SFS Terminal and Hangar

TECHNICAL SPECIFICATIONS (100%)

Stewart International Airport (SWF)
Orange County, New York

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SIGNATURE AVIATION

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NYSDOT Specifications

A. The standard specifications which will govern the prosecution of the work as set out in the proposal and/or shown on the plans shall conform when specified to the New York State Department of Transportation Standard Specification Volumes 1-4 2024, or Current Edition at time if Bidding, including all NYSDOT Supplements and as modified hereinafter.

B. These standard specifications may be obtained from:

New York State Department of Transportation
50 Wolf Road
Albany, New York 12232

Specifications are available online at https://www.dot.ny.gov/main/business-center/engineering/specifications/busi-e-standards-usc
D. A copy is on file and may be inspected at the Office of the Engineer. The Contractor shall have at least one set of the standard specifications available on the project.
E. Standard Specifications will apply to the Landside development only unless noted otherwise. NYSDOT specifications pertinent to this project are as follows:

NYSDOT Section	Description
Volume 2 of 4	
Earthwork	
203	Excavation and Embankment
Bases and Subbases	
302	Bituminous Stabilized Base Course
304	Subbase Course
Asphalt Mixture and Pavement	
404	Asphalt Pavements
407	Tack Coat

Attachments

A Construction Project Daily Safety Inspection Checklist
B Construction Safety and Phasing Plan (CSPP)
C Geotechnical Report

*Indicates Non-FAA Specification

Note:

Where applicable, FAA Specifications have been modified from FAA standards as specified in Advisory Circular 150/5370-10H, Standards for Specifying Construction of Airports as follows:

General Construction Items

Item C-100 Contractor Quality Control Program (CQCP)

100-1 General. Quality is more than test results. Quality is the combination of proper materials, testing, workmanship, equipment, inspection, and documentation of the project. Establishing and maintaining a culture of quality is key to achieving a quality project. The Contractor shall establish, provide, and maintain an effective Contractor Quality Control Program (CQCP) that details the methods and procedures that will be taken to assure that all materials and completed construction required by this contract conform to contract plans, technical specifications, and other requirements, whether manufactured by the Contractor, or procured from subcontractors or vendors. Although guidelines are established and certain minimum requirements are specified here and elsewhere in the contract technical specifications, the Contractor shall assume full responsibility for accomplishing the stated purpose.

The Contractor shall establish a CQCP that will:

a. Provide qualified personnel to develop and implement the CQCP.

b. Provide for the production of acceptable quality materials.

c. Provide sufficient information to assure that the specification requirements can be met.

d. Document the CQCP process.

The Contractor shall not begin any construction or production of materials to be incorporated into the completed work until the CQCP has been reviewed and approved by the Resident Project Representative (RPR). The RPR shall evaluate the CQCP elements, including but not limited to, staff resumes to assess qualifications to perform proposed function, Contractor lab, Contractor equipment material sources/quality, testing plan, etc. No partial payment will be made for materials subject to specific quality control (QC) requirements until the CQCP has been reviewed and approved.

The QC requirements contained in this section and elsewhere in the contract technical specifications are in addition to and separate from the quality assurance (QA) testing requirements. QA testing requirements are the responsibility of the RPR or Contractor as specified in the specifications.

A Quality Control (QC)/Quality Assurance (QA) workshop with the Engineer, Resident Project Representative (RPR), Contractor, subcontractors, testing laboratories, and Owner's representative must be held prior to start of construction. The QC/QA workshop will be facilitated by the Contractor. The Contractor shall coordinate with the Airport and the RPR on time and location of the QC/QA workshop. Items to be addressed, at a minimum, will include:

a. Review of the CQCP including submittals, QC Testing, Action & Suspension Limits for Production, Corrective Action Plans, Distribution of QC reports, and Control Charts.

b. Discussion of the QA program.

c. Discussion of the QC and QA Organization and authority including coordination and information exchange between QC and QA.

d. Establish regular meetings to discuss control of materials, methods, and testing.

e. Establishment of the overall QC culture.

100-2 Description of program.

a. General description. The Contractor shall establish a CQCP to perform QC inspection and testing of all items of work required by the technical specifications, including those performed by subcontractors. The CQCP shall ensure conformance to applicable specifications and plans with respect to materials, off-site fabrication, workmanship, construction, finish, and functional performance. The CQCP shall be effective for control of all construction work performed under this Contract and shall specifically include 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 QC.

b. Contractor Quality Control Program (CQCP). The Contractor shall describe the CQCP in a written document that shall be reviewed and approved by the RPR prior to the start of any production, construction, or off-site fabrication. The written CQCP shall be submitted to the RPR for review and approval at least 10 calendar days before the CQCP Workshop. The Contractor's CQCP and QC testing laboratory must be approved in writing by the RPR prior to the Notice to Proceed (NTP).
The CQCP shall be organized to address, as a minimum, the following:

1. QC organization and resumes of key staff.
2. Project progress schedule
3. Submittals schedule
4. Inspection requirements
5. QC testing plan
6. Documentation of QC activities and distribution of QC reports
7. Requirements for corrective action when QC and/or QA acceptance criteria are not met.
8. Material quality and construction means and methods. Address all elements applicable to the project that affect the quality of the pavement structure including subgrade, subbase, base, and surface course. Some elements that must be addressed include, but is not limited to mix design, aggregate grading, stockpile management, mixing and transporting, placing, and finishing, quality control testing and inspection, smoothness, laydown plan, equipment, and temperature management plan.

