, D.S. Brown, or Crafco. For Portland cement concrete – Portland cement concrete pavement construction and expansion joints, the joint sealant (Type B) must be manufactured by Dow, D.S. Brown, or Crafco.

TABLE 1
Silicone Sealant Requirements

Test Method	Test	Type A Sealant Requirements	Type B Sealant Requirements
As Supplied		50	50
MIL-S-8802	Flow, maximum	Self Leveling	Nil
ASTM D-1475	Specific Gravity	1.1-1.4	1.5-1.52
ASTM C-1183	Extrusion Rate, Type S ml/minute, minimum	50	50
ASTM C-679	Maximum Tack Free Time, minutes	120	90
Upon Complete Cure[1]			
ASTM D-2240	Durometer	20-65 (Shore 00)	10-25 (Shore A)
ASTM D-412, Die C	Joint Modulus at 150% elongation, maximum	30	45
ASTM D-412, Die C	Elongation, minimum %	800	800
CASTM D-5329	Tensile Adhesion, min % elongation	600	500
Performance[2]			
ASTM C-719	Movement, 10 cycles at +100/50%	No Failure	No Failure

[1]Sample cured 21 days at 77 degrees F±2 degrees F (25 degrees + 1 degrees C) and 50% ±5% relative humidity. Proper joint design and proper joint preparation are necessary for maximum performance.

[2]Specimens cured 28 days at 77 degrees F±2 degrees and 50% ±5% relative humidity with no other conditioning prior to testing.

3. Neoprene Compression Seals: The Contractor must furnish and install jet fuel resistant neoprene compression seals as manufactured by the D.S. Brown Company, Watson Bowman and Acme, or American Highway Technologies, in joints in concrete pavements. A detail of the installation is shown on the Plans Pavement Joint Details. The manufacturer must certify that the preformed seal must exert a minimum pressure of 3.0 pounds per square inch when compressed to 80 percent of nominal width and a maximum of 25.0 pounds per square inch when compressed to 50 percent of nominal width.

B. Backer Rods: Preformed backer rod must be installed in all pavement construction, expansion and contraction joints as shown in the Plans. Rods must be approved, non-moisture absorbing, non-gassing, extruded, closed-cell polyethylene foam or reticulated closed cell extruded polyolefin foam. Rods must be of a sufficient diameter to support the sealant in the joint without leakage until it has cured. Backup materials must be compatible with the sealant, will not adhere to the sealant, must be compressible without extruding the sealant until the sealant cures, and must recover to maintain contact with the joint faces when the joint is open.

C. Lubricant: Lubricant for installation of preformed joint seal must be one-component polycholoprene compound containing only soluble phenolic resins blended together with anti-oxidants and acid acceptors in aromatic hydrocarbon solvent mixture and must meet the following requirements:

	Requirements	ASTM
Average weight per gallons, pounds	7.8	
Solids content, percent by weight	22 – 28	D1644, Method A
Film strength, psi	2,300 min.	D412
Elongation, percent	750 min.	D412

1. Each shipment of lubricant must be delivered to the jobsite in the manufacturer's original sealed container. Each container must be marked with the manufacturer's name, batch or lot number, and the date of manufacture and must be accompanied by the manufacturer's certification stating that the lubricant meets the requirements of the Specification.

2. This lubricant must be stored at a temperature between 50 degrees Fahrenheit and 80 degrees F and must be used within 270 days of its manufacture.

D. Primer: Contractor must use an appropriate primer as recommended by the manufacturer. Primer must be compatible with the sealant and backer rod, and either manufactured by and/or approved by the sealant manufacturer.

2.02 PRELIMINARY MATERIAL ACCEPTANCE

A. Samples of all materials Contractor proposes for use and copies of the manufacturer's recommendations for mixing and installation must be submitted to the Commissioner for approval at least forty (40) days before use.

2.03 ACCEPTANCE SAMPLING

A. Each lot or batch of sealant or primer must be delivered to the job site in the manufacturer's original sealed container. Each container must be labeled to include the following:

1. Name of Material

2. Manufacturer's Name

3. Manufacturer's Lot Number

4. Shelf Life

5. Mixing Instructions

6. Storage Instructions

B. No sealant with expired shelf life will be installed.

PART 3 - CONSTRUCTION METHODS

3.01 TIME OF APPLICATION

A. As soon after completion of the curing period as feasible, Contractor must seal joints. Do not seal joints prior to seven days of moisture free drying after placement, or per minimum manufacturer's recommendation. Except as the Commissioner may otherwise approve, Contractor must complete joint sealing before the pavement is opened to traffic including construction equipment, and in any event within 30 days after curing. The joints must be sealed immediately following the final cleaning period or as soon thereafter as weather conditions allow. At the time of application of the sealing filler materials, the atmospheric and pavement temperature must be above 40 degrees F, and the weather will not be rainy or foggy. The temperature requirement may be waived only when so directed by the Commissioner. Sealing must be performed only during daylight hours.

B. A qualified representative of each sealant manufacturer must be present at the work site during start of sealing operations to insure adequate workmanship and inspection of the sealing operation.

C. At a temperature of 75 degrees F (24 degrees C) and 50 percent relative humidity, silicone sealant must cure to a tack-free surface in about two hours. At a temperature of 40 degrees F (4 degrees C) the tack-free time must be about 4 hours.

D. If the Contractor needs to use the sealed pavement for construction traffic before placement of the sealing filler materials, and if the Commissioner concurs in such use, the Contractor must temporarily fill the joints with a jute or nylon rope immediately after the joint is sawed. The rope must be slightly larger than the joint and must be forced into the joint so that the top of the rope is 1/8 inch below the pavement surface. The rope must be removed immediately before cleaning.

3.02 EQUIPMENT

A. All equipment necessary for the proper construction of this work must be on the Project in first-class working condition. The equipment must be as recommended by the sealant manufacturer and will be approved by the Commissioner before construction is permitted to start. Air compressors must be equipped with suitable traps capable of removing all free water and oil from the compressed air and must be capable of furnishing air with a pressure greater than 90 psi at 150 ft^3/min. Teflon-lined hoses will be required for silicone sealant application equipment.

3.03 PREPARATION OF JOINTS

A. After final joint sawing is complete and immediately before sealing, the joints must be thoroughly cleaned of all resulting cement slurry, laitance, curing compound and other foreign material. Cleaning must be accomplished by sandblasting or by high pressure water blasting. Upon completion of cleaning, the joints must be blown out with compressed air. During all operations, Contractor must exercise care not to damage or remove the filler material in expansion joints. No airborne dust will be allowed.

3.04 INSTALLATION OF SEALANT

A. Joints must be inspected for proper width, depth, alignment, and preparation, and will be approved by the Commissioner before sealing is allowed. Sealing filler materials must be installed according to the manufacturers' recommendations and the following requirements.

B. Silicone Sealants: Before sealing the joints, the Contractor must demonstrate that the equipment and procedures for preparing, mixing, and placing the sealing materials must produce a satisfactory joint seal. This must include the preparation of two small batches of sealant and the application of the resulting material.

1. To ensure that superior workmanship is achieved throughout the Work, the Contractor must construct tests as follows before commencing the Work. To evaluate workmanship of each of the Contractor's specific joint sealing crews, each will construct a test section at a location approved by the Commissioner. When the test sites are completed to the satisfaction of the Commissioner, the Contractor must be notified to proceed with the specifically approved crews in completing the work.

2. To maintain an acceptable level of productivity and quality, the Contractor must complete the remaining work with the same

crew members comprising the specifically approved crews. The Contractor must submit notice to the Commissioner if any personnel changes to the specifically approved crews are anticipated or experienced. If at any time during the construction of the work after a personnel change has been made, the Commissioner believes the workmanship has diminished and notifies the Contractor, the crew must halt construction. The Contractor must then reinstate the original specifically approved crews or must perform another test area to qualify the new crew. Upon a successful subsequent test section and approval of the new crew, the Contractor may proceed with the construction.

3. Sequence of backer rod installation and the primer application must be according to the sealant manufacturer's instructions. After the final cleaning with compressed air, the backer rod must be installed to the depth shown on the Plans by means of an approved roller device that ensures consistent, uniform placement. The backer rod must be butted tightly together at joint intersections, not allowing joint sealant to flow past the rod into the joint.

4. The joint faces must be clean and dry when the sealant is applied. The sealant must be applied directly from the original drums as received at the site. The sealant must be applied in a continuous operation, with an approved mechanical device that will force the sealant to the bottom of the joint and completely fill the joint without spilling the material on the surface of the pavement. Any sealant spilled on the surface of the pavement must be removed immediately. The sealant must adhere to the joint surfaces and fill the joints uniformly solid without formation voids. Sealant that does not bond to the joint walls, contains voids, or fails to set to a tack-free condition will be rejected and replaced by the Contractor at no additional cost to the Owner.

C. Preformed Elastomeric Joint Seals: Preformed joint sealer must be placed using equipment capable of installing the sealer in the upright position, without cutting, nicking, distorting, or otherwise damaging the seal. Lubricant must be applied to the concrete or preformed seal, or both, and the seal must 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 must be such that the joint sealer must not be stretched more than 4 percent of the minimum theoretical length, or compressed more than 2 percent. The method of installation must be checked for stretching or compression, using transverse joint sealer. The check must 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 premarking 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 indicated that the sealer is stretched or compressed beyond these limits, the installation must be modified to correct the situation. Once satisfactory sealing operations have started, one joint length per every hundred must 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 must be resealed in a satisfactory manner at no cost to the owner, and the method of installation must be checked again for satisfactory procedure. The seal must be installed and must be cut at the joint intersections for continuous installation of the seal in the transverse joints.

3.05 WARRANTY

A. The General Contractor must warrant, in writing, the entire joint sealing installation, regardless of installation conditions, for a period of five (5) years after the Project is substantially complete. The warranty must specifically state the sealant must prevent infiltration of water or other material through the joint under normal usage, will not flow, have loss of bond (adhesive failure), blister, crack, or lose its resiliency. Upon receipt of notice from the Commissioner of defects at any time within five years from the date of final acceptance, the Contractor must repair or replace any defective material or workmanship in a manner satisfactory and acceptable to the Commissioner.

PART 4 - MEASUREMENT AND PAYMENT

4.01 GENERAL

A. No measurement or direct payment will be made for joint sealing filler. All costs of furnishing materials, preparation, delivery, labor, and installation, equipment, tools, certification and all work necessary to complete this item, including but not limited to all sawcutting, will be considered subsidiary to and included in the price paid for the pavement adjacent to the joint.

END OF SECTION P-605

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RAPID CURE SEAL COAT
SECTION P-608R

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item shall consist of the application of an asphalt surface treatment composed of natural and refined asphalt materials, additives, and light oils, for taxiways and runways with the application of a suitable aggregate to maintain adequate surface friction; and airfield secondary and tertiary pavements including aprons, shoulders, overruns, roads, parking areas, and other general applications with or without aggregate applied as designated on the plans

1.02 REFERENCES

A. ASTM C88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

B. ASTM C117 – Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing

C. ASTM C128 – Standard Test Method for Relative Density (Specific Gravity) and Absorption of Fine Aggregate

D. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

E. ASTM C566 – Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying

F. ASTM C1252 – Standard Test Methods for Uncompacted Void Content of Fine Aggregate

G. ASTM D5 – Standard Test Method for Penetration of Asphalt Materials

H. ASTM D36 – Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)

I. ASTM D402 – Standard Test Method for Distillation of Cutback Asphalt

J. ASTM D2042 – Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene

K. ASTM D2216 – Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

L. ASTM D2995 – Standard Practice for Estimating Application Rate of Bituminous Distributors

M. ASTM D4402 – Standard Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer

N. ASTM D5340 – Standard Test Method for Airport Pavement Condition Index Surveys

O. ASTM D6433 – Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys

P. ASTM D6997 – Standard Test Method for Distillation of Emulsified Asphalt

Q. ASTM D7428 – Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus

R. AC 150/5320-12 – Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces

S. AC 150/5320-17 – Airfield Pavement Surface Evaluation and Rating (PASER) Manuals

T. AC 150/5380-6 – Guidelines and Procedures for Maintenance of Airport Pavements

U. AC 150/5380-7 – Airport Pavement Management Program (PMP)MATERIALS

PART 2 - MATERIALS

2.01 AGGREGATE

A. The fine-aggregate material shall be a dry, clean, sound, durable, angular shaped, with highly textured surfaces, manufactured specialty abrasive aggregate. It shall have 100% fractured faces, SiO2 content of 55% minimum, CaO of 3% max, with a sand equivalent greater than 85 and a Mohs hardness of 7 or greater. Additional characteristics as outlined in the following table(s). The Contractor shall submit specialty aggregate manufacturer's technical data and the specialty aggregate manufacturer's certification indicating that the specialty aggregate meets the requirements of the specification to the Commissioner prior to start of

construction. The aggregate must be approved for use by the Commissioner and shall meet the following gradation limits when tested in accordance with ASTM C136:

Aggregate Material Gradation Requirements

Sieve Designation	Percentage by Weight
No. 8	100
No. 14	98-100
No. 16	85-100
No. 30	15-45
No. 50	0-8
No. 70	0-2

Aggregate Characteristics

Test	Standard	Range
Micro-Deval	ASTM D7428	15% max
Magnesium Sulfate Soundness	ASTM C88	2% max
Aggregate Angularity	ASTM C1252 – Test Method A	45% min
Moisture Content (%)	ASTM C566	2% max
Bulk Dry Specific Gravity	ASTM C128	2.6 – 3.0
Absorption (%)	ASTM D2216	3% max
Mohs Hardness	Mohs Scale	7 min

B. The Contractor shall provide a certification of analysis (COA) showing analysis and properties of the material delivered for use on the project. The Contractor's certification may be subject to verification by testing the material delivered for use on the project.

2.02 ASPHALT MATERIAL

A. The asphalt material base residue shall contain not less than 40% gilsonite, or uintaite, and shall not contain any tall oil pitch or coal tar material. The material shall be compatible with asphalt pavement, and have a 5-year minimum proven aviation performance record at airports with similar climatic conditions. The solvent-based rapid cure material shall meet the following properties:

Properties for Asphalt Sealing Material

Properties	Specification	Limits
Kinematic Viscosity at 140°F (60°C)	ASTM D4402	10-30 cSt
Percent Residue by Distillation	ASTM D402	30-45%

Tests on Residue from Distillation

Properties	Specification	Limits
Penetration at 77°F (25°C)	ASTM D5	2-12 dmm
Softening Point	ASTM D36	180-200
Solubility in 1,1,1 Trichloroethylene	ASTM D2042	99% min.
HCI Precipitation Value		18-25

B. The Contractor shall provide a copy of the manufacturer's Certificate of Analysis (COA) for the asphalt sealer delivered to the project. If the asphalt sealer is diluted at other than the manufacturer's facility, the Contractor shall provide a supplemental COA from an independent laboratory verifying the asphalt sealer properties. The COA shall be provided to and approved by the Commissioner before the asphalt material is applied. The furnishing of the vendor's certified test report for the asphalt material shall not be interpreted as a basis for final acceptance. The manufacturer's COA may be subject to verification by testing the material delivered for use on the project.

C. The asphalt sealing material must be applied in an undiluted form. The material may be stored at ambient temperature for long periods of time if necessary. Storage will follow industry standard recommendations due to the flammability of the material; avoid sparks and open flames to come into contact with the material or any gasses that might be escaping the storage vessel.

D. Contractor shall provide a list of airport pavement projects, exposed to similar climate conditions, where this product has been successfully applied within at least 5 years of the project.

2.03 SEAL COAT WITH AGGREGATE

A. The Contractor shall submit friction test data from at least two (2) airport projects identified under Section 2.02A. The test data must be from the same project and include technical details on application rates, aggregate rates, and point of contact at the airport to confirm use and success of sealer with aggregate.

B. Friction test data in accordance with AC 150/5320-12, at 40 or 60 mph (65 or 95 km/h) wet, must include as a minimum; the friction value prior to sealant application; two values, between 24 and 96 hours after application, with a minimum of 24 hours between tests; and one value between 180 days and 360 days after the application. The results of the tests between 24 and 96 hours shall indicate friction is increasing at a rate to obtain similar friction value of the pavement surface prior to application, and the long-term test shall indicate no apparent adverse effect with time relative to friction values and existing pavement surface.

C. Seal coat material submittal without required friction performance will not be approved. Friction tests performed on this project cannot be used as a substitute of this requirement.

PART 3 - COMPOSITION AND APPLICATION RATE

3.01 APPLICATION RATE

A. The approximate amounts of materials per square yard for the asphalt surface treatment shall be as provided in the table for the treatment area(s) at the specified rate(s) as noted on the plans. The actual application rates will vary within the range specified to suit field conditions and will be recommended by the manufacturer's representative for control strip evaluations, and approved by the Commissioner from the test area/sections evaluation.