The Contractor must add any additional elements to the CQCP that is necessary to adequately control all production and/or construction processes required by this contract.

100-3 CQCP organization. The CQCP shall be implemented by the establishment of a QC organization. An organizational chart shall be developed to show all QC personnel, their authority, and how these personnel integrate with other management/production and construction functions and personnel.

The organizational chart shall identify all QC staff by name and function and shall indicate the total staff required to implement all elements of the CQCP, including inspection and testing for each item of work. If necessary, different technicians can be used 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 CQCP, the personnel assigned shall be subject to the qualification requirements of paragraphs 100-03a and 100-03b. The organizational chart shall indicate which personnel are Contractor employees and which are provided by an outside organization.

The QC organization shall, as a minimum, consist of the following personnel:

a. Program Administrator. The Contractor Quality Control Program Administrator (CQCPA) must be a full-time **on-site** employee of the Contractor, or a consultant engaged by the Contractor. The CQCPA must have a minimum of five (5) years of experience in QC pavement construction with prior QC experience on a project of comparable size and scope as the contract.

Included in the five (5) years of paving/QC experience, the CQCPA must meet at least one of the following requirements:

(1) Professional Engineer with one (1) year of airport paving experience.

(2) Engineer-in-training with two (2) years of airport paving experience.

(3) National Institute for Certification in Engineering Technologies (NICET) Civil Engineering Technology Level IV with three (3) years of airport paving experience.

(4) An individual with four (4) years of airport paving experience, with a Bachelor of Science Degree in Civil Engineering, Civil Engineering Technology or Construction.

The CQCPA must have full authority to institute any and all actions necessary for the successful implementation of the CQCP to ensure compliance with the contract plans and technical specifications. The CQCPA authority must include the ability to immediately stop production until materials and/or processes are in compliance with contract specifications. The CQCPA must report directly to a principal officer of the construction firm. The CQCPA may supervise the Quality Control Program on more than one project provided that person can be at the job site within two (2) hours after being notified of a problem.

b. QC Technicians. A sufficient number of QC technicians necessary to adequately implement the CQCP must be provided. These personnel must be either Engineers, engineering technicians, or experienced craftsman with qualifications in the appropriate field equivalent to NICET Level II in Civil Engineering Technology or higher and shall have a minimum of two (2) years of experience in their area of expertise.

The QC technicians must report directly to the CQCPA and shall perform the following functions:

(1) Inspection of all materials, construction, plant, and equipment for conformance to the technical specifications, and as required by paragraph 100-6.

(2) Performance of all QC tests as required by the technical specifications and paragraph100-8.

(3) Performance of tests for the RPR when required by the technical specifications.

Certification at an equivalent level of qualification and experience by a state or nationally recognized organization will be acceptable in lieu of NICET certification.

c. Staffing levels. The Contractor shall provide sufficient qualified QC personnel to monitor each work activity at all times. Where material is being produced in a plant for incorporation into the work, separate plant and field technicians shall 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 CQCP shall state where different technicians will be required for different work elements.

100-4 Project progress schedule. Critical QC activities must be shown on the project schedule as required by Section 80, paragraph 80-03, *Execution and Progress*.

100-5 Submittals schedule. The Contractor shall submit a detailed listing of all submittals (for example, mix designs, material certifications) and shop drawings required by the technical specifications. The listing can be developed in a spreadsheet format and shall include as a minimum:

a. Specification item number

b. Item description

c. Description of submittal

d. Specification paragraph requiring submittal

e. Scheduled date of submittal

100-6 Inspection requirements. QC inspection functions shall be organized to provide inspections for all definable features of work, as detailed below. All inspections shall be documented by the Contractor as specified by paragraph 100-9.

Inspections shall be performed as needed to ensure continuing compliance with contract requirements until completion of the particular feature of work. Inspections shall include the following minimum requirements:

a. During plant operation for material production, QC test results and periodic inspections shall be used 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 used in proportioning and mixing shall be inspected to ensure its proper operating condition. The CQCP shall detail how these, and other QC functions will be accomplished and used.

b. During field operations, QC test results and periodic inspections shall be used to ensure the quality of all materials and workmanship. All equipment used in placing, finishing, and compacting shall be inspected 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 CQCP shall document how these and other QC functions will be accomplished and used.