Application Rate

Dilution Rate	Quantity of Sealer gal/yd^2 (l/m^2)	Quantity of Aggregate lb/yd^2 (kg/m^2)
N/A	0.08-0.15 (0.36-0.68)	0.40-0.50 (0.11-0.22)

3.02 CONTROL AREAS AND CONTROL STRIPS

A. A qualified manufacturer's representative shall be present in the field to assist the Contractor in applying control areas and/or control strips to determine the appropriate application rate of both sealer and aggregate to be evaluated and approved by the Commissioner.

B. A test area and/or section shall be applied for each differing asphalt pavement surface identified in the project. The control area(s) and/or

control strip(s) shall be used to determine the material application rate(s) of both sealer and aggregate prior to full production. The same equipment and method of operation shall be utilized on the control area(s) and/or control strip(s) as will be utilized on the remainder of the work.

1. For runway and high-speed exit taxiway surfaces.

    a. Prior to full application, the Contractor shall place a series of control strips a minimum of 300 feet long by 12 feet wide, or width of anticipated application, whichever is greater, at varying application rates as recommended by the manufacturer's representative and acceptable to the Commissioner to determine appropriate application rate(s). The control strips should be separated by a minimum of 200 feet between control strips. The area to be tested will be located on a representative section of the pavement to receive the asphalt surface treatment designated by the Commissioner. The control strips should be placed under similar field conditions as anticipated for the actual application. Before beginning the control strip(s), the skid resistance of the existing pavement shall be determined for each control strip with a continuous friction measuring equipment (CFME). The skid resistance of existing pavement can be immediately adjacent to the control strip or at the same location as the control strip if testing prior to application.

    b. The Contractor may begin testing the skid resistance of runway and high-speed exit taxiway control strips after application of the asphalt surface treatment has fully cured, generally 2 to 4 hours after application of the control strips depending on site conditions. Aircraft shall not be permitted on the runway or high-speed exit taxiway control strips until such time as the Contractor validates that its surface friction meets the maintenance planning friction levels in AC 150/5320-12, Table 3-2 when tested at speeds of 40 and 60 mph wet with approved CFME. The JMF must be submitted in writing by the Contractor at least 30 days prior to the start of paving operations. The JMF must be developed within the same construction season using aggregates currently being produced.

2. Control Strip.

    a. If the control strip should prove to be unsatisfactory, necessary adjustments to the application rate, placement

operations, and equipment shall be made. Additional control strips shall be placed and additional skid resistance tests performed and evaluated. Full production shall not begin without the Commissioner's approval of an appropriate application rate(s).

PART 4 - CONSTRUCTION METHODS

4.01 WEATHER LIMITATIONS

A. The asphalt sealer shall be applied only when the existing pavement surface is dry and when the weather is not foggy, rainy, or when the wind velocity will prevent the uniform application of the material. No material shall be applied when dust or aggregate is blowing or when rain is anticipated within four (4) hours of application completion. The atmospheric temperature and the pavement surface temperature shall both be at, or above 55°F and rising. The sealer will shall not be applied when pavement temperatures are expected to exceed 160F within the subsequent 72 hours if traffic will be opened on pavement within those 72 hours. During application, account for wind drift. Cover existing buildings, structures, runway edge lights, taxiway edge lights, informational signs, retro-reflective marking and in-pavement duct markers as necessary to protect against overspray before applying the sealer. Should sealer get on any light or marker fixture, promptly clean the fixture. If cleaning is not satisfactory to the Commissioner, the Contractor shall replace any light, sign or marker with equivalent equipment at no cost to the Commissioner.

4.02 EQUIPMENT AND TOOLS

A. The Contractor shall furnish all equipment, tools, and machinery necessary for the performance of the work.

1. Pressure distributor.

a. The sealer shall be applied with a manufacturer-approved computer rate-controlled asphalt distributor. The equipment shall be in good working order and contain no contaminants or diluents in the tank. Spray bar tips must be clean, free of burrs, and of a size to maintain an even distribution of the sealer. Any type of tip or pressure source is suitable that will maintain predetermined flow rates and constant pressure during the application process with application speeds under eight (8) miles per hour or seven (700) feet per minute. The Contractor will provide verification of truck

set-up (via a test-shot area), including but not limited to, nozzle tip size appropriate for application per nozzle manufacturer, spray-bar height and pressure and pump speed appropriate for the viscosity and temperature of sealer material, evidence of triple-overlap spray pattern, lack of leaks, and any other factors relevant to ensure the truck is in good working order before use. The distributor truck shall be equipped with a 12-foot, minimum, spray bar with individual nozzle control. The distributor truck shall be capable of specific application rates in the range of 0.05 to 0.25 gallons per square yard. These rates shall be computer-controlled rather than mechanical. The distributor truck shall have an easily accessible thermometer that constantly monitors the temperature of the sealer,and have an operable mechanical tank gauge that can be used to cross-check the computer accuracy.

b. The distributor truck shall effectively mix the material prior to application.

c. The distributor shall be equipped with a hand sprayer to spray the sealer in areas not accessible to the distributor truck.

2. Aggregate spreader.

a. The asphalt distributor truck will be equipped with an aggregate spreader mounted to the distributor truck that can apply aggregate to the sealer in a single pass operation without driving through wet sealer. The aggregate spreader shall be equipped with a variable control system capable of uniformly distributing the aggregate at the specified rate at varying application widths and speeds. The aggregate spreader must be adjusted to produce an even and accurate application of specified aggregate. Prior to any seal coat application, the aggregate spreader will be calibrated onsite to ensure acceptable uniformity of spread. The Commissioner will observe the calibration and verify the results. The aggregate spreader will be re-calibrated each time the aggregate rate is changed either during the application of test strips or production. The Contractor may consult the seal coat manufacturer representative for procedure and guidance. The aggregate spreader shall have a minimum hopper capacity of 3,000 pounds of aggregate. Push-type hand spreaders will be allowed for

use around lights, signs and other obstructions, if necessary.

3. Power broom/blower.

   a. A power broom and/or blower shall be provided for removing loose material from the surface to be treated.

4. Equipment calibration.

   a. Asphalt distributors must be calibrated within the same construction season in accordance with ASTM D2995. The Contractor must furnish a current calibration certification for the asphalt distributor truck from any State or other agency as approved by the Commissioner.

4.03 PREPARATION OF ASPHALT PAVEMENT SURFACES

A. Clean pavement surface immediately prior to placing the seal coat so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film. Remove oil or grease from the asphalt pavement by scrubbing with a detergent, washing thoroughly with clean water, and treating these areas with the oil spot primer. Any additional surface preparation, such as crack repair, shall be in accordance with Item P-406 & P-605.

4.04 APPLICATION OF ASPHALT SEALER

A. The asphalt sealer shall be applied using a pressure distributor upon the properly prepared, clean and dry surface at the application rate recommended by the manufacturer's representative and approved by the Commissioner from the test area/sections evaluation for each designated treatment area. Recommended material temperature for application is 70°F to 90°F, but depending on the application equipment used, good material dispersion and pavement coverage may be achieved at lower material temperatures. The material should not be heated above 100°F.

B. Pavement surfaces which have excessive runoff of seal coat due to excessive amount of material being applied or excessive surface grade shall be treated in two or more applications, if feasible, to the specified application rate at no additional cost to the Commissioner. Each additional application shall be performed after the prior application of material has penetrated into the pavement.

C. If low spots and depressions greater than 1/2 inch in depth in the pavement surface cause ponding or puddling of the applied materials, the

pavement surface shall be lightly broomed with a broom or brush type squeegee. Brooming shall continue until the pavement surface is free of any pools of excess material. Ponding and/or puddling shall not cause excessive pavement tackiness and/or additional distress.

D. During all applications, the surfaces of adjacent structures shall be protected to prevent their being spattered or marred. Asphalt materials shall not be discharged into borrow pits or gutters or on the airport area.

E. ***Caution.*** *Heating asphalt binders of any kind always constitutes some degree of hazard. The most hazardous of these are cutback asphalts because of the highly volatile solvents used. Care must be taken not to allow any spark or open flame to come in contact with the cutback asphalt or the gases from cutback asphalt due to the low flash point. It is the Contractor's responsibility to understand and adhere to these standards in regards to staying within the recommended application temperatures of this material and at all times during production.*

4.05 APPLICATION OF AGGREGATE MATERIAL

A. Immediately following the application of the asphalt sealer, aggregate at the rate recommended by the manufacturer's representative and approved by the Commissioner from the test area/sections evaluation for each designated application area, shall be spread uniformly over the asphalt sealer in a single-pass operation simultaneous with the sealer application. The sealer material and aggregate shall be applied simultaneously in a single pass operation, so as to not drive through the applied fresh sealer. The aggregate shall be spread to the same width of application as the asphalt material and shall not be applied in such thickness as to cause blanketing.

B. Sprinkling of additional aggregate material, and spraying additional asphalt material over areas that show up having insufficient cover or bitumen, shall be done by hand whenever necessary. In areas where hand work is necessitated, the aggregate shall be applied before the sealant begins to break.

C. Minimize aggregate from being broadcast and accumulating on the untreated pavement adjacent to an application pass. Prior to the next application pass, the Contractor shall clean areas of excess or loose aggregate and remove from project site.

PART 5 - QUALITY CONTROL (QC)

5.01 MANUFACTURER'S REPRESENTATION

A. The manufacturer's representative knowledgeable of the material, procedures, and equipment described in the specification is responsible to assist the Contractor and Commissioner in determining the appropriate application rates of the emulsion and aggregate, as well as recommendations for proper preparation and start-up of seal coat application. Documentation of the manufacturer representative's experience and knowledge for applying the seal coat product shall be furnished to the Commissioner a minimum of 10 work days prior to placement of the control strips. The cost of the manufacturer's representative shall be included in the Contractor's bid price.

B. The Contractor shall provide the Commissioner with the seal coat Contractor's qualifications for applicators, personnel and equipment. The Contractor shall also provide documentation that the seal coat Contractor is qualified to apply the seal coat and has made at least three (3) applications similar to this project in the past two (2) years.

PART 6 - MATERIAL ACCEPTANCE

6.01 GENERAL

A. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the Commissioner at no cost to the Contractor except that coring as required in this section must be completed and paid for by the Contractor.

6.02 ACCEPTANCE CRITERIA

A. Application Rate. The rate of application of the asphalt emulsion shall be verified at least twice per day.

B. Friction tests. Friction tests in accordance with AC 150/5320-12, Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces, shall be accomplished on all runway and high-speed taxiways that have received a seal coat. Each test includes performing friction tests at 40 mph and 60 mph both wet, 15 feet to each side of runway centerline. The Contractor shall coordinate testing with the Commissioner and provide the Commissioner a written report of friction test results. The Commissioner shall be present for testing.

PART 7 - METHOD OF MEASUREMENT

7.01 MEASUREMENT

A. Rapid Cure Seal Coat – Will not be measured in place, but will be considered incidental to associated pay items found in Section P-401(FAA) and Section P-405.

PART 8 - BASIS OF PAYMENT

8.01 PAYMENT

A. No separate payment will be made for Rapid Cure Seal Coat. This work, including materials, labor, tools and equipment, will be incidental to associated pay items found in Section P-401(FAA) and Section P-405.

END OF SECTION P-608R

STRUCTURAL PORTLAND CEMENT CONCRETE
SECTION P-610

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item must consist of either plain or reinforced cast-in-place structural Portland Cement concrete and precast concrete structures, prepared and constructed in accordance with these Specifications, at the locations and of the form and dimensions shown on the Drawings. The work under this Section is subject to the requirements of the Contract Documents. Work under this Section is subject to full-time Quality Control surveillance.

1.02 SUBMITTALS

A. Mix designs

1. Submit concrete mix designs prepared by an independent testing laboratory meeting the requirements of ASTM C1077 in accordance with ACI 301 “Specifications for Structural Concrete”.

B. Shop Drawings

1. Structural concrete structure details including reinforcing steel.

C. Test Reports

1. Submit material test reports and certifications where referenced in this Specification.

PART 2 - MATERIALS

2.01 GENERAL

A. Only approved materials, conforming to the requirements of these Specifications, must 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 must be approved by the Commissioner before delivery or use is started. Representative preliminary samples of the materials must be submitted by the Contractor, when required, for examination and test. Materials must be stored and handled to insure the preservation of their quality and fitness

for use and must 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.

B. In no case will the use of pit-run or naturally mixed aggregates be permitted. Naturally mixed aggregate must be screened and washed, and all fine and coarse aggregates must 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.

C. Reactivity: Aggregates (coarse and fine) must be tested for deleterious reactivity with alkalies in the cement, which may cause excessive expansion of the concrete. Tests of coarse and fine aggregate must be made in accordance with ASTM C1260 by an independent test laboratory that meets the requirements of ASTMC 1077. If the expansion of the coarse or fine aggregate test specimens, tested in accordance with ASTM C1260, does not exceed 0.10% at 28 days (30 days from casting), the coarse or fine aggregates shall be accepted. If the expansion at 28 days is greater than 0.10%, test specimens must be made in accordance with ASTM C1567 using all components (e.g. coarse aggregate, fine aggregate, cementitious materials, and/or specific reactivity reducing chemicals) in the proportions proposed for the mixture design. If the expansion of the proposed mixture design test specimens, tested in accordance with ASTM C1567 does not exceed 0.10% at 28 days, the aggregates will be accepted. If the expansion of the proposed mixture design test specimens is greater than 0.10% at 28 days, the aggregates will not be accepted unless adjustments to the mixture design can reduce the expansion to less than 0.10% at 28 days, or new aggregates must be evaluated and tested.

2.02 COARSE AGGREGATE

A. The coarse aggregate for concrete must meet the requirements of IDOT S.S.R.B.C. Section 1004.

B. Coarse aggregate must be well graded from coarse to fine and must meet one of the gradations shown in Table 1, using ASTM C 136. Independent certified test results not more than 30 days old must be submitted.

2.03 FINE AGGREGATE

A. The fine aggregate for concrete must meet the requirements of IDOT S.S.R.B.C. Section 1003.

B. The fine aggregate must be well graded from fine to coarse and must meet the requirements of Table 2, when tested in accordance with ASTM C 136. Independent certified test results not more than 30 days old must be submitted.

TABLE 1
Gradation for Coarse Aggregate

	Percentage by Weight Passing Sieves				
Sieve Designation (square openings)	1-1/2"	1"	3/4"	1/2"	No. 4
No. 4. to 3/4 in.	----	100	90-100	40-70	5-15
No. 4 to 1 in.	100	90-100	----	30-60	0-10

TABLE 2
Gradation for Fine Aggregate

Sieve Designation (square openings)	By Weight Passing Sieves
Sieve	Percentage
3/8 inch (9.5 mm)	100
No. 4 (4.75 mm)	95-100
No. 16 (1.18 mm)	45-80
No. 30 (0.60 mm)	25-55
No. 50 (0.30 mm)	10-30
No. 100 (0.15 mm)	2-10

C. Blending will be permitted, if necessary, in order to meet the gradation requirements for fine aggregate. Fine aggregate deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, provided that such deficiency does not exceed 5% and is remedied by the addition of pozzolanic or cementitious materials other than portland cement, as specified in 610-2.06 on admixtures, in sufficient quantity to produce the required workability as acceptable to the Commissioner.

2.04 CEMENT

A. Cement must conform to the requirements of ASTM C-150 Type I. See Paragraph 610-3.02 for the required amount of cement.

B. The Contractor must furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the Project. The report

must be delivered to the Commissioner before permission to use the cement is granted. All such test reports may be subject to verification by testing sample materials received for use on the Project.

2.05 WATER

A. The water used in concrete must be free from sewage, oil, acid, strong alkalies, vegetable matter, and clay and loam. If the water is of questionable quality, it must be tested in accordance with AASHTO T 26. Water known to be of potable quality may be used without testing.

2.06 ADMIXTURES

A. The use of any material added to the concrete mix must be acceptable to the Commissioner. Before acceptance of any material, the Contractor must be required to submit the results of complete physical and chemical analyses made by an acceptable testing laboratory. Subsequent tests may be made of samples taken by the Commissioner 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 accepted.

B. Fly ash will not be permitted in this mix.

C. Air-entraining admixtures must meet the requirements of ASTM C 260.

D. Air-entraining admixtures must be added at the mixer in the amount necessary to produce the specified air content.

E. Water-reducing, set-controlling admixtures must meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding.

F. Water-reducing admixtures must be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions.

G. Admixtures to accelerate curing and strength must be added for all concrete construction within runway or taxiway safety areas outside full-strength pavement, or as shown in the plans. Accelerating admixtures must meet the requirements of ASTM D98, and provide sufficient time to allow runways and taxiways to reopen on time after approved closures.