100-7 Contractor QC testing facility.

a. For projects that include Item P-401, Item P-403, and Item P-404, the Contractor shall ensure facilities, including all necessary equipment, materials, and current reference standards, are provided that meet requirements in the following paragraphs of ASTM D3666, *Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials*:

- 8.1.3 Equipment Calibration and Checks;
- 8.1.9 Equipment Calibration, Standardization, and Check Records;
- 8.1.12 Test Methods and Procedures

100-8 QC testing plan. As a part of the overall CQCP, the Contractor shall implement a QC testing plan, as required by the technical specifications. The testing plan shall include the minimum tests and test frequencies required by each technical specification Item, as well as any additional QC tests that the Contractor deems necessary to adequately control production and/or construction processes.

The QC testing plan can be developed in a spreadsheet fashion and shall, as a minimum, include the following:

a. Specification item number (e.g., P-401)

b. Item description (e.g., Hot Mix Asphalt Pavements)

c. Test type (e.g., gradation, grade, asphalt content)

d. Test standard (e.g., ASTM or American Association of State Highway and Transportation Officials (AASHTO) test number, as applicable)

e. Test frequency (e.g., as required by technical specifications or minimum frequency when requirements are not stated)

f. Responsibility (e.g., plant technician)

g. Control requirements (e.g., target, permissible deviations)

The QC testing plan shall contain a statistically-based procedure of random sampling for acquiring test samples in accordance with ASTM D3665. The RPR shall be provided the opportunity to witness QC sampling and testing.

All QC test results shall be documented by the Contractor as required by paragraph 100-9.

100-9 Documentation. The Contractor shall maintain current QC records of all inspections and tests performed. These records shall include factual evidence that the required QC 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.

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 terms of the contract. Legible copies of these records shall be furnished to the RPR daily. The records shall cover all work placed subsequent to the previously furnished records and shall be verified and signed by the CQCPA.

Contractor QC records required for the contract shall include, but are not necessarily limited to, the following records:

a. Daily inspection reports. Each Contractor QC technician shall maintain a daily log of all inspections performed for both Contractor and subcontractor operations. These technician's daily reports shall provide factual evidence that continuous QC inspections have been performed and shall, as a minimum, include the following:

(1) Technical specification item number and description

(2) Compliance with approved submittals

(3) Proper storage of materials and equipment

(4) Proper operation of all equipment

(5) Adherence to plans and technical specifications

(6) Summary of any necessary corrective actions

(7) Safety inspection

(8) Photographs and/or video

The daily inspection reports shall identify all QC inspections and QC tests conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed.

The daily inspection reports shall be signed by the responsible QC technician and the CQCPA. The RPR shall be provided at least one copy of each daily inspection report on the work day following the day of record. When QC inspection and test results are recorded and transmitted electronically, the results must be archived.

b. Daily test reports. The Contractor shall be responsible for establishing a system that will record all QC test results. Daily test reports shall document the following information:

(1) Technical specification item number and description

(2) Test designation

(3) Location

(4) Date of test

(5) Control requirements

(6) Test results

(7) Causes for rejection

(8) Recommended remedial actions

(9) Retests

Test results from each day's work period shall be submitted to the RPR prior to the start of the next day's work period. When required by the technical specifications, the Contractor shall maintain statistical QC charts. When QC daily test results are recorded and transmitted electronically, the results must be archived.

100-10 Corrective action requirements. The CQCP shall 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 shall include both general requirements for operation of the CQCP as a whole, and for individual items of work contained in the technical specifications.

The CQCP shall detail how the results of QC inspections and tests will be used for determining the need for corrective action and shall contain clear rules to gauge when a process is out of control and the type of correction to be taken to regain process control.

When applicable or required by the technical specifications, the Contractor shall establish and use statistical QC charts for individual QC tests. The requirements for corrective action shall be linked to the control charts.

100-11 Inspection and/or observations by the RPR. All items of material and equipment are subject to inspection and/or observation by the RPR at the point of production, manufacture, or shipment to determine if the Contractor, producer, manufacturer or shipper maintains an adequate QC system in conformance with the requirements detailed here and the applicable technical specifications and plans. In addition, all items of materials, equipment and work in place shall be subject to inspection and/or observation by the RPR at the site for the same purpose.

Inspection and/or observations by the RPR does not relieve the Contractor of performing QC inspections of either on-site or off-site Contractor's or subcontractor's work.