2.07 STEEL REINFORCEMENT

A. Reinforcing must consist of deformed reinforcement bars conforming to the requirements of ASTM A-706 Grade 60.

B. Reinforcing steel must be epoxy coated in accordance with Articles 508 and 1006 of the SSRBC.

2.08 COVER MATERIALS FOR CURING

A. Curing materials must conform to one of the following Specifications:

1. Waterproof Paper for Curing Concrete - ASTM C 171.

2. Polyethylene Sheeting for Curing Concrete - ASTM C 171.

3. Liquid Membrane-Forming Compounds for Curing Concrete - ASTM C 309, Type 2.

PART 3 - CONSTRUCTION METHODS

3.01 GENERAL

A. The Contractor must furnish all labor, materials, and services necessary for, and included in 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 or she proposes to use on the work, must be of sufficient size to meet the requirements of the work, and must be such as to produce satisfactory work; all work will be subject to inspection and acceptance by the Commissioner.

3.02 CONCRETE COMPOSITION

A. Cast-in-place concrete must develop a minimum compressive strength of 4,000 pounds per square inch in 28 days, except as otherwise noted on the Plans or in the Specifications, as determined by test cylinders made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The concrete must contain not less than 535 pounds of total cementitious materials per cubic yard (318 kg per cubic meter). The concrete must contain 6 percent of entrained air, plus or minus 1 percent, as determined by ASTM C 231. The concrete must have a slump of not more than 4 inches (10 cm) as determined by ASTM C 143. For placement where workability may require a slump higher than 4 inches, the Contractor may adjust the slump upwards subject to the mix not exceeding a water cement ratio of 0.45 and that batch weights are obtained from the concrete supplier and the Contractor QC organization conducts calculations to ensure that the water/cement ratio is not exceeded, subject to the approval by the Commissioner on a case-to-case basis.

B. The Contractor must employ at his expense, an independent quality control testing laboratory that meets the requirements of ASTM C1077 and approved by the Commissioner, to design the mix for each type of concrete required in accordance with the Specifications and Drawings. Mix designs prepared by concrete manufacturers must be tested and verified by the quality control testing laboratory for conformity with the Specifications and submitted to the Commissioner for review. No concrete will be placed until the mix design and 28 day strength test results are submitted and accepted by the Commissioner.

3.03 ACCEPTANCE SAMPLING AND TESTING

A. Cast-in-place concrete for each structure will be accepted on the basis of the compressive strength specified in Paragraph 3.02. The concrete must be sampled in accordance with ASTM C 172. Compressive strength specimens must be made by the Contractor in accordance with ASTM C 31. Tests for slump (ASTM C143), air content (ASTM C231), and temperature (ASTM C1064) must be made by the Contractor on the first load and last load and for every 50 cubic yards of each days placement of concrete. Compressive strength specimens (1 cylinder to be tested at 7 days, 1 at 14 days, 2 at 28 days) must be casted by the Contractor in accordance with ASTM C 31, for each 100 cubic yards placed with a minimum of one set per day's placement.

B. The Contractor must make and initially cure and store the test specimens in accordance with ASTM C31. The Contractor must transport and deliver the test specimens to the Commissioner's laboratory for testing. A Chain of Custody form provided by the Commissioner must be used. The Contractor must be responsible for developing a system of recording the initial curing temperatures and this data must be sent to the Commissioner's laboratory with the test specimens. The Commissioner will make the actual tests on the specimens in accordance with ASTM C 39 at no expense to the Contractor.

3.04 PROPORTIONING AND MEASURING DEVICES

A. When package cement is used, the quantity for each batch must be equal to one or more whole sacks of cement. The aggregates must be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge must be contained in each batch compartment. Weighing boxes or hoppers must be approved by the Commissioner and must 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.

3.05 CONSISTENCY

A. The consistency of the concrete must be checked by the slump test specified in ASTM C 143.

3.06 MIXING

A. Concrete may be mixed at the construction site, at a central point, and/or wholly or in part in truck mixers. The concrete must be mixed and delivered in accordance with the requirements of ASTM C 94.

3.07 MIXING CONDITIONS

A. The concrete must be mixed only in quantities required for immediate use. Concrete must not be mixed while the air temperature is below 40 degrees F (4 degrees C) without permission of the Commissioner. If permission is granted for mixing under such conditions, aggregates or water, or both, must be heated and the concrete must be placed at a temperature not less than 50 degrees F (10 degrees C) nor more than 90 degrees F (32 degrees C). The Contractor must be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and must replace such work at his or her expense.

B. No retempering of concrete by adding water or any other material is permitted.

C. The delivery of concrete to the job must be in such a manner that batches of concrete will be deposited at uninterrupted intervals.

3.08 FORMS

A. Concrete must not be placed until all the forms and reinforcements have been inspected and acceptable to the Commissioner. Forms must be of suitable material and must be of the type, size, shape, quality, and strength to build the structure as designed on the Plans. The forms must be true to line and grade and must be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The Contractor must bear responsibility for their adequacy. The surfaces of forms must be smooth and free from irregularities, dents, sags, and holes.

B. The internal ties must be arranged so that, when the forms are removed, no metal will show in the concrete surface or discolor the surface when exposed to weathering. All forms must be wetted with water or with a nonstaining mineral oil which must be applied shortly

before the concrete is placed. Forms must be constructed so that they can be removed without injuring the concrete or concrete surface. The forms must not be removed from vertical faces, walls, slender columns, and similar structures before the expiration of at least 30 hours; forms supported by falsework under slabs, beams, girders, arches, and similar construction must not be removed until tests indicate that at least 60% of the design strength of the concrete has developed.

3.09 PLACING REINFORCEMENT

A. All reinforcement must be accurately placed, as shown on the Plans, and must be firmly held in position during concreting. Bars must be tied at all intersections except where the center to center dimension is less than 1 foot in each direction, in which case alternate intersections may be tied. The reinforcement must be supported by approved metal chairs. Shop Drawings, lists, and bending details must be supplied by the Contractor when required.

3.10 EMBEDDED ITEMS

A. Before placing concrete, any items that are to be embedded must be firmly and securely fastened in place as indicated. All such items must be clean and free from coating, rust, scale, oil, or any foreign matter. The embedding of wood must be avoided. The concrete must be spaded and consolidated around and against embedded items.

3.11 PLACING CONCRETE

A. All concrete must be placed during daylight, unless otherwise approved. The concrete must 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 must be placed as soon as practical after mixing and in no case later than 60 minutes after water has been added to the mix. The method and manner of placing must be such to avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes must 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 must be placed upon clean, damp surfaces, free from running water, or upon properly consolidated soil.

B. The concrete must be compacted with suitable mechanical vibrators operating within the concrete. When necessary, vibrating must be supplemented by hand spading with suitable tools to assure proper and adequate compaction. Vibrators must 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 must be of sufficient duration to accomplish compaction but must not be prolonged to the point where segregation occurs. Concrete deposited under water must 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 must not be disturbed after being deposited.

3.12 CONSTRUCTION JOINTS

A. When the placing of concrete is suspended, necessary provisions must 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 must be made for grooves, steps, keys, dovetails, reinforcing bars or other devices as may be prescribed. The work must be arranged so that a section begun on any day must 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 must be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.

3.13 DEFECTIVE WORK

A. Any defective work disclosed after the forms have been removed must 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 Commissioner cannot be repaired satisfactorily, the entire section must be removed and replaced at the expense of the Contractor.

3.14 SURFACE FINISH

A. All exposed concrete surfaces must be true, smooth and free from open or rough spaces, depressions, or projections greater than ¼-inch of the proposed finish. The concrete in horizontal plane surfaces must be brought flush with the finished top surface at the proper elevation and must be struck-off with a straightedge and floated. Mortar finishing will not be permitted, nor must dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.

B. When directed, the surface finish of exposed concrete must be a rubbed finish. If forms can be removed while the concrete is still green, the surface must 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 must be used to finish the

surface. When approved, the finishing can be done with a rubbing machine. Surfaces subject to foot traffic must have a broom finish.

3.15 CURING AND PROTECTION

A. All concrete must be properly cured and protected by the Contractor.

The work must be protected from the elements, flowing water, and from defacement of any nature during the building operations. The concrete must be cured as soon as it has sufficiently hardened by covering with an approved material. Membrane-forming curing compound must be applied in accordance with the manufacturer's recommendations. Water-absorptive coverings must be thoroughly saturated when placed and kept saturated for a period of at least 3 days. All curing mats or blankets must be sufficiently weighted or tied down to keep the concrete surface covered and to prevent the surface from being exposed to currents of air or blown about due to the blast of jet engines. Where wooden forms are used, they must be kept wet at all times until removed to prevent the opening of joints and drying out of the concrete. Traffic or loading must not be allowed on concrete surfaces for 7 days after the concrete has been placed. If the Contractor seeks permission from the Commissioner to place traffic or load before 7 days, the Contractor QC and his laboratory must make and break additional cylinders for this purpose, subject to verification by the Commissioner.

3.16 DRAINS OR DUCTS

A. Drainage pipes, conduits, and ducts that are to be encased in concrete must be installed by the Contractor before the concrete is placed. The pipe must be held rigidly so that it will not be displaced or moved during the placing of the concrete.

3.17 HOT AND COLD WEATHER PROTECTION

A. The Contractor will not be entitled to additional compensation for satisfying the hot weather or cold weather placement requirements below.

B. The Contractor must place concrete in accordance with ACI 305R Hot Weather Concreting and ACI 306.1 Standard Specification for Cold Weather Concreting.

C. If concrete is placed where the weather is such that the temperature of the concrete could exceed 90 degrees Fahrenheit, the Contractor must

employ effective means such as pre-cooling of aggregates or using ice as necessary to maintain the temperature of concrete below 90 degrees Fahrenheit as it is placed.

D. When concrete is placed at temperatures below 40 degrees F (4 degrees C), the Contractor must provide satisfactory methods and means to protect the mix from injury by freezing. The aggregates, or water, or both, must be heated in order to place the concrete at temperatures between 50 degrees and 90 degrees F. Snow, ice, and frost must be removed from the surfaces, including reinforcement against which concrete is to be placed. Before beginning concrete placement, the subgrade must be thawed.

E. Calcium chloride must not be used in the concrete mix. After the concrete has been placed, the Contractor must provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50 degrees F (10 degrees C) until at least 60% of the designed strength has been attained.

F. The Contractor must submit detailed procedures for production, transportation, placement, protection curing, testing and temperature monitoring of concrete during hot or cold weather. The Hot or Cold Weather Concreting Plan must include procedures to be implemented upon abrupt changes in weather conditions or equipment failures.

3.18 FILLING JOINTS

A. All joints which require filling must be thoroughly cleaned, and any excess mortar or concrete must be cut out with proper tools. Joint filling must not be started until after final curing and must be done only when the concrete is completely dry. The cleaning and filling must be carefully done with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

3.19 PRECAST CONCRETE

A. At the option of the Contractor and subject to the approval by the Commissioner, some cast-in-place structures such as manholes, handholes, and drainage structures may be substituted with precast concrete. If precast concrete is adopted, it will be subject to the requirements of the applicable portions of Sections 504, 1020, and 1042 or other Sections or articles cited elsewhere in this Specifications of the following:

1. "Standard Specifications for Road and Bridge Construction: (SSRBC) prepared by the Illinois Department of Transportation, latest edition. The SSRBC is referred to in the following Articles as the "Standard Specifications" and as except as may be otherwise stated, the work to be done under Precast Concrete must conform to the requirements of said "Standard Specifications".

2. Where the "Standard Specifications" refer to "Engineer", it will be understood to mean "Commissioner".

3. Where the "Standard Specification refer to "Engineer" for required tests and inspections, it will be understood to mean "Contractor".

4. Standard Specifications articles referring to "Method of Measurement" and "Basis of Payment" are not applicable.

B. Precast concrete materials must meet the requirements of Article 504.02 as applicable and equipment must meet the requirements of Article 504.03.

C. The precast unit manufacturer must have experience in producing precast/precast prestressed units and must have a current Prestressed Concrete Institute quality program certification which demonstrates its registration to the ISO 9002 standard or approved equal. A copy of the certification must be submitted to the Commissioner for review.

D. Concrete materials must be combined so as to produce a concrete meeting all the requirements specified in Articles 1020.04, 1020.05, and 1042.03 for Class PC Concrete (Mix design compressive strength of 4,500 psi minimum at 28 days) for precast structures. Other concrete mix designs proposed by the Contractor must be submitted for review and approval by the Commissioner. Aggregates must conform to the requirements of Articles 1003.02 and 1004.02 with the exception of gradation. It will be the Contractor's responsibility to determine the proportions of the materials for the concrete, and to exercise quality control with respect to the mixture, so that each batch of concrete entering into the members will meet the requirements specified. Batches of concrete not meeting the requirements as to slump and entrained air content will be rejected.

E. Before the work begins, the Contractor must furnish the Commissioner a listing of the name, source, brand or type and/or supplier for each of the materials, and must secure the Commissioner's approval of the

proportions of cement, fine aggregate, coarse aggregate, admixtures and water the Contractor proposes to use.

F. Precast construction requirements must be in accordance with the applicable provisions of Articles 504.05 and 504.06.

G. Slump, air content, and strength tests for precast concrete must be in accordance to the applicable provisions of Articles 1020.07, 1020.08, and 1020.09, respectively. Certified concrete test results must be submitted in a timely manner by the Contractor for review of the Commissioner. Handling, measuring, batching, and mixing of precast concrete must be in accordance with Articles 1020.10 and 1020.11.

H. The Commissioner reserves the right to inspect and witness the manufacture of the precast units and the testing of concrete samples.

I. Precast sections must be installed in horizontal courses. The units must be laid in mortar, sealed with external sealing bands, or sealed using mortar joint sealer. When mastic joint sealer is used, the material shall completely fill the joint after the units have been brought together. All precast units shall be installed on a 6” thick sand cushion of FA-6 compacted to 95% Modified Proctor ASTM D1557, or as shown on the Drawings.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENTS

A. Cast-in-place and precast Portland Cement concrete, either plain or reinforced, and the reinforcing steel will not be measured separately for payment but will be included in the unit of measurement for manholes, handholes, catch basins, marker light bases, inspection holes, repair or adjustment of existing structures, and other improvements as shown in the plans.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENTS

A. Payment for Cast-in-Place and Portland cement concrete, either plain or reinforced, will be made at the Contract unit price for designated item and unit of measurement, including but not limited to: manholes, handholes, catch basins, guidance sign foundations, and marker light bases. Reinforcing steel will not be paid for separately but will be included in the unit price bid for the designated item.

END OF SECTION P-610

PAVEMENT SCARIFICATION
SECTION P-617

PART 1 - DESCRIPTION

1.01 GENERAL

A. This work must consist of scarifying (Cold Milling) existing portland cement concrete (P.C.C.) or bituminous concrete pavement and shoulder areas and satisfactory disposal of the scarified material. The work under this Section is subject to the requirements of the Contract Documents.

1.02 RELATED WORK

A. Related work specified elsewhere includes:

1. Section 01356 – Recycled Content
2. Section 01524 – Construction Waste Management
3. Section 02245 – Recycled Asphalt Pavement
4. Section P-150 – Pavement Removal
5. Section X-100 – Site Demolition

PART 2 - CONSTRUCTION METHODS

2.01 SCARIFICATION

A. Existing runway and taxiway pavements must be scarified (Cold Milled) as shown on the Plans and as directed by the Commissioner. The Contractor must mill to a uniform depth below proposed pavement grade as shown on the details in the Plans.

B. Before or during milling operations, areas of delaminated bituminous pavement may be discovered. The Contractor must immediately notify the Commissioner of the existence and location of this condition. The Commissioner, with the aid of the Contractor, must determine and delineate the limits of delaminated pavement to be removed by the Contractor. The Contractor must mill a uniform depth sufficient to remove the delamination.

C. Removal of loose or fragmented underlying pavement lifts up to 3 inches in thickness encountered during the milling operations must be removed to the satisfaction of the Commissioner and will be incidental to the pavement scarification pay item(s).

D. All milling must be performed up to a clean edge, either an existing concrete joint, or a new sawcut edge.

2.02 EQUIPMENT

A. The machine used for surface removal must be a self-propelled milling machine capable of planning and cutting the existing surface and depositing the cuttings into a windrow or loading directly into trucks. The machine must 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 milled surface within a tolerance of 3/16 inch in 10 feet when checked with a 10-foot straight-edge. It will have an effective means of removing the excess material from the surface without permitting dust from the operation escaping into the air. The scarified area must immediately be swept as directed and acceptable to the Commissioner.

2.03 SAWCUTTING

A. Sawcutting must be to the depth of milling and as directed by the Commissioner. This will be included in the cost of pavement scarification. All sawcutting for milling operations is incidental to milling.

B. Sawcut edges must be located as shown on the plans or directed by the Commissioner. Existing pavement must be removed up to the clean edge to the depth of the milling.

PART 3 - DISPOSAL OF MATERIAL

3.01 GENERAL

A. Materials resulting from removal of pavement and scarification must be disposed of properly at locations shown in the plans or as directed by the Commissioner. These materials must not be used in the foundation of any embankments, etc. It must be Contractor's responsibility to provide a suitable site for disposal of the milled pavement material.