100-12 Noncompliance.

a. The Resident Project Representative (RPR) will provide written notice to the Contractor of any noncompliance with their CQCP. After receipt of such notice, the Contractor must take corrective action.

b. When QC activities do not comply with either the CQCP or the contract provisions or when the Contractor fails to properly operate and maintain an effective CQCP, and no effective corrective actions have been taken after notification of non-compliance, the RPR will recommend the Owner take the following actions:

(1) Order the Contractor to replace ineffective or unqualified QC personnel or subcontractors and/or

(2) Order the Contractor to stop operations until appropriate corrective actions are taken.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

National Institute for Certification in Engineering Technologies (NICET)

ASTM International (ASTM)

ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
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

END OF ITEM C-100

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Item C-102 Temporary Air and Water Pollution, Soil Erosion, and Siltation Control

DESCRIPTION

102-1. This item shall consist of temporary control measures as shown on the plans or as ordered by the Resident Project Representative (RPR) during the life of a contract to control pollution of air and water, soil erosion, and siltation through the use of silt fences, berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

Temporary erosion control shall be in accordance with the approved erosion control plan; the approved Construction Safety and Phasing Plan (CSPP) and AC 150/5370-2, *Operational Safety on Airports During Construction*. The temporary erosion control measures contained herein shall be coordinated with the permanent erosion control measures specified as part of this contract to the extent practical to assure economical, effective, and continuous erosion control throughout the construction period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, waste areas, and temporary plant sites.

Temporary control measures shall be designed, installed and maintained to minimize the creation of wildlife attractants that have the potential to attract hazardous wildlife on or near public-use airports.

MATERIALS

102-2.1 Grass. Grass that will not compete with the grasses sown later for permanent cover per Item T-901shall be a quick-growing species (such as ryegrass, Italian ryegrass, or cereal grasses) suitable to the area providing a temporary cover. Selected grass species shall not create a wildlife attractant.

102-2.2 Mulches. Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials per Item T-908. Mulches shall not create a wildlife attractant.

102-2.3 Fertilizer. Fertilizer shall be a standard commercial grade and shall conform to all federal and state regulations and to the standards of the Association of Official Agricultural Chemists.

102-2.4 Slope drains. Slope drains may be constructed of pipe, fiber mats, rubble, concrete, asphalt, or other materials that will adequately control erosion.

102-2.5 Silt fence. Silt fence shall consist of polymeric filaments which are formed into a stable network such that filaments retain their relative positions. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life. Silt fence shall meet the requirements of ASTM D6461.

102-2.6 Other. All other materials shall meet commercial grade standards and shall be approved by the RPR before being incorporated into the project.

CONSTRUCTION REQUIREMENTS

102-3.1 General. 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 shall apply.

The RPR shall be responsible for assuring compliance to the extent that construction practices, construction operations, and construction work are involved.

102-3.2 Schedule. Prior to the start of construction, the Contractor shall submit schedules in accordance with the approved Construction Safety and Phasing Plan (CSPP) and the plans for accomplishment of temporary and permanent erosion control work for clearing and grubbing; grading; construction; paving; and structures at watercourses. The Contractor shall 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 shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the RPR.

102-3.3 Construction details. The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in the plans and approved CSPP. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices but are not associated with permanent control features on the project.

Where erosion may be a problem, schedule and perform clearing and grubbing operations so that grading operations and permanent erosion control features can follow immediately if project conditions permit. Temporary erosion control measures are required if permanent measures cannot immediately follow grading operations. The RPR shall 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 with the accepted schedule. If seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified as directed by the RPR.

The Contractor shall 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 as directed by the RPR. If 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 directed by the RPR, the work shall be performed by the Contractor and the cost shall be incidental to this item.

The RPR may increase or decrease the area of erodible earth material that can be exposed at any time based on an analysis of project conditions.

The erosion control features installed by the Contractor shall be maintained by the Contractor during the construction period.

Provide temporary structures whenever construction equipment must cross watercourses at frequent intervals. Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into any waterways, impoundments or into natural or manmade channels.

102-3.4 Installation, maintenance and removal of silt fence. Silt fences shall extend a minimum of 16 inches and a maximum of 34 inches above the ground surface. Posts shall be set no more than 10 feet on center. Filter fabric shall be cut from a continuous roll to the length required minimizing joints where possible. When joints are necessary, the fabric shall be spliced at a support post with a minimum 12-inch overlap and securely sealed. A trench shall be excavated approximately 4 inches deep by 4 inches wide on the upslope side of the silt fence. The trench shall be backfilled and the soil compacted over the silt fence fabric. The Contractor shall remove and dispose of silt that accumulates during construction and prior to establishment of permanent erosion control. The fence shall be maintained in good working condition until permanent erosion control is established. Silt fence shall be removed upon approval of the RPR.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5200-33 *Hazardous Wildlife Attractants on or Near Airports*

AC 150/5370-2 *Operational Safety on Airports During Construction*

ASTM International (ASTM)

ASTM D6461 *Standard Specification for Silt Fence Materials*

United States Department of Agriculture (USDA)

FAA/USDA Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM C-102

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Item C-105 Mobilization

105-1 Description. This item of work shall consist of, but is not limited to, work and operations necessary for the movement of personnel, equipment, material and supplies to and from the project site for work on the project except as provided in the contract as separate pay items.

105-2 Mobilization limit. Mobilization shall be limited to 10 percent of the total project cost.

105-3 Posted notices. Prior to commencement of construction activities, the Contractor must post the following documents in a prominent and accessible place where they may be easily viewed by all employees of the prime Contractor and by all employees of subcontractors engaged by the prime Contractor: Equal Employment Opportunity (EEO) Poster "Equal Employment Opportunity is the Law" in accordance with the Office of Federal Contract Compliance Programs Executive Order 11246, as amended; Davis Bacon Wage Poster (WH 1321) - DOL "Notice to All Employees" Poster; and Applicable Davis-Bacon Wage Rate Determination. These notices must remain posted until final acceptance of the work by the Owner.

105-4 Engineer/RPR field office. An Engineer/RPR field office is not required.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Office of Federal Contract Compliance Programs (OFCCP)

Executive Order 11246, as amended

EEOC-P/E-1 – Equal Employment Opportunity is the Law Poster

United States Department of Labor, Wage and Hour Division (WHD)

WH 1321 – Employee Rights under the Davis-Bacon Act Poster

END OF ITEM C-105

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Item P-101 Preparation/Removal of Existing Pavements

DESCRIPTION

101-1 This item shall consist of preparation of existing pavement surfaces for overlay, surface treatments, removal of existing pavement, and other miscellaneous items. The work shall be accomplished in accordance with these specifications and the applicable plans.

EQUIPMENT AND MATERIALS

101-2 All equipment and materials shall be specified here and in the following paragraphs or approved by the Resident Project Representative (RPR). The equipment shall not cause damage to the pavement to remain in place.

CONSTRUCTION

101-3.1 Removal of existing pavement.

The Contractor's removal operation shall be controlled to not damage adjacent pavement structure, and base material, cables, utility ducts, pipelines, or drainage structures which are to remain under the pavement.

a. Concrete pavement removal. Full depth saw cuts shall be made perpendicular to the slab surface. The Contractor shall saw through the full depth of the slab including any dowels at the joint, removing the pavement as shown on the plans and per the specifications. Where the perimeter of the removal limits is not located on the joint and there are no dowels present, the perimeter shall be saw cut the full depth of the pavement. The pavement inside the saw cut shall be removed by methods which will not cause distress in the pavement which is to remain in place. If the material is to be wasted on the airport site, it shall be reduced to a maximum size of . Concrete slabs that are damaged by under breaking shall be repaired or removed and replaced as directed by the RPR.

The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Spall and underbreak repair shall be in accordance with the plans. Any underlaying material that is to remain in place, shall be recompacted and/or replaced as shown on the plans. Adjacent areas damaged during repair shall be repaired or replaced at the Contractor's expense.

b. Asphalt pavement removal. Asphalt pavement to be removed shall be cut to the full depth of the asphalt pavement around the perimeter of the area to be removed. If the material is to be wasted on the airport site incorporated into embankment, it shall be broken to a maximum size of inches.

c. Repair or removal of Base, Subbase, and/or Subgrade. All failed material including surface, base course, subbase course, and subgrade shall be removed and repaired as shown on the plans or as directed by the RPR. Materials and methods of construction shall comply with the applicable sections of these specifications. Any damage caused by Contractor's removal process shall be repaired at the Contractor's expense.

101-3.2 Preparation of joints and cracks prior to overlay/surface treatment. Remove all vegetation and debris from cracks to a minimum depth of 1-inch. If extensive vegetation exists, treat the specific area with a concentrated solution of a water-based herbicide approved by the RPR. Fill all cracks greater than 1/4 inch wide with a crack sealant per ASTM D6690. The crack sealant, preparation, and application shall be compatible with the surface treatment/overlay to be used. To minimize contamination of the asphalt with the crack sealant, underfill the crack sealant a minimum of 1/8 inch, not to exceed 1/4 inch. Any excess joint or crack sealer shall be removed from the pavement surface.

Wider cracks (over 1-1/2-inch-wide), along with soft or sunken spots, indicate that the pavement or the pavement base should be repaired or replaced as stated below.

Cracks and joints may be filled with a mixture of emulsified asphalt and aggregate. The aggregate shall consist of limestone, volcanic ash, sand, or other material that will cure to form a hard substance. The combined gradation shall be as shown in the following table.

Gradation

Sieve Size	Percent Passing
No. 4	100
No. 8	90-100
No. 16	65-90
No. 30	40-60
No. 50	25-42
No. 100	15-30
No. 200	10-20

Up to 3% cement can be added to accelerate the set time. The mixture shall not contain more than 20% natural sand without approval in writing from the RPR.

The proportions of asphalt emulsion and aggregate shall be determined in the field and may be varied to facilitate construction requirements. Normally, these proportions will be approximately one-part asphalt emulsion to five parts aggregate by volume. The material shall be poured or placed into the joints or cracks and compacted to form a voidless mass. The joint or crack shall be filled to within +0 to -1/8 inches of the surface. Any material spilled outside the width of the joint shall be removed from the pavement surface prior to constructing the overlay. Where concrete overlays are to be constructed, only the excess joint material on the pavement surface and vegetation in the joints need to be removed.