B. No payment will be made for multiple handling or movements of the milled material.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENTS

A. Scarifying and milling will be measured for payment in square yards.

B. No additional compensation will be made for multiple handling of stockpiled or removed material.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENTS

A. Scarification and milling will be paid for at the Contract unit price per square yard for pavement scarification or milling as shown on the Plans. This price will be full compensation for furnishing all labor, equipment, tools, sawcutting, and all work necessary to complete the item including hauling, stockpiling and disposal of waste product in accordance with this Specification and the plans.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
P-617-01	SCARIFY OR MILL BITUMINOUS PAVEMENT - 3"	SY
P-617-02	SCARIFY OR MILL BITUMINOUS PAVEMENT - 5"	SY

END OF SECTION P-617

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PAVEMENT MARKING
SECTION P-620

PART 1 - DESCRIPTION

1.01 GENERAL

A. This work consists of the painting of numbers, markings, and stripes on the surface of runways, taxiways, aprons, and airside service roads in accordance with these Specifications, the latest edition of FAA Advisory Circular 150/5340, and at the locations shown on the Plans, or as directed by the Commissioner. The work under this Section is subject to the requirements of the Contract Documents.

PART 2 - MATERIALS

2.01 MATERIALS ACCEPTANCE

A. The Contractor must furnish manufacturer's certified test reports for the materials shipped to the Project. The certified test reports must include a statement that the materials meet the Specification requirements.

The reports can be used for material acceptance or the Commissioner may perform verification testing. The reports will not be interpreted as a basis for payment. The Contractor must notify the Commissioner upon arrival of a shipment of materials to the site.

2.02 PAINT

A. Paint must be Waterborne or Solvent base in accordance with the requirements of paragraph 2.02.A.1 or 2.02.A.2. Paint shall be furnished in accordance with Federal Standard No. 595 *Colors used in Government Procurement.* Paint must be furnished in White – 37925, Yellow – 33538 or 33655, Red – 31136, and Black – 37038 in accordance with Federal Standard No. 595. Paint must be furnished in Type I – Standard drying time for no-pick-up or Type II – Fast drying time for no-pick-up when tested in accordance with ASTM D 711. Any pavement to be utilized immediately must be marked with waterborne paint meeting the requirements of Federal Specification TT-P-1952E. Waterborne or solvent base black paint must be used to outline a border at least 6 inches (150 mm) wide around markings on the pavements.

1. WATERBORNE. Paint must meet the requirements of Federal Specification TT-P-1952E Type I or Type II.

2. SOLVENT BASE. Paint must meet the requirements of Federal Specification A-A-2886B Type I or Type II.

B. Performed Thermoplastic Airport Pavement Markings – Markings must be composed of ester modified resins in conjunction with aggregates, pigments, and binders that have been factory produced as a finished product. The material must be impervious to degradation by aviation fuels, motor fuels, and lubricants.

1. The markings must be able to be applied in temperatures down to 35°F without any special storage, preheating, or treatment of the material before application.

a. The markings must be supplied with an integral, non-reflectorized black border.

2. Graded Glass Beads

a. The material must contain a minimum of thirty percent (30%) intermixed graded glass beads by weight. The intermixed beads shall conform to [Federal Specification TT-B-1325D, Type I, Gradation A] [Federal Specification TT-B-1325D, Type IV].

b. The material must have factory applied coated surface beads in addition to the intermixed beads at a rate of 1 lb (± 10%) per 10 sq. ft. These factory applied coated surface beads shall have a minimum of 90% true spheres, minimum refractive index of 1.50 and meet the following gradation:

Size Gradation			
US Mesh	um	Retained %	Passing %
12	1700	0 – 2	98 – 100
14	1400	0 – 3.5	96.5 – 100
16	1180	2 – 25	75 – 98
18	1000	28 – 63	37 – 72
20	850	63 – 72	28 – 37
30	600	67 – 77	23 – 33
50	300	89 – 95	5 – 11
80	200	97 – 100	0 – 3

3. Heating Indicators. The top surface of the material (same side as the factory applied surface beads) shall have regularly spaced indents. These indents shall act as a visual cue during application that the material has reached a molten state so satisfactory adhesion and proper bead embedment has been achieved and a post-application visual cue that the installation procedures have been followed.

4. Pigments. Percent by weight.

   a. White:
   Titanium Dioxide, ASTM D 476, Type II shall be 10 percent minimum.

   b. Yellow and Colors:
   Titanium Dioxide, ASTM D 476, Type II shall be 1 percent minimum.
   Organic yellow, other colors, and tinting as required to meet color standard.

5. Prohibited Materials. The manufacturer shall certify that the product does not contain mercury, lead, hexavalent chromium, halogenated solvents, nor any carcinogen as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.

6. Daylight Directional Reflectance:

   a. White:
   The daylight directional reflectance of the white paint shall not be less than 75 percent (relative to magnesium oxide), when tested in accordance with Federal Test Method Standard No. 141D/GEN, Method 6121.

   b. Yellow:
   The daylight directional reflectance of the yellow paint shall not be less than 45 percent (relative to magnesium oxide), when tested in accordance with Federal Test Method Standard No. 141D/GEN. The x and y values shall be consistent with the tolerance listed below:

x .462	x .470	x .479	x .501
y .438	y .455	y .428	y .452

7. Skid Resistance. The surface, with properly applied and embedded surface beads, must provide a minimum resistance value of 45 BPN when tested according to ASTM E303.

8. Thickness. The material must be supplied at a nominal thickness of 65 mils (1.7 mm).

9. Environmental Resistance. The material must be resistant to deterioration due to exposure to sunlight, water, salt, or adverse weather conditions and impervious to aviation fuels, gasoline, and oil.

10. Retro Reflectivity. The material, when applied in accordance with manufacturer's guidelines, must demonstrate a uniform level of nighttime retro reflection when tested in accordance ASTM E1710.

11. Packaging. A protective film around the box must be applied in order to protect the material from rain or premature aging.

12. Manufacturing Control and ISO Certification. The manufacturer must be ISO 9001:2000 certified and provide proof of current certification. The scope of the certification shall include manufacture of reflective markings.

    a. The markings must be a resilient thermoplastic product with uniformly distributed glass beads throughout the entire cross-sectional area. The markings must be resistant to the detrimental effects of aviation fuels, motor fuels and lubricants, hydraulic fluids, de-icers, anti-icers, protective coatings, etc. Lines, legends, and symbols must be capable of being affixed to bituminous and/or Portland cement concrete pavements by the use of a large radiant heater. Colors shall be available as required.

    b. The markings must be capable of conforming to pavement contours, breaks, and faults through the action of airport traffic at normal pavement temperatures. The markings must be capable of fully conforming to grooved pavements, including pavement grooving per FAA AC 150/5320-12C. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastics when heated with a heat source per manufacturer's recommendation.

    c. Multicolored markings must consist of interconnected individual pieces of performed thermoplastic pavement

marking material, which through a variety of colors and patterns, make up the desired design. The individual pieces in each large marking segment (typically more than 20 ft. long) must be factory assembled with a compatible material and interconnected so that in the field it is not necessary to assemble the individual pieces within a marking segment. Obtaining multicolored effect by overlaying materials of different colors is not acceptable due to resulting inconsistent marking thickness and inconsistent application temperature in the marking/substrate interface.

d. The marking material must set up rapidly, permitting the access route to be re-opened to traffic a maximum of 15 minutes after application.

e. The marking material shall have an integral color throughout the thickness of the marking material.

2.03 REFLECTIVE MEDIA

A. Glass spheres to be applied on water borne and solvent based paints must meet the requirements of Federal Specification TT-P-1325D, Type III. Glass beads must be treated with all compatible coupling agents and adhesion promoting and/or flotation coatings as specified by the manufacturers of the paint and reflective media.

Paint Color	Glass Beads, Type I, Gradation A	Glass Beads, Type III	Glass Beads, Type IV
White	See Table 1.	See Table 1.	See Table 1.
Yellow	See Table 1.	See Table 1.	See Table 1.
Red	See Table 1 and Note.	Not Used.	See Table 1 and Note.
Pink	See Table 1 and Note.	Not Used.	See Table 1 and Note.
Black	Not Used.	Not Used.	See Table 1 and Note.

PART 3 - CONSTRUCTION METHODS

3.01 WEATHER LIMITATIONS

A. The painting must be performed only when the surface is dry, when the atmospheric temperature is above 45 degrees F (7 degrees C) and rising and the pavement surface temperature is at least 5 degrees F above the dew point and when the weather is not foggy or windy. The

Commissioner may specify a lower temperature in the field based on the conditions and the paint manufacturer's recommendations.

Painting operations must be discontinued when the surface temperature exceeds 120 degrees F or the maximum surface temperature recommended by the paint manufacturer.

3.02 EQUIPMENT

A. Equipment Commissioner will include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead and/or silica sand dispensing machine and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

B. The mechanical marker must be an atomizing spray-type marking machine suitable for application of traffic paint. It must produce an even and uniform film thickness at the required coverage and must apply markings of uniform cross sections and clear-cut edges without running or spattering and without overspray.

C. The heater used to apply performed thermoplastic pavement markings must be in accordance with Paragraph 3.08.

3.03 PREPARATION OF SURFACE

A. Immediately before application of the paint, the surface must 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 must be cleaned by sweeping and blowing or by other methods as required to remove all dirt, laitance, and loose materials without damage to the pavement surface.

B. Paint must not be applied to Portland cement concrete pavement until the areas to be painted are clean of curing material. Shotblasting will be used to remove curing materials.

3.04 PAVEMENT MARKING REMOVAL

A. The Contractor must remove pavement marking in areas designated by the Commissioner. The Contractor must only use shotblasting or hydroblasting to remove markings. Removal by grinding will not be permitted.

3.05 LAYOUT OF MARKINGS

A. The proposed markings must be laid out in advance of the paint application. All permanent markings must receive glass beads.

B. Locations to receive glass beads include all holding position markings used on runways, taxiways, and holding bays and used to indicate instrument landings system/microwave landing system (ILS/MLS) or precision obstacle-free zone (POFZ) critical areas; runway threshold marking; runway threshold bar; runway aiming point marking; runway designation marking; runway touchdown zone markings; runway centerline marking;, all taxiway centerline markings and enhanced taxiway centerline markings; geographical position marking;, surface painted signs for holding position signs, taxiways direction signs, taxiway location signs, gate destination signs, and apron entrance point signs;, runway side stripes, taxiway edge markings, and non- movement area boundary markings; runway displaced threshold markings; and runway demarcation bar.

3.06 TEST SECTION

A. Prior to the application of the paint materials, the Contractor must provide a 300 linear foot test strip at a location directed by the Commissioner to include both centerline and edge striping (including edge strips around a radius fillet) for acceptance by the Commissioner. The cost of this section must be included in the work.

3.07 APPLICATION – WATERBORNE OR SOLVENT BASE PAINT

A. Markings must be applied at the locations and to the dimensions and spacing shown on the Plans or as outlined in FAA Advisory Circular 150/5340- 1L (latest edition). Paint must not be applied until the layout and condition of the surface have been accepted by the Commissioner.

Prior to the initial application of markings, the Contractor must certify in writing that the surface has been prepared in accordance with the paint manufacturer's requirements, that the application equipment is appropriate for marking paint and that environmental conditions are appropriate for the material being applied. Their certification along with a copy of the paint manufacturer's application and surface preparation requirements must be submitted to the Commissioner prior to the initial application of markings.

B. The edges of the markings must not vary from a straight line more than ½ inch in 50 feet and marking dimensions and spacings must be within the following tolerances:

Dimensions and Spacing	Tolerance
36 inches or less	+/- ½ inch
Greater than 36 inches to 6 feet	+/- 1 inch
Greater than 6 feet to 60 feet	+/- 2 inches
Greater than 60 feet	+/- 3 inches

C. The paint must be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine at the rate(s) shown in Table 1. The addition of thinner will not be permitted. A period of 24 hours must elapse between placement of a bituminous surface course (4 days for a bituminous seal coat) and application of waterborne paint.

D. Temporary marking must be applied at 50 percent of the specified coverage rate. Glass beads will not be applied to temporary marking. However, the final marking application must be at full strength in order to adequately set the glass bead.

TABLE 1
Application Rates for Paint and Glass Beads

Paint Type	Paint, Square Feet per Gallon, ft^2/gal	Glass Beads, Type I, Gradation A Pounds per Gallon of Paint lb./gal.	Glass Beads, Type III, Pounds per Gallon of Paint lb./gal.	Glass Beads, Type IV, Pounds per Gallon of Paint lb./gal.
Waterborne	115 ft^2/gal. maximum	7 lb. /gal. minimum	10 lb. /gal. minimum	--
Solvent Base	115 ft^2/gal. maximum	7 lb. /gal. minimum	10 lb. /gal. minimum	--
Waterborne	90 ft^2/gal. maximum	--	--	8 lb. /gal. minimum
Solvent Base	90 ft^2/gal. maximum	--	--	8 lb. /gal. minimum

Note: The glass bead application rate for Red and Pink shall be reduced by 2 lb. / gal. for Type I and Type IV beads. Type III beads shall not be applied to Red or Pink paint.

E. Glass beads must be distributed upon the markings immediately after application of the paint. A dispenser must be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Glass beads must be applied at the rate(s) shown in Table 1. Glass beads will not be applied to black paint. Glass beads must adhere to the cured paint or all marking operations must cease until all corrections are made.

F. All emptied containers must be returned to the paint storage area for checking by the Commissioner. The containers will not be removed from the Airport or destroyed until authorized by the Commissioner.

3.08 APPLICATION – PREFORMED THERMOPLASTIC AIRPORT PAVEMENT MARKINGS

A. Asphalt and Portland cement. To ensure minimum single-pass application time and optimum bond in the marking/substrate interface, the materials must be applied using a variable speed self-propelled mobile heater with an effective heating width of no less than 16 feet (4.88 m) and a free span between supporting wheels of no less than 18 feet (5.49 m). The heater must emit thermal radiation to the marking material in such a manner that the difference in temperature of 2 inch (5.08 cm) wide linear segments in the direction of heater travel must be within 5 percent (%) of the overall average temperature of the heated thermoplastic material as it exits the heater. The material must be able to be applied at ambient and pavement temperatures down to 35°F (2°C) without any preheating of the pavement to a specific temperature. The material must be able to be applied without the use of a thermometer. The pavement shall be clean, dry and free of debris. Curing compound, laitance and other materials which will prevent adhesion must be removed from the Portland cement concrete pavement prior to the application of the pre-formed markings. A non- VOC sealer with a maximum applied viscosity of 250 centi-Poise (ASTM D 2393) must be applied to the pavement shortly before the markings are applied. The supplier must enclose application instructions with each box/package.

3.09 PROTECTION AND CLEANUP

A. After application of the paint, all markings must be protected from damage until the paint is dry. All surfaces must be protected from excess moisture and/or rain and from disfiguration by splatter, splashes, spillage, or drippings of paint.

B. The Contractor must remove from the work area all debris, waste, loose or un-adhered reflective media and by-products generated by the surface preparation and application operations to the satisfaction of the Commissioner. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local and Federal environmental statutes and regulations.

3.10 CONTRACTOR'S QUALIFICATIONS

A. The Contractor must show proof that he is familiar with Airport painting and that he has done such work in the past.

3.11 INTERIM MARKING

A. At the end of each shift's paving, the Contractor will be required to reestablish the markings on the newly overlaid pavement.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENTS

A. The quantity of runway and taxiway markings or temporary markings to be paid for will be the number of square feet of painting, excluding black outline painting, performed in accordance with the Specifications and accepted by the Commissioner. Black outline painting and glass beads will not be measured separately for payment but will be included in the Contract unit price for marking.

B. The quantity of runway and taxiway marking removal to be paid for will be the number of square feet of painting removed outside of the disturbed pavement areas and in accordance with the Specifications and accepted by the Commissioner. The total number of square feet measured includes the black outline border paint.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENTS

A. Payment will be made at the respective Contract price per square feet for runway and taxiway marking to include reflective media. This price will be full compensation for furnishing all materials and for all labor, equipment, tools, and all work necessary to complete the item.

B. Payment will be made at the respective Contract price per square feet for runway and taxiway marking removal. This price will be full compensation for furnishing all materials and for all labor, equipment, tools, and all work necessary to complete the item.

C. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
P-620-01	PAVEMENT MARKING REMOVAL	SF
P-620-02	PAVEMENT MARKING - TEMPORARY	SF
P-620-03	PAVEMENT MARKING - PERMANENT	SF

END OF SECTION P-620

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SAWCUT AND SEAL - 2 INCH
SECTION P-623

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item must consist of sawcutting bituminous concrete and Portland cement concrete pavement to a minimum depth of two inches including all initial or first sawcuts for joints and joint edge bevels as shown on the Drawings, and sealing the sawcut with resilient and adhesive joint sealing filler capable of effectively sealing joints in both types of pavements. The work under this Section is subject to the requirements of the Contract Documents.

PART 2 - MATERIALS

2.01 JOINT SEALING MATERIAL

A. The joint sealing material must conform to the requirements as specified in Section P-605.

PART 3 - CONSTRUCTION METHODS

3.01 EQUIPMENT

A. Equipment and tools necessary for handling materials and performing all parts of the work will be accepted by the Commissioner as to design, capacity, and mechanical condition. The equipment must be at the job site sufficiently before the start of construction operations for examination and acceptance.

B. The Contractor must 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 must provide at least one standby saw in good working order. An ample supply of saw blades must be maintained at the site of the work at all times during sawing operations. The Contractor must provide adequate artificial lighting facilities for night sawing. All of this equipment must be on the job both before and at all times during sawcutting operations.

C. The joint sealing equipment must be as described in Section P-605.

D. Joints must be prepared as described in Section P-605.

3.02 FIELD TEST

A. Before sealing the joints, the Contractor must 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 must 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 will be rejected.

3.03 INSTALLATION OF SEALANT

A. Joints must be inspected for proper width, depth, alignment, and preparation, and will be acceptable to the Commissioner before sealing is allowed. Sealants must be installed in accordance with Section P-605.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. The amount of 2 inch sawcut and seal to be paid for will be the number of lineal feet approved to be measured. Initial or first cuts and edge bevels will not be measured separately but will be considered included in the sawcut and seal measurements.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. Payment will be made at the Contract unit price per linear foot for Sawcut and Seal - 2". The price will be full compensation for furnishing all materials, placing all materials and for all labor, equipment, tools, and all work necessary to complete the work.

B. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
P-623-01	SAWCUT AND SEAL - 2"	LF

END OF SECTION P-623

GEOTEXTILE FABRIC
SECTION P-629

PART 1 - DESCRIPTION

1.01 GENERAL

A. This work must consist of furnishing and placing geotextile fabrics for use as shown on the typical sections of the Plans. The work under this Section is subject to the requirements of the Contract Documents.

PART 2 - MATERIALS

2.01 GEOTEXTILES

A. Fibers, used in the manufacture of geotextiles, and thread, used in joining geotextiles by sewing, must consist of long chain synthetic polymers, composed of at least 95%, by weight, polypropylene or polyester. The material must be free of defects and tears and must meet or exceed the material requirements as listed below.

B. The geotextile must meet or exceed the minimum property values in Table 1.

TABLE 1
Physical Property Requirements

Test	Woven[1]	Nonwoven[1]
Grab Tensile Strength (ASTM D-4632)	270 lbs	180 lbs
Puncture Resistance (ASTM D-4833)	100 lbs	75 lbs
Trapezoid Tear Strength (ASTM D-4533)	100 lbs	75
lbs Apparent Opening Size (ASTM D-4751)	< 0.3 mm	
Permittivity (ASTM D-4991)	>1.5 sec^{-1}	
Flow Rate (ASTM D-4991)	> 70 gpm/ft^2	
Ultraviolet Degradation (ASTM D-4355)	> 70% strength 500 hrs exposure	

1Values shown are minimum average roll values with strength values based on the weaker principle direction. Specification conformance of the geotextile must be based on the ASTM D-4759 procedure.

C. In addition to the above requirements, the following limitations will also apply:

1. If the fabric must be in contact with asphalt, it must be capable of withstanding temperatures of 338 degrees F without any negative effect on material's properties.

D. Geotextile Fabric for Temporary Erosion Control

1. Geotextile fabric materials for silt fence and temporary erosion control devices are specified separately under Section P-156 Temporary Air and Water Pollution, Soil Erosion, and Sediment Control.

PART 3 - SUBMITTALS

3.01 CERTIFICATE OF COMPLIANCE

A. Before starting the work, the Contractor must submit:

1. A Certification of Compliance from the geotextile manufacturer that the product(s) delivered to the Project will have property values equal to or greater than those specified, and

2. Factory test results of materials certified by the manufacturer as being similar, showing conformance with the requirements of these Specifications. Certified property values must be equal to the average value less two standard deviations. A swatch of the geotextile to be used must be submitted with the certification letter.

B. For quantities over 10,000 square yards, the Contractor must furnish to the Commissioner, at least 10 working days prior to use in the work, a sample of five square yards of the geotextile from the shipment of materials to be used on the Project of verification testing. The lot number of the roll and the location of the sample obtained must be documented.

C. After Contract award, upon request, the geotextile manufacturer must make available quality control test results for the materials delivered to the Project. Quality control sampling must be done in accordance with ASTM D-4354, and the samples must be tested according to ASTM standards to grab tensile strength, trapezoidal tear strength, and puncture resistance. At least one AOS and one permeability test must be performed per lot number.

PART 4 - PACKAGING, STORAGE, AND HANDLING OF MATERIALS

4.01 PACKAGING

A. Geotextile materials delivered to the site must be furnished with an outer plastic wrapping, suitable for protection against moisture and extended ultraviolet exposure prior to placement. An opaque tarp must be placed over all rolls where the outer wrap is removed or damaged, such that the geotextile is exposed.

B. Each role of geotextile must be externally labeled or tagged to provide product identification sufficient for field identification, as well as inventory and quality control purposes. As a minimum, external tagging must include:

1. Name of Manufacturer

2. Product Type and Style

3. Product Grade

4. Lot Number

5. Physical Dimensions (Length and width)

C. The product grade, manufacturer's name, and lot number must be clearly marked directly on the geotextile at the beginning and end of each roll of product.

D. Rolls must be stored in a manner which protects them from the elements. If stored outdoors, they must be elevated and protected with a waterproof cover.

PART 5 - INSTALLATION

5.01 GENERAL

A. The installation site must be prepared by clearing and grading the areas, as indicated on the Plans. Remove all sharp objects, large stones, stumps, etc.

B. The geotextile must be unrolled as smoothly as possible with no wrinkles or folds (except in curved sections and corners) on the prepared subgrade in the direction of construction traffic. Adjacent rolls must be overlapped of 12 inches or greater, as shown on the Plans. Adjacent rolls may be connected by sewn or sealed seams, provided the seam meets or exceeds the grab strength requirement in Table 1.

C. For curves, the geotextile must be folded or cut and overlapped in the direction of the turn. Overlaps must be 12 inches or greater. Folds in geotextile must be stapled or pinned five feet on center.

D. The frost protection material must be placed onto the geotextile from the edge of the fabric or over previously placed aggregate. The first lift of aggregate must be spread and graded down to a minimum depth of 12 inches or to the design thickness, if less than 12 inches. A minimum lift of six inches compacted thickness must be maintained in all cases. Compaction of the first lift must be performed by "tracking" with a dozer, followed by compaction with a smooth-drum roller to the specified density. Construction vehicles that create ruts in the apron surface of greater than three inches will not be allowed. All ruts occurring during construction must be filled with additional aggregate and compacted to the specified density. Sudden stops and starts must be avoided where possible.

E. Holes, tears, or otherwise damaged geotextiles, as determined by the Commissioner, must be repaired immediately at the Contractor's expense. The damaged area must be cleared of all fill material, a suitable distance from the damaged area, to allow placement of a geotextile patch which extends 3 feet beyond perimeter of the damaged area. Aggregate removed must be replaced to the specified lift thickness and density.

PART 6 - METHOD OF MEASUREMENT

6.01 MEASUREMENTS

A. The geotextile fabric will not be measured for payment, but will be considered included in paving items where it is required as shown on the Plans.

PART 7 - BASIS OF PAYMENT

7.01 PAYMENTS

A. No separate payment for geotextile fabrics will be made.

END OF SECTION P-629

QUALITY CONTROL PROGRAM
SECTION Q-100

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor must establish, provide, and maintain an effective Quality Control Program that details the methods and procedures that will be taken to assure that all materials and completed construction for all work items included under this project, as described in the Contract Documents, conform to the contract requirements, whether manufactured by the Contractor or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified herein and elsewhere in the contract technical specifications, the Contractor must assume full responsibility for accomplishing the stated purpose. This purpose will be included in a mission statement for the program.

B. The intent of this section is to enable the Contractor to establish a necessary level of control prior to performing work that will:

1. Adequately provide for the production of acceptable quality materials.

2. Provide sufficient information to assure both the Contractor and the Commissioner that the specification requirements must be met.

3. Allow the Contractor as much latitude as possible to develop its own standard of quality control.

C. The Contractor is to discuss and present, in an oral presentation at the preconstruction conference, its understanding of the quality control requirements. The Quality Control Program will be submitted to the Commissioner at the preconstruction conference. The Contractor must not begin any construction or production of materials to be incorporated into the completed work until the Quality Control Program has been reviewed and accepted by the Commissioner. No partial payment will be made for materials subject to specific quality control requirements until the Quality Control Program has been accepted by the Commissioner.

D. The requirements for the Contractor's Quality Control Program contained in this section are in addition to and separate from the acceptance testing

requirements stated in the technical specifications. Acceptance testing requirements will be as specified in the individual technical specifications.

E. Paving projects over $250,000 will have a Quality Control (QC)/Quality Assurance (QA) workshop with the Designer, Contractor, subcontractors, testing laboratories, and Commissioner's representative and the FAA prior to or at start of construction. The workshop must address QC and QA requirements of the project specifications. The Contractor will coordinate with the Commissioner and the Designer on time and location of the QC/QA workshop.

1.02 DESCRIPTION OF PROGRAM

A. General Description. This Quality Control Program will ensure conformance to applicable specifications and plans with respect to materials, workmanship, construction, finish, and functional performance. The Quality Control Program will be effective for control of all construction work performed under this Contract and will specifically include full-time surveillance and tests required by the technical specifications, in addition to other requirements of this section and any other activities deemed necessary by the Contractor to establish an effective level of quality control.

B. Quality Control Program. The Contractor must describe the Quality Control Program in a written document which will be reviewed by the Commissioner prior to the start of any production, construction, or off-site fabrication. The written Quality Control Program will be submitted to the Commissioner for review at the preconstruction conference.

C. The Quality Control Program will be organized to address, as a minimum, the following items:

1. Quality control organization;

2. Project progress schedule;

3. Submittals schedule;

4. Inspection requirements;

5. Quality control testing plan;

6. Documentation of quality control activities; and

7. Requirements for corrective action when quality control and/or acceptance criteria are not met.

D. The Contractor is encouraged to add any additional elements to the Quality Control Program that it deems necessary to adequately control all production and/or construction processes required by this contract.

1.03 QUALITY CONTROL ORGANIZATION

A. The Contractor's Quality Control Program must be implemented by the establishment of a separate quality control organization. An organizational chart must be developed to show all quality control personnel and how these personnel integrate with other management/ production and construction functions and personnel. In addition, a letter from the President of the company certifying the authority given to the Program Administrator and the QC organization, in accordance with the requirements of the Contract Documents, must be included as part of the plan.

B. The organizational chart must identify all quality control staff by name and function, and must indicate the total staff required to implement all elements of the Quality Control Program, including full-time inspection, testing and full time surveillance for each item of work. Different technicians must be utilized for specific inspection and testing functions for different items of work. If an outside organization or independent testing laboratory is used for implementation of all or part of the Quality Control Program, the personnel assigned must be subject to the qualification requirements of Paragraphs 1.03.D.1 and 1.03.D.2. The organizational chart must indicate which personnel are Contractor employees and which are provided by an outside organization. The Program Administrator will be required to conduct a documented training session, detailing the aspects of the Quality Control Program. All project foremen, superintendents, project managers and QC technicians, whether employed by the Contractor, subcontractor or outside testing organization must attend. The Commissioner will have the opportunity to have his designees attend this training. In addition, the Program Administrator will conduct a pre-activity meeting at least 2 workdays in advance of any activity of work. This meeting must be attended by the Superintendent and Foreman responsible for the work, with notification to the CM Quality Assurance Manager and Resident Engineer. QC and QA Technicians are encouraged to attend.

C. Payment will not be made for any materials installed without Quality Control inspection by the Contractor. In addition, the Commissioner may withhold, or deny payment for an inspected item, if in the Commissioner’s opinion; the Contractor’s Quality Control Program is not functioning as required by the project specifications.

D. The quality control organization will consist of the following minimum personnel:

1. Program Administrator. The Program Administrator will be a full-time employee of the Contractor, or a consultant engaged by the Contractor. The Program Administrator will be acceptable to the Commissioner and will have had prior quality control experience on a project of comparable size and scope as this contract.

a. Additional qualifications for the Program Administrator will include at least one (1) of the following requirements:

(1) Professional engineer with 1 year of airport paving experience acceptable to the Commissioner.

(2) Engineer-in-training with 2 years of airport paving experience acceptable to the Commissioner.

(3) An individual with 3 years of highway and/or airport paving experience acceptable to the Commissioner, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.

(4) Construction materials technician certified at Level III by the National Institute for Certification in Engineering Technologies (NICET).

(5) Highway materials technician certified at Level III by NICET.

(6) Highway construction technician certified at Level III by NICET.

(7) A NICET certified engineering technician in Civil Engineering Technology with 5 years of highway and/or airport paving experience acceptable to the Commissioner.

(8) Certification of technicians at an equivalent level, by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

b. The Program Administrator will have full authority to institute any and all actions necessary for the successful implementation of the Quality Control Program to ensure compliance with the contract plans and technical

specifications. The Program Administrator will report directly to a responsible officer of the construction firm and will be independent from the field operation.

2. Quality Control Technicians. A sufficient number of quality control technicians necessary to adequately implement the Quality Control Program will be provided. These personnel will be engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II or higher construction materials technician or highway construction technician and will have a minimum of 2 years of experience in their area of expertise, and have the necessary certifications appropriate for the testing and inspection performed.

   a. The quality control technicians will report directly to the Program Administrator and will perform the following functions:

      (1) Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by Paragraph 1.06.

      (2) Performance of all quality control tests as required by the technical specifications and Paragraph 1.07.

      (3) Performance of density tests for the Commissioner where required by the technical specifications.

   b. Certification of technicians at an equivalent level, by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

3. Staffing Levels. The Contractor must provide qualified quality control staff to monitor each work activity on a full time basis. The Commissioner will make the final determination as to the adequacy of quality control staffing levels and personnel. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians will be provided at each plant and field placement location. The scheduling and coordinating of all inspection and testing must match the type and pace of work activity. The Quality Control Program will state where different technicians will be required for different work elements.

1.04 PROJECT PROGRESS SCHEDULE

A. The Contractor must submit a coordinated construction schedule for all work activities. The schedule must be prepared as a network diagram in Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), or other format, or as otherwise specified in Part Two of the Specifications, Article VIII, Paragraph D.

B. The Contractor must maintain a work schedule and provide an update and analysis of the progress schedule on a twice monthly basis, or as otherwise specified in the contract. Submission of the work schedule will not relieve the Contractor of overall responsibility for scheduling, sequencing, and coordinating all work to comply with the requirements of the contract.

1.05 SUBMITTALS SCHEDULE

A. The Contractor must submit a detailed listing of all submittals (e.g., mix designs, material certifications) and Shop Drawings prior to the start of work required by the technical specifications. The listing can be developed in a spreadsheet format and must include:

1. Specification item number;

2. Item description;

3. Description of submittal;

4. Specification paragraph requiring submittal;

5. Scheduled date of submittal;

6. Submittal approval level; and

7. Contractor/subcontractor responsible.

B. This spreadsheet must be produced and maintained by the Contractor’s Project Manager on a bi-weekly basis and will be reviewed by the Program Administrator prior to submission to the Commissioner.

1.06 INSPECTION REQUIREMENTS

A. Quality control inspection functions included in the Contractor's Quality Control Program will be organized to provide full-time inspections by the Contractor's personnel or by an outside organization provided by the Contractor, as detailed below. All such inspections must be documented by the Contractor as specified in Paragraph 1.08.

B. Inspections will be performed daily to ensure continuing compliance with contract requirements until completion of the particular feature of work. These will include the following minimum requirements:

1. During plant operation for material production, quality control test results and full time inspections will be utilized to ensure the quality of aggregates and other mix components, and to adjust and control mix proportioning to meet the approved mix design and other requirements of the technical specifications. All equipment utilized in proportioning and mixing will be inspected to ensure its proper operating condition. The Quality Control Program will detail how these and other quality control functions will be accomplished and utilized.

2. During field operations, quality control test results and full time inspections will be utilized to ensure the quality of all materials and workmanship. All equipment utilized in placing, finishing, and compacting will be inspected and calibrated as necessary to ensure its proper operating condition and to ensure that all such operations are in conformance to the technical specifications and are within the plan dimensions, lines, grades, and tolerances specified. The Program will document how these and other quality control functions will be accomplished and utilized.

1.07 QUALITY CONTROL TESTING PLAN

A. As a part of the overall Quality Control Program, the Contractor must implement a quality control testing plan, as required by the technical specifications. The testing plan will include the minimum tests and test frequencies required by each technical specification Item, as well as any additional quality control tests that the Contractor deems necessary to adequately control production and/or construction processes.