101-3.3 Removal of Foreign Substances/contaminates prior to overlay or remarking. Removal of foreign substances/contaminates from existing pavement that will affect the bond of the new treatment shall consist of removal of rubber, fuel spills, oil, crack sealer, at least 90% of paint, and other foreign substances from the surface of the pavement. Areas that require removal are designated on the plans and as directed by the RPR in the field during construction.

Chemicals high-pressure waterheater scarifier (asphaltic concrete only) cold milling rotary grinding may be used. If chemicals are used, they shall comply with the state's environmental protection regulations. Removal methods used shall not cause major damage to the pavement, or to any structure or utility within or adjacent to the work area. Major damage is defined as changing the properties of the pavement, removal of asphalt causing the aggregate to ravel, or removing pavement over 1/8 inch deep. If it is deemed by the RPR that damage to the existing pavement is caused by operational error, such as permitting the application method to dwell in one location for too long, the Contractor shall repair the damaged area without compensation and as directed by the RPR.

Removal of foreign substances shall not proceed until approved by the RPR. Water used for high-pressure water equipment shall be provided by the Contractor at the Contractor's expense. No material shall be deposited on the pavement shoulders. All wastes shall be disposed of in areas indicated in this specification or shown on the plans.

101-3.4 Concrete spall or failed asphaltic concrete pavement repair.

a. Repair of concrete spalls in areas to be overlaid with asphalt. Not Used.

b. Asphalt pavement repair. The Contractor shall repair all spalled concrete as shown on the plans or as directed by the RPR. The failed areas shall be removed as specified in paragraph 101-3.1b. All failed material including surface, base course, subbase course, and subgrade shall be removed. Materials and methods of construction shall comply with the applicable sections of these specifications.

101-3.5 Cold milling. Milling shall be performed with a power-operated milling machine or grinder, capable of producing a uniform finished surface. The milling machine or grinder shall operate without tearing or gouging the underlaying surface. The milling machine or grinder shall be equipped with grade and slope controls, and a positive means of dust control. All millings shall be removed and properly disposed off Airport property. If the Contractor mills or grinds deeper or wider than the plans specify, the Contractor shall replace the material removed with new material at the Contractor's Expense.

a. Patching. The milling machine shall be capable of cutting a vertical edge without chipping or spalling the edges of the remaining pavement and it shall have a positive method of controlling the depth of cut. The RPR shall layout the area to be milled with a straightedge in increments of 1-foot widths. The area to be milled shall cover only the failed area. Any excessive area that is milled because the Contractor doesn't have the appropriate milling machine, or areas that are damaged because of his negligence, shall be repaired by the Contractor at the Contractor's Expense.

b. Profiling, grade correction, or surface correction. The milling machine shall have a minimum width of 7 feet and it shall be equipped with electronic grade control devices that will cut the surface to the grade specified. The tolerances shall be maintained within +0 inch and -1/4 inch of the specified grade. The machine must cut vertical edges and have a positive method of dust control. The machine must have the ability to remove the millings or cuttings from the pavement and load them into a truck. All millings shall be removed and disposed of in areas designated on the plans.

c. Clean-up. The Contractor shall sweep the milled surface daily and immediately after the milling until all residual materials are removed from the pavement surface. Prior to paving, the Contractor shall wet down the milled pavement and thoroughly sweep and/or blow the surface to remove loose residual material. Waste materials shall be collected and removed from the pavement surface and adjacent areas by sweeping or vacuuming. Waste materials shall be removed and disposed off Airport property.

101-3.6. Preparation of asphalt pavement surfaces prior to surface treatment.

101-3.7 Maintenance. The Contractor shall perform all maintenance work necessary to keep the pavement in a satisfactory condition until the full section is complete and accepted by the RPR. The surface shall be kept clean and free from foreign material. The pavement shall be properly drained at all times. If cleaning is necessary or if the pavement becomes disturbed, any work repairs necessary shall be performed at the Contractor's expense.

101-3.8 Preparation of Joints in Rigid Pavement prior to resealing. Prior to application of sealant material, clean and dry the joints of all scale, dirt, dust, old sealant, curing compound, moisture and other foreign matter. The Contractor shall demonstrate, in the presence of the RPR, that the method used cleans the joint and does not damage the joint.

101-3.8.1 Removal of Existing Joint Sealant. All existing joint sealants will be removed by plowing or use of hand tools. Any remaining sealant and or debris will be removed by use of wire brushes or other tools as necessary. Resaw joints removing no more than 1/16 inch from each joint face. Immediately after sawing, flush out joint with water and other tools as necessary to completely remove the slurry.

101-3.8.2 Cleaning prior to sealing. Immediately before sealing, joints shall be cleaned by removing any remaining laitance and other foreign material. Allow sufficient time to dry out joints prior to sealing. Joint surfaces will be surface-dry prior to installation of sealant.

101-3.8.3 Joint sealant. Joint material and installation will be in accordance with Item P-605.