B. The testing plan can be developed in a spreadsheet fashion and will, as a minimum, include the following:

1. Specification item number (e.g., P-401);

2. Item description (e.g., Plant Mix Bituminous Pavements);

3. Test type (e.g., gradation, grade, asphalt content);

4. Test standard (e.g., ASTM or AASHTO test number, as applicable);

5. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated; where no minimum test frequency is specified for aggregate gradations, one gradation test must be run per 5000 tons per aggregate type delivered or a minimum of one test per week, and one modified proctor ASTM D 1557 test must be run at a minimum of double the frequency above, or when materials substantially change as determined by the Commissioner);

6. Responsibility (e.g., plant technician); and

7. Control requirements (e.g., target, permissible deviations).

C. The testing plan will contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D 3665. The Commissioner will be given access to witness all quality control sampling and testing.

D. All quality control test results must be documented by the Contractor as specified in Paragraph 1.08.

1.08 DOCUMENTATION

A. The Contractor must maintain current quality control records of all inspections and tests performed under the Quality Control Program. These records must include factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken.

B. These records must cover both conforming and defective or deficient features, and must include a statement that all supplies and materials incorporated in the work are in full compliance with the Contract Documents. Legible copies of these records must be furnished to the Commissioner daily, at a time established by the Commissioner at the pre-construction conference. The records must cover all work placed subsequent to the previously furnished records and must be verified and signed by the Contractor's Program Administrator and the inspector.

C. Specific Contractor quality control records required for the contract must include, but are not necessarily limited to, the following records:

1. Daily Inspection Reports. Each Contractor quality control technician must maintain a daily log of all inspections performed for both Contractor and subcontractor operations on a form

acceptable to the Commissioner. These technician's daily reports must provide factual evidence that continuous quality control inspections have been performed and will, as a minimum, include the following:

a. Technical specification item number and description;

b. Compliance with approved submittals;

c. Proper storage of materials and equipment;

d. Proper operation of all equipment;

e. Adherence to plans and technical specifications;

f. Review of quality control tests; and

g. Safety inspection.

D. The daily inspection reports must identify inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

E. The daily inspection reports will be signed by the responsible quality control technician and the Program Administrator. The Commissioner will be provided at least one legible original copy of each daily inspection reports, by 10:00 am on the work day following the day of record.

1. Daily Test Reports. The Contractor must be responsible for establishing a system which will record all quality control test results. Daily test reports must document the following information:

a. Technical specification item number and description;

b. Test designation;

c. Location;

d. Date and time of test;

e. Control requirements;

f. Test results;

g. Causes for rejection;

h. Recommended remedial actions; and

i. Retests.

2. Checklists. The Quality Control Program Administrator must develop Checklists for each specification section in the Contract Documents. The Checklist must summarize the major items contained in the technical specifications and include a check box signifying compliance designated “Yes”, “No” or “N/A”. Each Quality Control Technician must fill out a Checklist for each specification section worked on that day. The form must also include:

a. Date

b. Shift

c. Specification Section

d. QC Conformance – Yes/No

e. Non-Conformance Report (NCR) Number

f. Contractor

g. Pay Item Number and Description

h. Location

i. Comments

j. Signatures of Technicians and Program Administrator

F. Test results from each day's work period must be submitted to the Commissioner prior to the start of the next day's work period. When required by the technical specifications, the Contractor must maintain statistical quality control charts. The daily test reports will be signed by the responsible quality control technician and the Program Administrator.

1.09 CORRECTIVE ACTION REQUIREMENTS

A. The Quality Control Program will indicate the appropriate action to be taken when a process is deemed, or believed, to be out of control (out of tolerance) and detail what action will be taken to bring the process into control. The requirements for corrective action will include both general requirements for operation of the Quality Control Program as a whole, and for individual items of work contained in the technical specifications.

B. The Quality Control Program will detail how the results of quality control inspections and tests will be used for determining the need for corrective action and will contain clear sets of rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

C. When applicable or required by the technical specifications, the Contractor must establish and utilize statistical quality control charts for individual quality control tests. The requirements for corrective action will be linked to the control charts.

1.10 SURVEILLANCE BY THE COMMISSIONER

A. All items of material and equipment will be subject to surveillance by the Commissioner at the point of production, manufacture or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate quality control system in conformance with the requirements detailed herein and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place will be subject to surveillance by the Commissioner at the site for the same purpose.

B. Surveillance by the Commissioner does not relieve the Contractor of performing quality control inspections of either on-site or off-site Contractor's or subcontractor's work.

C. Any testing performed by the Commissioner and deemed by the Contractor to be improperly performed will be noted on the Daily Inspection Report. In addition, a written document by the Program Administrator will be submitted indicating the deviation noted. Testing procedures will be considered accurate and correct unless this procedure is followed. The Contractor must not seek additional compensation for any testing irregularities not reported.

D. Any testing performed by the Contractor and deemed by the Contractor to be improperly performed or not meeting the requirements of the project specifications must be noted by the Contractor on their daily inspection reports.

E. No videotaping or recording of QA or QC personnel will be permitted unless written permission is given by both parties.

1.11 NONCOMPLIANCE

A. The Commissioner will notify the Contractor of any noncompliance with any of the foregoing requirements. The Contractor must, after receipt of such notice, immediately take corrective action. Any notice, when

delivered by the Commissioner or its authorized representative to the Contractor or its authorized representative at the site of the work, must be considered sufficient notice.

B. In cases where quality control activities do not comply with either the Contractor's Quality Control Program or the contract provisions, or where the Contractor fails to properly operate and maintain an effective Quality Control Program, as determined by the Commissioner, the Commissioner may:

1. Order the Contractor in writing to replace ineffective or unqualified quality control personnel or subcontractors within 24 hours after receipt of such order.

2. Order the Contractor to stop operations until appropriate corrective actions are taken.

3. Withhold progress payments in the event of Contractor failure to take corrective actions within the specified time.

PART 2 - PRODUCTS

2.01 NOT APPLICABLE

PART 3 - EXECUTION

3.01 NOT APPLICABLE

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Contractor quality control program will not be measured for payment and will be considered included in the total contract price.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENT

A. The preparation of a Quality Control Program and its implementation, including any corrective measures that may be required to be carried out by the Contractor to bring items of work into compliance with the requirements of the Quality Control Program and the technical

specifications will not be paid for separately but will be included in the total Contract price.

END OF SECTION Q-100

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METHOD OF ESTIMATING PERCENTAGE OF MATERIAL WITHIN SPECIFICATION LIMITS (PWL)
SECTION Q-110

PART 1 - DESCRIPTION

1.01 GENERAL

A. When the specifications provide for acceptance of material based on the method of estimating percentage of material within specification limits (PWL), the PWL will be determined in accordance with this section. All test results for a lot will be analyzed statistically to determine the total estimated percent of the lot that is within specification limits. The PWL is computed using the sample average (X) and sample standard deviation (Sn) of the specified number (n) of sublot for the lot and the specification tolerance limits, L for lower and U for upper, for the particular acceptance parameter. From these values, the respective Quality index(s) (QL for Lower Quality Index and/or QU for Upper Quality Index) is computed and the PWL for the lot for the specified n is determined from Table 1.

B. There is some degree of uncertainty (risk) in the measurement for acceptance because only a small fraction of production material (the population) is sampled and tested. This uncertainty exists because all portions of the production have the same probability to be randomly sampled. The Contractor's risk is the probability that material produced at the acceptable quality level is rejected or subjected to a pay adjustment. The Owner's risk is the probability that material produced at the rejectable quality level is accepted.

C. *IT IS THE INTENT OF THIS SECTION TO INFORM THE CONTRACTOR THAT, IN ORDER TO CONSISTENTLY OFFSET THE CONTRACTOR'S RISK FOR MATERIAL EVALUATED, PRODUCTION QUALITY (USING POPULATION AVERAGE AND POPULATION STANDARD DEVIATION) MUST BE MAINTAINED AT THE ACCEPTABLE QUALITY SPECIFIED OR HIGHER. IN ALL CASES, IT IS THE RESPONSIBILTY OF THE CONTRACTOR TO PRODUCE AT QUALITY LEVELS THAT WILL MEET THE SPECIFIED ACCEPTANCE CRITERIA WHEN SAMPLED AND TESTED AT THE FREQUENCIES SPECIFIED.*

1.02 METHOD FOR COMPUTING PWL

Note: Spreadsheets for PWL calculations are available at the following website: http://www.faa.gov/airports/engineering/design software/.

A. The computational sequence for computing the PWL is as follows:

1. Divide the lot into n sublots in accordance with the acceptance requirements of the specification.

2. Locate the random sampling position within the sublot in accordance with the requirements of the specification.

3. Make a measurement at each location, or take a test portion and make the measurement on the test portion in accordance with the testing requirements of the specification.

4. Find the sample average of all sublot values within the lot by using the following formula:

$$X = (x_1 + x_2 + x_3 + \ldots x_n) / n$$

Where:

X = Average of all sublot values within a lot

x_1, x_2 = Individual sublot values

n = Number of sublots

B. Find the sample standard deviation Sn by use of the following formula:

$$Sn = [(d_1^2 + d_2^2 + d_3^2 + \ldots d_n^n) / (n-1)]^{1/2}$$

Where:

S_n = standard deviation of the number of sublot values in the set

d_1, d_2 = deviations of the individual sublot values X_1, X_2 . . .from the average value X

that is: $d_1 = (x_1 - X)$, $d_2 = (x_2 - X)$ . . $d_n = (x_n - X)$

n = number of sublots

C. For single sided specification limits (i.e., L only), compute the Lower Quality Index Q_L by use of the following formula:

$$Q_L = (X - L) / S_n$$

Where:

L = specification lower tolerance limit

Estimate the percentage of material within limits (PWL) by entering Table 1 with Q_L, using the column appropriate to the total number (n) of

measurements. If the value of Q_L falls between values shown on the table, use the next higher value of PWL.

D. For double sided specification limits (i.e. L and U), compute the Quality Indexes Q_L and Q_U by use of the following formulas:

$$Q_L = (X - L) / S_n \text{ and } Q_U = (U - X) / S_n$$

Where:

L and U = specification lower and upper tolerance limits

Estimate the percentage of material between the lower (L) and upper (U) tolerance limits (PWL) by entering Table 1 separately with Q_L and Q_U, using the column appropriate to the total number (n) of measurements, and determining the percent of material above P_L and percent of material below P_U for each tolerance limit. If the values of Q_L fall between values shown on the table, use the next higher value of P_L or P_U. Determine the PWL by use of the following formula:

$$PWL = (P_U + P_L) - 100$$

Where:

P_L = percent within lower specification limit

P_U = percent within upper specification limit

1.03 EXAMPLE OF PWL CALCULATION

Project: Example Project

Test Item: Item P-401, Lot A.

A. PWL Determination for Mat Density.

1. Density of four random cores taken from Lot A.

A-1 96.60

A-2 97.55

A-3 99.30

A-4 98.35 n=4

2. Calculate average density for the lot.

$X = (x_1 + x_2 + x_3 + . . x_n) / n$

$X = (96.60 + 97.55 + 99.30 + 98.35) / 4$

$X = 97.95$ percent density

3. Calculate the standard deviation for the lot.

$S_n = [(96.60 - 97.95)^2 + (97.55 - 97.95)^2 + (99.30 - 97.95)^2 + (98.35 - 97.95)^2 / (4 - 1)]^{1/2}$

$Sn = [(1.82 + 0.16 + 1.82 + 0.16) / 3]^{1/2}$

$Sn = 1.15$

4. Calculate the Lower Quality Index Q_L for the lot. (L=96.3)

$Q_L = (X - L) / Sn$

$Q_L = (97.95 - 96.30) / 1.15$

$Q_L = 1.4348$

5. Determine PWL by entering Table 1 with Q_L= 1.43 and n= 4. PWL = 98

B. PWL Determination for Air Voids.

1. Air Voids of four random samples taken from Lot A.

A-1 5.00

A-2 3.74

A-3 2.30

A-4 3.25

2. Calculate the average air voids for the lot.

$X = (x_1 + x_2 + x_3 . . x_n) / n$

$X = (5.00 + 3.74 + 2.30 + 3.25) / 4$

$X = 3.57$ percent

3. Calculate the standard deviation S_n for the lot.

$Sn = [((3.57 - 5.00)^2 + (3.57 - 3.74)^2 + (3.57 - 2.30)^2 + (3.57 - 3.25)^2 / (4 - 1)]^{1/2}$

$Sn = [(2.04 + 0.03 + 1.62 + 0.10) / 3]^{1/2}$

$Sn = 1.12$

4. Calculate the Lower Quality Index Q_L for the lot. (L= 2.0)

$Q_L = (X - L) / Sn$

$Q_L = (3.57 - 2.00) / 1.12$

$Q_L = 1.4018$

5. Determine P_L by entering Table 1 with $Q_L = 1.40$ and n = 4.

$P_L = 97$

6. Calculate the Upper Quality Index Q_U for the lot. (U= 5.0)

$Q_U = (U - X) / S_n$

$Q_U = (5.00 - 3.57) / 1.12$

$Q_U = 1.2768$

7. Determine P_U by entering Table 1 with $Q_U = 1.28$ and n = 4.

$P_U = 93$

8. Calculate Air Voids PWL

PWL = (P_L + P_U) - 100

PWL = (97 + 93) - 100 = 90

1.04 EXAMPLE OF OUTLIER CALCULATION (Reference ASTM E178)

Project: Example Project

Test Item: Item P-401, Lot A

A. Outlier Determination for Mat Density

1. Density of four random cores taken from Lot A arranged in descending order

A-3 99.30

A-4 98.35

A-2 97.55

A-1 96.60

2. Use n = 4 and upper 5% significance level to find the critical value for test criterion = 1.463.

3. Use average density, standard deviation, and test criterion value to evaluate density measurements.

a. For measurement greater than the average:

(1) If (measurement - average) / (standard deviation) is less than test criterion, then the measurement is not considered an outlier.

(2) For A-3, check if (99.30 – 97.95) / 1.15 is greater than 1.463.

(3) Since 1.174 is less than 1.463, the value is not an outlier.

b. For measurements less than the average:

(1) If (average - measurement) / (standard deviation) is less than test criterion, then the measurement is not considered an outlier.

(2) For A-1, check if (97.95 – 96.60) / 1.15 is greater than 1.463.

(3) Since 1.435 is less than 1.463, the value is not an outlier.

Note: In this example, a measurement would be considered an outlier if the density were:

Greater than (97.95 + 1.463 x 1.15) = 99.63%, or

Less than (97.95 – 1.463 x 1.15) = 96.27%.