101-3.9 Preparation of Cracks in Flexible Pavement prior to sealing. Prior to application of sealant material, clean and dry the joints of all scale, dirt, dust, old sealant, curing compound, moisture and other foreign matter.

The Contractor shall demonstrate, in the presence of the RPR, that the method used cleans the cracks and does not damage the pavement.

101-3.9.1 Preparation of Crack. Widen crack with router random crack saw by removing a minimum of 1/16 inch from each side of crack. Immediately before sealing, cracks will be blown out with a hot air lance combined with oil and water-free compressed air.

101-3.9.2 Removal of Existing Crack Sealant. Existing sealants will be removed by routing random crack saw. Following routing sawing any remaining debris will be removed by use of a hot lance combined with oil and water-free compressed air.

101-3.9.3 Crack Sealant. Crack sealant material and installation will be in accordance with Item P-605.

101-3.9.4 Removal of Pipe and other Buried Structures.

a. Removal of Existing Pipe Material. Not Used.

b. Removal of Inlets/Manholes. Not Used.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

Advisory Circulars (AC)

AC 150/5380-6	Guidelines and Procedures for Maintenance of Airport Pavements.

ASTM International (ASTM)

ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

END OF ITEM P-101

Item P-102 Safety, Security and Maintenance of Airfield Operations

GENERAL

102-1.1 The provisions of this safety and security plan and associated procedures are applicable within the boundaries of the Airport. A complete understanding of all procedures and requirements contained herein is required to ensure safety during construction. The Airport has completed a Construction Safety and Phasing Plan (CSPP), which is included in Appendix 2 of the Technical Specifications. It is required that the contractor comply with this CSPP at all times during the project. The contractor shall be required to submit for approval a Safety Plan Compliance Document (SPCD) which details how the contractor will comply with the CSPP. This safety plan is a part of this Contract and deviations from the requirements established herein will be sufficient cause for Contract termination.

Required reference material associated with this safety plan includes:

FAA AC 150/5200-18, Airport Safety Self-Inspection
FAA AC 150/5210-5, Painting, Marking and Lighting of Vehicles Used on an Airport
FAA AC 150/5370-2, Operational Safety on Airports During Construction

These documents are available online at http://www.faa.gov/airports/resources/advisory_circulars or can be provided upon request.

CONTRACTOR SAFETY AND SECURITY OFFICER

102-2.1 CONTRACTOR SAFETY AND SECURITY OFFICER (CSSO). The Contractor shall appoint its on-site Construction Superintendent or other qualified individual(s) as its duly authorized representative to serve as Contractor Safety and Security Officer (CSSO) for the duration of the Contract. The CSSO shall thoroughly understand the safety and security requirements of the Contract, the necessity for them and shall have sufficient authority to implement its provisions without significant deviation. The Contractor shall notify the Resident Project Representative (RPR) in writing of the name of the individual(s) selected for the assignment.
The CSSO shall represent the Contractor on safety and security requirements compliance. The CSSO shall be especially knowledgeable regarding the requirements of FAA AC's 150/5200-18, Airport Self Inspection Guide and 150/5370-2, Operational Safety on Airports During Construction, latest edition.

102-2.2 RESPONSIBILITIES OF THE CONTRACTOR SAFETY AND SECURITY OFFICER. Prior to the desired date for commencement of any work on the project, the CSSO shall accomplish the following:

a. Develop and submit in writing a detailed work sequence schedule with dates and times specified for all milestone events. This sequence schedule shall be subject to the approval of the RPR. To assure adequate time for coordination, this document shall be submitted at least one week prior to the date of the Pre-construction Conference.

b. Develop and submit in writing a detailed outline of the procedures to be followed to maintain safety and security of both Contractor operations and the integrity of airport landside and airside operations during the prosecution of contract work. This plan shall detail, in addition, the procedures to be followed in the event of an accident or fire involving Contractor personnel and the Contractor's efforts to maintain fire protection and security. These procedures shall be subject to the approval of the RPR and reflect any change as may be deemed necessary.

c. Conduct at least one meeting of all Contractor supervisory personnel prior to the start of contract work. The purpose of this meeting is to review the approved Work sequence schedule and safety and security procedures. Attendance at this meeting by the CSSO, all Contractor supervisory personnel and the RPR is mandatory. This meeting shall also be open to other employees of the Contractor and others as the RPR may deem appropriate. Minutes of this meeting shall be taken by the CSSO, copies provided to each supervisor and kept on file in the Contractor's construction office for periodic review and updating.

d. Develop a safety and security orientation program and provide a briefing for all employees of the Contractor and subcontractors that will be used on the project. A similar briefing will be given to new employees prior to their use on contract work. In addition, the CSSO shall be responsible for briefing, from time to time, all Contractor personnel on any changes to safety and security measures deemed necessary.

e. 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 approvals 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 in advance.