TABLE 1

Table for Estimating Percent of Lot Within Limits (PWL)

Percent Within Limits (P_L and P_U)	Positive Values of Q (Q_L and Q_U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520	1.9994	2.0362
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053	1.8379	1.8630
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993	1.7235	1.7420
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127	1.6313	1.6454
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381	1.5525	1.5635
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4716	1.4829	1.4914
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112	1.4199	1.4265
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554	1.3620	1.3670
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032	1.3081	1.3118
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541	1.2576	1.2602
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075	1.2098	1.2115
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630	1.1643	1.1653
87	1.0597	1.1100	1.1173	1.1191	1.1199	1.1204	1.1208	1.1212
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794	1.0791	1.0789
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399	1.0389	1.0382
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015	1.0000	0.9990
83	0.9939	0.9900	0.9785	0.9715	0.9672	0.9643	0.9624	0.9610
82	0.9749	0.9600	0.9452	0.9367	0.9325	0.9281	0.9258	0.9241
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928	0.8901	0.8882
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583	0.8554	0.8533
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245	0.8214	0.8192
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915	0.7882	0.7858
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590	0.7556	0.7531
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271	0.7236	0.7211
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958	0.6922	0.6896
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649	0.6613	0.6587
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344	0.6308	0.6282
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044	0.6008	0.5982
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747	0.5712	0.5686

TABLE 1

Table for Estimating Percent of Lot Within Limits (PWL)

Percent Within Limits (P_L and P_U)	Positive Values of Q (Q_L and Q_U)							
	n=3	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=9**	**n=10**
70	0.6787	0.6000	0.5719	0.5583	0.5504	0.5454	0.5419	0.5394
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164	0.5130	0.5105
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877	0.4844	0.4820
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592	0.4560	0.4537
66	0.5563	0.4800	0.4545	0.4424	0.4354	0.4310	0.4280	0.4257
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4031	0.4001	0.3980
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753	0.3725	0.3705
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477	0.3451	0.3432
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203	0.3179	0.3161
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931	0.2908	0.2892
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660	0.2639	0.2624
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391	0.2372	0.2358
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122	0.2105	0.2093
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855	0.1840	0.1829
56	0.2164	0.1800	0.1688	0.1636	0.1607	0.1588	0.1575	0.1566
55	0.1806	0.1500	0.1408	0.1363	0.1338	0.1322	0.1312	0.1304
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057	0.1049	0.1042
53	0.1087	0.0900	0.0843	0.0817	0.0802	0.0792	0.0786	0.0781
52	0.0725	0.0600	0.0562	0.0544	0.0534	0.0528	0.0524	0.0521
51	0.0363	0.0300	0.0281	0.0272	0.0267	0.0264	0.0262	0.0260
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 2

Table for Estimating Percent of Lot Within Limits (PWL)

Percent Within Limits (P_L and P_U)	Negative Values of Q (Q_L and Q_U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
49	-0.0363	-0.0300	-0.0281	-0.0272	-0.0267	-0.0264	-0.0262	-0.0260
48	-0.0725	-0.0600	-0.0562	-0.0544	-0.0534	-0.0528	-0.0524	-0.0521
47	-0.1087	-0.0900	-0.0843	-0.0817	-0.0802	-0.0793	-0.0786	-0.0781
46	-0.1447	-0.1200	-0.1125	-0.1090	-0.1070	-0.1057	-0.1049	-0.1042
45	-0.1806	-0.1500	-0.1408	-0.1363	-0.1338	-0.1322	-0.1312	-0.1304
44	-0.2164	-0.1800	-0.1688	-0.1636	-0.1607	-0.1588	-0.1575	-0.1566
43	-0.2519	-0.2100	-0.1971	-0.1911	-0.1877	-0.1855	-0.1840	-0.1829
42	-0.2872	-0.2400	-0.2254	-0.2186	-0.2147	-0.2122	-0.2105	-0.2093
41	-0.3222	-0.2700	-0.2537	-0.2461	-0.2418	-0.2391	-0.2372	-0.2358
40	-0.3568	-0.3000	-0.2822	-0.2738	-0.2691	-0.2660	-0.2639	-0.2624
39	-0.3911	-0.3300	-0.3107	-0.3016	-0.2964	-0.2931	-0.2908	-0.2892
38	-0.4251	-0.3600	-0.3392	-0.3295	-0.3239	-0.3203	-0.3179	-0.3161
37	-0.4586	-0.3900	-0.3679	-0.3575	-0.3515	-0.3477	-0.3451	-0.3432
36	-0.4916	-0.4200	-0.3967	-0.3856	-0.3793	-0.3753	-0.3725	-0.3705
35	-0.5242	-0.4500	-0.4255	-0.4139	-0.4073	-0.4031	-0.4001	-0.3980
34	-0.5563	-0.4800	-0.4545	-0.4424	-0.4354	-0.4310	-0.4280	-0.4257
33	-0.5878	-0.5100	-0.4836	-0.4710	-0.4638	-0.4592	-0.4560	-0.4537
32	-0.6187	-0.5400	-0.5129	-0.4999	-0.4924	-0.4877	-0.4844	-0.4820
31	-0.6490	-0.5700	-0.5423	-0.5290	-0.5213	-0.5164	-0.5130	-0.5105
30	-0.6787	-0.6000	-0.5719	-0.5583	-0.5504	-0.5454	-0.5419	-0.5394
29	-0.7077	-0.6300	-0.6016	-0.5878	-0.5798	-0.5747	-0.5712	-0.5686
28	-0.7360	-0.6600	-0.6316	-0.6176	-0.6095	-0.6044	-0.6008	-0.5982
27	-0.7636	-0.6900	-0.6617	-0.6477	-0.6396	-0.6344	-0.6308	-0.6282
26	-0.7904	-0.7200	-0.6921	-0.6781	-0.6701	-0.6649	-0.6613	-0.6587
25	-0.8165	-0.7500	-0.7226	-0.7089	-0.7009	-0.6958	-0.6922	-0.6896
24	-0.8417	-0.7800	-0.7535	-0.7401	-0.7322	-0.7271	-0.7236	-0.7211
23	-0.8662	-0.8100	-0.7846	-0.7716	-0.7640	-0.7590	-0.7556	-0.7531
22	-0.8897	-0.8400	-0.8160	-0.8036	-0.7962	-0.7915	-0.7882	-0.7858
21	-0.9124	-0.8700	-0.8478	-0.8360	-0.8291	-0.8245	-0.8214	-0.8192
20	-0.9342	-0.9000	-0.8799	-0.8690	-0.8625	-0.8583	-0.8554	-0.8533

TABLE 2

Table for Estimating Percent of Lot Within Limits (PWL)

Percent Within Limits (P_L and P_U)	Negative Values of Q (Q_L and Q_U)							
	n=3	n=4	n=5	n=6	n=7	n=8	n=9	n=10
19	-0.9550	-0.9300	-0.9123	-0.9025	-0.8966	-0.8928	-0.8901	-0.8882
18	-0.9749	-0.9600	-0.9452	-0.9367	-0.9325	-0.9281	-0.9258	-0.9241
17	-0.9939	-0.9900	-0.9785	-0.9715	-0.9672	-0.9643	-0.9624	-0.9610
16	-1.0119	-1.0200	-1.0124	-1.0071	-1.0037	-1.0015	-1.0000	-0.9990
15	-1.0288	-1.0500	-1.0467	-1.0435	-1.0413	-1.0399	-1.0389	-1.0382
14	-1.0448	-1.0800	-1.0817	-1.0808	-1.0800	-1.0794	-1.0791	-1.0789
13	-1.0597	-1.1100	-1.1173	-1.1191	-1.1199	-1.1204	-1.1208	-1.1212
12	-1.0736	-1.1400	-1.1537	-1.1587	-1.1613	-1.1630	-1.1643	-1.1653
11	-1.0864	-1.1700	-1.1909	-1.1995	-1.2043	-1.2075	-1.2098	-1.2115
10	-1.0982	-1.2000	-1.2290	-1.2419	-1.2492	-1.2541	-1.2576	-1.2602
9	-1.1089	-1.2300	-1.2683	-1.2860	-1.2964	-1.3032	-1.3081	-1.3118
8	-1.1184	-1.2600	-1.3088	-1.3323	-1.3461	-1.3554	-1.3620	-1.3670
7	-1.1269	-1.2900	-1.3508	-1.3810	-1.3991	-1.4112	-1.4199	-1.4265
6	-1.1342	-1.3200	-1.3946	-1.4329	-1.4561	-1.4717	-1.4829	-1.4914
5	-1.1405	-1.3500	-1.4407	-1.4887	-1.5181	-1.5381	-1.5525	-1.5635
4	-1.1456	-1.3800	-1.4897	-1.5497	-1.5871	-1.6127	-1.6313	-1.6454
3	-1.1496	-1.4100	-1.5427	-1.6181	-1.6661	-1.6993	-1.7235	-1.7420
2	-1.1524	-1.4400	-1.6016	-1.6982	-1.7612	-1.8053	-1.8379	-1.8630
1	-1.1541	-1.4700	-1.6714	-1.8008	-1.8888	-1.9520	-1.9994	-2.0362

END OF SECTION Q-110

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SEEDING
SECTION T-901

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item consists of seeding in the areas shown on the Plans to be regraded or as directed by the Commissioner in accordance with these Specifications.

PART 2 - MATERIALS

2.01 SEED

A. The kinds of grass, legume, and cover-crop seed furnished must be those stipulated herein. Seed must conform to the requirements of the Illinois Department of Transportation (IDOT) Standard Specification for Road and Bridge Construction (SSRBC), latest edition, Article 1081.04 unless otherwise specified in this Specification. For Tall Fescue varieties shown in 2.01C, use parameters specified for "Fescue Inferno Tall" in Table II of Article 1081.04.

B. Seed must 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 must furnish the Commissioner duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within 6 months of date of delivery. This statement must 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.

C. Seeds must be spread uniformly at the rate and mixture specified below in pounds per acre of pure live seed (PLS):

Grass Seed Blend	lb/acre PLS
Type 1 – CDA/CCA Permanent Seed Mix	
Tall Fescue (Festuca arundinacea)	325

Use a minimum of 3 varieties of tall fescue. Each variety should contain a minimum of 70% viable endophytes. Varieties should come from the following list: 2nd Millennium, Bonsai, Cayenne, Cochise III, Constitution, Covenant, Coyote II, Crossfire II, Dakota, Dynasty II, Escalade, Falcon IV, Mustang 3, Rendition, SR 8600, Scorpion II, Shenandoah II, Taos, Titan Ltd., Titanium or Tombstone or as approved by the Commissioner.

Type 2 – Late Fall Seed Mix

Tall Fescue (Festuca arundinacea)	250
Perennial Ryegrass (Lolium perenne)	75

Use Tall Fescue blend of varieties listed in Schedule 1 and a blend of up to two cultivars of endophyte – containing Perennial Ryegrass.

Type 3 – Dormant Seed Mix

Tall Fescue (Festuca arundinacea)	300
Perennial Ryegrass (Lolium perenne)	75

Use Tall Fescue blend of varieties listed in Schedule 1 and a blend of up to two cultivars of endophyte – containing Perennial Ryegrass.

Type 4 – Swale/Ditch Seed Mix (See CDA/CCA Standard Detail 7-03-01)

Type 1	325
or	
Type 2	325
or	
Type 3	375
and	
Red Top (Agrostis alba)	10
Rough Bluegrass (Poa trivialis)	20

Use swale mix in areas where irregular inundation is expected. The area to be seeded shall include the swale/ditch banks up to an elevation that is two feet above the normal water elevation for the channel. For normally dry channels, this shall be measured from the channel invert. The Red Top and Rough Bluegrass should be

over seeded at the specified rates over the Type 1 or Type 2 seed application depending on application date.

D. The Contractor must store the Tall Fescue seed varieties in a cool dry place until planted to protect endophyte levels from high heat. The seed must not be stored in direct sunlight and must not be kept in a hot shed during summer.

2.02 LIME

A. Lime, if required to adjust the soil pH, must be ground limestone containing not less than 85% of total carbonates, and must be ground to such fineness that 90% will pass through a No. 20 mesh sieve and 50% will pass through a No. 100 mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and depth specified in the special provision on the basis of the two sieve requirements above. Dolomitic lime or a high magnesium lime must contain at least 10% magnesium oxide.

B. To determine if lime is required, the Contractor must perform 4 pH tests, located at least 50 feet apart, on the soil for each acre to be seeded. The average value of the test results must be the pH value for that acre tested. If the pH value is less than 5.5, the soil must be amended to raise the pH to the acceptable range. Lime requirement must be determined by soil test of the buffering capacity of the soil. Sufficient lime must be applied to raise soil pH to 6.5. Copies of the test results must be transmitted to the Commissioner upon receipt by the Contractor.

2.03 FERTILIZER

A. Fertilizer must be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphorus, and water-soluble potash. They must be applied at the rate and to the depth specified in this Specification, and must meet the specified requirements of the applicable state and federal laws. They must be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime will be permitted in mixed fertilizers.

B. The fertilizers may be supplied as a finely-ground fertilizer soluble in water, suitable for application by power sprayers or for dry application as granules.

2.04 SOILS FOR REPAIRS

A. The soil for fill and topsoiling of areas to be repaired must be at least of equal quality to the topsoil as outlined in Section T-905, Topsoiling.

2.05 MULCH WITH TACKIFIER

A. Mulch must be a hydraulic mulch that meets the requirements of Article 1081.06 (a) (2) for a Light-Duty Hydraulic Mulch of the Illinois Department of Transportation, Standard Specifications for Road and Bridge Construction (S.S.R.B.C.), latest edition; except that the minimum application rate must be 2,500 lbs/acre instead of 2,000 lbs/acre and as further modified herein.

B. Mulch fiber must be colored green to contrast the area on which the mulch is being applied and must not stain concrete or other surfaces with which it comes in contact.

C. Prior to use of the mulch, the Contractor must submit the following to the Commissioner for review and approval:

1. A notarized certification by the manufacturer that the mulch meets the requirements of these specifications.

2. Property test results for the mulch including the C factor analytical results performed and certified by an approved accredited independent laboratory.

PART 3 - CONSTRUCTION METHODS

3.01 ADVANCE PREPARATION AND CLEANUP

A. After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded must be raked or otherwise cleared of stones, 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 must repair such damage. This may include filling gullies, smoothing irregularities, and repairing other work related damages.

B. An area to be seeded must 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.

C. However, when the area to be seeded is sparsely sodded, weedy, barren and unworked, or packed and hard, any grass and weeds must 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 must be broken and the top 3 inches of soil must be worked into a satisfactory seedbed by disking, or appropriate means.

D. Lime if required must be sprayed only upon previously prepared seedbeds. After the applied lime mixture has dried, the lime must be worked into the top 3 inches after which the seedbed must again be properly graded and dressed to a smooth finish.

E. Apply a starter fertilizer, derived from quick release or mineral sources of nutrients, containing a minimum of 45 pounds of nitrogen per acre, 45 pounds of phosphorus (P_2O_5) per acre, and 45 pounds of potassium (K_2O) per acre immediately prior to the seed application described in paragraph 3.02. Additionally, apply a minimum of 70/lbs N/acre containing at least 75% SCU, XCU or nitroform type slow release nitrogen immediately prior to the application described in paragraph 3.02. These products can be applied separately or may be combined into a single application, providing a fertilizer formulator does the mixing. No on-site mixing will be allowed.

3.02 APPLICATION METHODS

A. Seed Application: The Contractor must apply seed uniformly to the prepared seedbed in two directions perpendicular to each other, using one or more of the following methods as required:

1. Class 1 – Apply seed uniformly, using a slit seeder, cultipacker or Brillion-type seeder. Roll with corrugated roller after seeding.

2. Class 2 - Broadcast seed and cover with a light disk harrow or cultipacker or other suitable equipment. Class 2 seed application to be done only with the approval of the Commissioner.

3. Class 3 - Apply seed uniformly with a hydroseeder in a mixture not exceeding 220 pounds solids per 100 gallons of water. Class 3 seed application to be done only with the approval of the Commissioner.

B. Mulch Application: After application of the seed using the approved methods above, mulch and mulch supertackifier must be applied

immediately over the freshly seeded areas in opposing directions using the following rates:

1. Mulch 2500 lbs/acre (1250 lbs/acre per direction)

2. Mulch supertackifier per manufacturer recommendations.

C. Mulch must be applied in accordance with Article 251.03 (c), Method 3 of SSRBC, except that mulch supertackifier must be applied concurrently with mulch.

D. Spraying Equipment: The spraying equipment must 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 must 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.

1. The unit must 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 must 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 must be capable of providing clearance for 5/8 inch solids. The power unit for the pump and agitator must have controls mounted so as to be accessible to the nozzle operator. There must be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

2. The nozzle pipe must be mounted on an elevated supporting stand in such a manner that it can be rotated through 360 degrees horizontally and inclined vertically from at least 20 degrees below to at least 60 degrees above the horizontal. There must 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 must be supplied so that mixtures may be properly sprayed over distance varying from 20 feet to 100 feet. One must be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-range jet nozzle. For ease of removal and cleaning, all nozzles must be connected to the nozzle pipe by means of quick-release couplings.

3. In order to reach areas inaccessible to the regular equipment, an extension hose at least 50 feet in length must be provided to which the nozzles may be connected.

E. Mixtures: Lime, if required, must be applied separately, in the quantity specified, prior to the fertilizing and seeding operations. Not more than 220 pounds of lime must be added to and mixed with each 100 gallons of water. Mulch and mulch supertackifier must be mixed together and applied after seed application at the specified rates above but not more than 220 pounds combined solids per 100 gallons of water.

F. All water used must be obtained from fresh water sources and must be free from injurious chemicals and other toxic substances harmful to plant life. Brackish water must not be used at any time. The Contractor must identify to the Commissioner all sources of water at least 2 weeks prior to use. The Commissioner may take samples of the water at the source of from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor must not use any water from any source which is disapproved by the Commissioner following such tests.

G. All mixtures must be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures must be used within 2 hours from the time they were mixed or they must be wasted and disposed of at locations acceptable to the Commissioner.

H. The mixtures must be applied by means of a high-pressure spray which will 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 will never be directed toward the ground in such a manner as might produce erosion or runoff.

I. Particular care must 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 must 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 or paper or pans over the area at intervals and observing the quantity of material deposited thereon.

3.03 MAINTENANCE OF SEEDED AREAS

A. The Contractor must protect seeded areas against traffic or other use by warning signs or barricades, as approved by the Commissioner. Surfaces gullied or otherwise damaged following seeding must be

repaired by regrading and reseeding as directed. The Contractor must mow, water as directed, and otherwise maintain seeded areas in a satisfactory condition until final inspection and acceptance of the work. Areas with excessive weed growth must be regraded and/or treated with an application of a select herbicide, at the approval of the Commissioner, and reseeded to establish a satisfactory stand of grass. Watering will only be accomplished at night or as directed by the Commissioner.

B. When the seed application method outlined above is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density to the satisfaction of the Commissioner. If at the time when the Contract has been otherwise completed it is not possible to make an adequate determination of the color, density, and uniformity of such stand of grass, payment for the unaccepted portions of the areas seeded out of season will be withheld until such time as these requirements have been met.

3.04 TIME OF SEEDING

A. The seeding and related operations must be performed during the following periods:

1. Standard seeding must occur between March 15 and September 15. Apply at specified rate and mix according to 2.01C (Type 1).

2. Late fall seeding must occur between September 16 and October 15 according to 2.01C (Type 2).

3. Late Fall seeding can be done between October 16 and November 14 at the direction of the Commissioner (Type 2).

4. Dormant seeding must occur between June 15 and August 15 at the discretion of the Commissioner and between November 15 and December 31 or until the ground becomes frozen according to 2.01C (Type 3).

5. Seeding must be done immediately upon completion of work in a given area. The outlet channel, peripheral drain and other areas of work completed during the course of the Contract must be permanently seeded during the next seeding period after completion. If it is more than 45 days until the period, the Contractor must use temporary protection measures to prevent soil erosion, and they will be acceptable to the Commissioner.

6. No seeding may occur between October 16 and November 14 (except as directed by the Commissioner in Section 3.04.A.3) and between January 1 and March 14.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENT

A. Completed and approved work will be measured as follows:

B. Permanent seeding must include seed bed preparation, including fertilization, and hydroseeding (seed, fertilizer, mulch, and mulch supertackifier).

PART 5 - BASIS OF PAYMENT

5.01 PAYMENTS

A. Accepted quantities ordered by the Commissioner and measured as described in will be paid for under:

ITEM NO.	DESCRIPTION	UOM
T-901-01	SEEDING, PERMANENT	AC
T-901-02	LIME, pH ADJUSTMENT	TON

END OF SECTION T-901

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TOPSOILING
SECTION T-905

PART 1 - DESCRIPTION

1.01 GENERAL

A. This item must consist of preparing the ground surface for topsoil application, placing machine pulverized topsoil obtained from onsite unclassified excavation or from approved sources off the site at the Contractor's option, and spreading the topsoil on prepared areas in accordance with this Specification at the locations shown on the Drawings or as determined by the Commissioner. The work under this Section is subject to the requirements of the Contract Documents.

PART 2 - MATERIALS

2.01 TOPSOIL

A. Topsoil must be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it must be reasonably free from subsoil and stumps, roots, brush, stones, clay lumps, sticks, debris, or similar objects of one inch many dimension and larger. The topsoil must be thoroughly pulverized through a topsoil pulverizer / screen machine before placement. Brush and other vegetation which will not be incorporated with the soil during handling operations must be cut and removed. Ordinary sods and herbaceous growth such as grass and weeds are not to be removed but must be thoroughly broken up and intermixed with the soil during handling and pulverizing operations. The topsoil or soil mixture, unless otherwise specified or approved, must 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 must be not less than 3% nor more than 20% as determined by the wet-combustion method (chromic acid reduction) AASHTO T194. There must 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 AASHTO T 11.

B. Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above Specifications. Topsoil must be pulverized prior to application.

2.02 INSPECTION AND TESTS

A. At least 21 days prior to placement, the Contractor must notify the Commissioner of the source of topsoil he proposes to furnish whether from strippings or grading on site, supplemented from sources off site of the Project area, or totally from an offsite source. When directed by the Commissioner, the topsoil must be inspected to determine if the selected soil meets the requirements specified and to determine the depth to which stripping will be permitted. The Contractor must take a minimum of one representative soil sample from three (3) locations within the area under consideration and to the proposed stripping depths, for testing purposes as specified in Paragraph 2.01.

PART 3 - CONSTRUCTION METHODS

3.01 GENERAL

A. Areas to be topsoiled must be as shown on the Drawings or designated by the Commissioner. 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 must be on hand, in good condition, and approved by the Commissioner before the various operations are started.

3.02 PREPARING THE GROUND SURFACE

A. Immediately prior to dumping and spreading the topsoil on any area, the surface must be loosened by discs or spike-tooth harrows, or by other means acceptable to the Commissioner, to a minimum depth of one (1) inch to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled must be cleared of all stones larger than 1 inch 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, must receive special scarification.

B. Grades on the area to be topsoiled, which have been established by others as shown on the Plans, must be maintained in a true and even condition. Where grades have not been established, the areas must 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.

3.03 OBTAINING TOPSOIL

A. Topsoil, whether obtained on-site or off-site, must be pulverized prior to installation in the Project.

B. Prior to the stripping of topsoil from designated areas, any vegetation, briers, stumps and large roots, sticks, rubbish or stones found on such areas, which may interfere with subsequent operations, must be removed using methods acceptable to the Commissioner. Heavy sod or other cover, which cannot be incorporated into the topsoil by pulverizing must be removed.

C. The topsoil must be spread on areas already tilled and smooth-graded, or stockpiled in areas approved by the Commissioner. Any topsoil stockpiled by the Contractor must be rehandled and placed without additional compensation. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor must be graded if required and put into a condition acceptable for seeding.

D. When suitable topsoil is secured off the Airport site, the Contractor must locate and obtain the supply, subject to the approval of the Commissioner. The Contractor must notify the Commissioner sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor must remove the topsoil from approved areas and to the depth as directed. The topsoil must be hauled to the site of the work and pulverized per Paragraph 2.01.A and placed for spreading, or spread as required. Any topsoil hauled to the site of the work and stockpiled must be rehandled and placed without additional compensation.

3.04 PLACING TOPSOIL

A. The topsoil must be evenly spread on the prepared areas to a uniform depth of 4 inches after compaction, unless otherwise shown on the Plans. Spreading must not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading must be carried on so that turfing operations can proceed with a minimum of soil preparation or tilling.

B. After spreading, any large, stiff clods and hard lumps must be broken with a pulverizer or by other effective means, and all stones or rocks (1 inch or more in diameter), roots, sticks, litter, or any foreign matter must be raked up and disposed of by the Contractor. After spreading is completed, the topsoil must be satisfactorily compacted by rolling with a cultipacker or by other means acceptable to the Commissioner. The compacted topsoil surface must 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 must be promptly removed.

PART 4 - METHOD OF MEASUREMENT

4.01 COMPLETED AND APPROVED WORK WILL BE MEASURED AS FOLLOWS:

A. Topsoiling will be measured for payment in square yards for the surface quantity installed at the depth as specified, completed and accepted by the Commissioner as specified herein.

PART 5 - BASIS OF PAYMENT

A. Topsoiling, 4" Depth, completed in place and accepted and measured as specified above, will be paid for at the Contract unit price per square yard for which payment will be full compensation for furnishing, pulverizing, hauling, and placing material, ground preparation and compaction including all labor, materials, tools, equipment and incidentals required to complete the work as specified herein and on the drawings:

B. Payment will be made under the following item:

ITEM NO.	DESCRIPTION	UOM
T-905-01	TOPSOILING, 4" DEPTH	SY

END OF SECTION T-905

SITE DEMOLITION
SECTION X-100

PART 1 - DESCRIPTION

1.01 GENERAL

A. This Section includes all the work required to demolish and remove existing surface and underground structures and utilities indicated on the Plans or as directed by the Commissioner. Structures include but are not limited to existing manholes, inlets, catch basins, underdrain inspection holes, paved ditches, and pipes associated with utilities, ductbanks, conduits, in-pavement and elevated edge lights and guidance signs as shown in the Plans.

B. Contractor must conform to the Building Code of the City of Chicago for Demolition of Structures, safety of adjacent structures and dust control.

C. Contractor must notify affected utility companies before starting work and comply with their requirements for protection and or termination of facilities.

D. All equipment to be used on the Project must comply with the height restrictions of the FAA 7460 permit.

E. Blasting will not be permitted.

1.02 RELATED WORK

A. Section 01524 – Construction Waste Management

B. Section 02705 – Abandoning Existing Storm/Sanitary Sewer Systems and Structures

C. Section 02710 – Dust Control

D. Section P-150 – Pavement Removal

E. Section P-152 –Excavation and Embankment

F. Section P-153 – Controlled Low Strength Material (CLSM)

G. Section P-157 – Trench Backfilling

H. Section P-617 – Pavement Scarification

1.03 REFERENCES

A. IDOT-"Standard Specifications for Road and Bridge Construction", latest edition, (SSRBC)

B. American Society for Testing and Materials (ASTM)

1.04 DELIVERY, STORAGE AND HANDLING

A. The Contractor must coordinate demolition with the Commissioner to identify any items to be salvaged. The Contractor must deliver all salvaged items to the Commissioner at a location determined by the Commissioner on airport property.

1.05 MATERIAL OWNERSHIP

A. Except for items or materials indicated to be abandoned or otherwise indicated to remain the Department of Aviation's property, (including Recyclable Materials), demolished materials must become the Contractor's property and must be removed from airport property. Final disposition of the materials must conform to applicable Laws.

PART 2 - MATERIALS

2.01 GRANULAR BACKFILL

A. Granular backfill must conform to IDOT Standard Specification, Section 209 or 311, Type CA-6. Recycled or virgin is allowed.

PART 3 - CONSTRUCTION METHODS

3.01 DEMOLITION REQUIREMENTS

A. Contractor must:

1. Conduct demolition operations to minimize interference with adjacent structures, utilities or appurtenances.

2. Cease operations immediately if adjacent structures appear in danger. Notify the Commissioner. Do not resume operations until directed.

3. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose. If water is to be supplied from a fire hydrant, then backflow preventers must be used and

a meter must be installed to provide usage readings to the Commissioner on a monthly basis. Water trucks may also be needed.

4. Determine how much, if any, of the demolished materials is not suitable for crushing and remove such material prior to crushing operations. The Contractor must dispose of the unsuitable material at a location off of Airport property, as directed by the Commissioner, at no additional cost to the City.

3.02 EXISTING UTILITIES

A. Contractor must demolish and completely remove existing utilities where indicated. Contractor must cap and abandon in place utilities where indicated. Utilities must include, but not limited to, hydrants, underground piping, conduit and cables, mechanical and electrical systems indicated to be removed. Contractor must coordinate with existing utility owners for shut-off of services if lines are active and for cut-off and sealing or capping (Commonwealth Edison Co., Ameritech, Peoples Gas, etc).

3.03 CLOSING ABANDONED UNDERGROUND UTILITIES

A. Contractor must permanently close open ends of abandoned underground utilities indicated to remain with the following materials to withstand backfill pressures which may result after closing.

B. Close open ends of conduit and pipe with caps, plugs or other suitable method for the type and size of material as acceptable to the Commissioner. Wooden caps or plugs are not acceptable.

C. Close open ends of concrete and masonry utilities 2'-0" diameter or smaller with not less than 8 inches thick concrete bulkheads, constructed to completely close the openings, or as shown in the Plans, as directed by the Commissioner or in accordance with Section 02705.

D. Submit details for closure of concrete or masonry utilities larger than 2'- 0" to the Commissioner for review.

3.04 REMOVAL OF ABANDONED UNDERGROUND UTILITIES

A. Contractor must remove underground utility lines and structures indicated to be removed in their entirety. Backfill must be placed in layers not to exceed 6" and compacted to 95% of the maximum density determined by ASTM D 1557..

3.05 UNCLASSIFIED EXCAVATION

A. Excess dirt spoils and excavated material not required or acceptable for backfill must be removed and disposed of off Airport property at the Contractors expense, unless otherwise directed by the Commissioner.

B. Due to material being generated from an airport property, per- and polyfluoroalkyl substances (PFAS) may be present in the soil, as PFAS is present in Aqueous Film-Forming Foam (AFFF) used at airports for fire-fighting. Coordination with disposal facilities regarding acceptance of this material is required prior to bidding. See P-152 for additional details.

3.06 FILL

A. All areas excavated below the elevation indicated on the Plans such as manholes and like areas must be filled with granular backfill in accordance with Section P-157 and Section P-154 or as directed by the Commissioner at no additional cost.

3.07 UTILITY CONFLICTS OR UNFORESEEN CONDITIONS

A. An allowance amount has been established for unforeseen conditions. The directed removal or demolition of unforeseen material, including, but not limited to, foundations, former basements, existing debris piles, recycled materials, and underground structures, which require demolition, relocation, adjustment or tie-in connections will be removed to at least two (2) feet below the proposed excavation grades during construction of the proposed improvements of the Contract Documents.

B. The Allowance is required to cover the cost of any required demolition, removal, relocation, adjustment, or tie-in connection, providing labor, materials, equipment, expendables, and services for the utility or obstruction encountered. The disposition of the encountered unforeseen utility or obstruction will be determined at the sole discretion of the Commissioner. Such unforeseen removals are not indicated in the Plans. Items identified on the plans for removal will be paid in accordance with the applicable pay item. The Contractor will not proceed to perform any such Work without written permission from the Commissioner and Chief Procurement Officer.

C. The Contractor will be responsible to notify the Commissioner when an unforeseen utility or obstruction is encountered and to receive written permission from the Commissioner and Chief Procurement Officer to proceed with the Work.

PART 4 - METHOD OF MEASUREMENT

4.01 MEASUREMENTS

A. The work covered under this Section includes, but is not limited to, the removal of items as shown on the Drawings to be removed. Such demolition as described herein will not be measured for separate payment except for those payment items listed below. The costs of the payment items will be measured per Allowance, Lump Sum, per Linear Foot, per Square Yards, or Each, as appropriate. The costs of meeting all other requirements of this Specification will be included in the Contract as a whole, and no additional compensation will be allowed. No additional compensation will be allowed for structures, pipes, ductbanks, and/or conduit runs based on in-situ depths that differ from those depicted in the Drawings or that are not specifically identified in the Drawings. The cost of recyclable and salvageable items will be included in the Contract Unit Price of the item and no additional compensation will be allowed.

B. No separate payment will be made for acceptable fill, granular backfill material, trench backfill or CLSM used to fill abandoned or resultant spaces of demolished structures or removed utility lines and structures and will be considered to be included in the Contract Unit Price for the associated item being removed, abandoned or demolished.

C. Allowance for Utility Conflicts & Unforeseen Conditions' will be paid by Allowance.

D. All remaining circuits to remain in service that are impacted by demolition operations must be reconnected to new or remaining circuits. Cost associated with the reconnection is included in the demolition item.

E. When an Unforeseen Utility or Unforeseen Demolition of material is encountered, or the Commissioner requires Site Investigation, notification to the Commissioner is required and written permission is received prior to start of work; the Contractor will perform the required Work for the disposition of the encountered unforeseen utility or unforeseen demolition of material or site investigation as "Unforeseen

Utilities", per Allowance, or "Unforeseen Demolition", per Allowance, or "Site Investigation", per Allowance and measurement of this Work will be as described in Article X, "Changes In the Work", of the Part 2, General Conditions of the Contract.

F. Remove Guidance Sign: Will be measured per each and will include all associated appurtenances, circuit connections, covers, and foundations. Guidance Signs are to be salvaged and delivered to the Commissioner.

G. Remove Edge Light: Will be measured per each and will include the removal of the transformer, reconnection of electrical cables if the circuit is to remain, and furnishing and installation of a cover plate on the existing base. Associated items include but are not limited to installation of edge light and transformer as well as removal of steel cover.

H. Remove Underdrain: will be measured per linear foot and will include utility coordination and removal of all associated appurtenances and connections.

I. Remove Electrical Conduit: Will be measured per linear foot and will include utility coordination and removal of all associated appurtenances and connections, including conduit encased in concrete or direct-buried.

J. Remove Airfield Cable: Will be measured per linear foot and will include utility or agency coordination and removal of all associated appurtenances and connections.

K. Remove Electrical Handhole: Will be measured each and will include all work required to remove utility structures including frames, grates, structures, all associated appurtenances and utility coordination.

L. Remove Taxiway Centerline Can and Base: Will be measured each and will include all work required to remove utility structures including frames, grates, structures, all associated appurtenances and utility coordination.

M. Remove in pavement weather sensor: Will be measured per each and will include all work required to remove in pavement weather sensors and associated cable.

N. Remove Inspection Hole: Will be measured each and will include all work required to remove underdrain structure including frames, grates, structures, all associated appurtenances and utility coordination.

PART 5 - BASIS OF PAYMENT

5.01 PAYMENTS

A. For 'Allowance for Utility Conflicts & Unforeseen Conditions' payment will be made for efforts requested by the Commissioner to remedy any unforeseen utility conflict or condition. Payment will be based from Time and Materials proposal from the Contractor, approved and accepted by the Commissioner, and will be subject to the requirements described in Part 3.07.

B. Payment will be made at the Contract unit price for Site Demolition which will be payment in full for all labor, materials, equipment, granular backfilling, sawcutting, tools, and all work necessary to remove or abandon all items in accordance with this Specification.

C. Payment will be made under:

ITEM NO.	DESCRIPTION	UOM
X-100-01	ALLOWANCE FOR UNFORESEEN DEMOLITION	AL
X-100-02	REMOVE STORM SEWER	LF
X-100-03	REMOVE INSPECTION HOLE	EA
X-100-04	REMOVE EXISTING MANHOLE	EA

END OF SECTION X-100