1) 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 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:

i. **Coordination**. Discuss details of proposed safety meetings with the airport operator and with contractor employees and subcontractors.

ii. **Phasing**. Discuss proposed construction schedule elements, including:

1. Duration of each phase.
2. Daily start and finish of construction, including "night only" construction.
3. Duration of construction activities during:
4. Normal runway operations.
5. Closed runway operations.
6. Modified runway "Aircraft Reference Code" usage.

iii. **Areas and operations affected by the construction activity**. These areas and operations should be identified in the CSPP and should not require an entry in the SPCD.

iv. **Protection of NAVAIDs**. Discuss specific methods proposed to protect operating NAVAIDs.

v. **Contractor access**. Provide the following:

1. Details on how the contractor will maintain the integrity of the airport security fence (gate guards, daily log of construction personnel, and other).
2. Listing of individuals requiring driver training (for certificated airports and as requested).
3. Radio communications.
4. Types of radios and backup capabilities.
5. Who will be monitoring radios.
6. Whom to contact if the ATCT cannot reach the contractor's designated person by radio.
7. Details on how the contractor will escort material delivery vehicles.

vi. **Wildlife management**. Discuss the following:

1. Methods and procedures to prevent wildlife attraction.

2. Wildlife reporting procedures.

vii. **Foreign Object Debris (FOD) management**. Discuss equipment and methods for control of FOD, including construction debris and dust.

viii. **Hazardous material (HAZMAT) management**. Discuss equipment and methods for responding to hazardous spills.

ix. **Notification of construction activities**. Provide the following:

1. Contractor points of contact.
2. Contractor emergency contact.
3. Listing of tall or other requested equipment proposed for use on the airport and the timeframe for submitting 7460-1 forms not previously submitted by the airport operator.

x. **Inspection requirements**. Discuss daily (or more frequent) inspections and special inspection procedures.

xi. **Underground utilities**. Discuss proposed methods of identifying and protecting underground utilities.

xii. **Penalties**. Any penalties are identified in the CSPP.

xiii. **Special conditions**. Discuss proposed actions for each special condition identified in the CSPP.

xiv. **Runway and taxiway visual aids**. Including marking, lighting, signs, and visual NAVAIDs. Discuss proposed visual aids including the following:

1. Equipment and methods for covering signage and airfield lights.

xv. **Marking and signs for access routes**. Discuss proposed methods of demarcating access routes for vehicle drivers.

xvi. **Hazard marking and lighting**. Discuss proposed equipment and methods for identifying excavation areas.

xvii. **Protection of runway and taxiway safety areas**, including object free areas, obstacle free zones, and approach/departure surfaces. Discuss proposed methods of identifying, demarcating, and protecting airport surfaces including:

1. Equipment and methods for maintaining Taxiway Safety Area standards.
2. Equipment and methods for separation of construction operations from aircraft operations, including details of barricades.

xviii. **Other limitations on construction** should be identified in the CSPP and should not require an entry in the SPCD.

2) Have available at all times copies of the CSPP and SPCD for reference by the airport operator and its representatives, and by subcontractors and contractor employees.
3) Ensure that construction personnel are familiar with safety procedures and regulations on the airport. Provide a point of contact who will coordinate an immediate response to correct any construction-related activity that may adversely affect the operational safety of the airport. Contractor shall provide 24-hour coverage.
4) Identify in the SPCD the contractor's on-site employees responsible for monitoring compliance with the CSPP and SPCD during construction. At least one of these employees must be on-site whenever active construction is taking place.
5) Conduct inspections sufficiently frequently to ensure construction personnel comply with the CSPP and SPCD and that there are no altered construction activities that could create potential safety hazards.
6) Restrict movement of construction vehicles and personnel to permitted construction areas by flagging, barricading, erecting temporary fencing, or providing escorts, as appropriate and as specified in the CSPP and SPCD.
7) Ensure that no contractor employees, employees of subcontractors or suppliers, or other persons enter any part of the air operations area (AOA) from the construction site unless

authorized.

8) Ensure prompt submittal through the airport operator of Form 7460-1 for the purpose of conducting an aeronautical study of contractor equipment such as tall equipment (cranes, concrete pumps, other equipment), stockpiles, and haul routes when different from cases previously filed by the airport operator. The FAA encourages online submittal of forms for expediency.
9) **Complete the Construction Project Daily Inspection Checklist at the end of each workday.**
10) The Contractor shall submit and receive approval of SPCD prior to issuance of Notice to Proceed.

CONSTRUCTION SEQUENCING

102-3.1 CONSTRUCTION SEQUENCE. The Contractor shall prepare a construction schedule and submit to the RPR at least one week prior to the pre-construction conference.

102-3.2 CLOSING RUNWAYS AND TAXIWAYS. The Contractor shall acquaint his supervisors and employees with the CSPP/sequence of construction and its relationship to airport activity and aircraft operations that are inherent to this airport. No runway, taxiway, apron or airport roadway shall be closed without the written approval of the Owner, to enable necessary NOTAMS and/or advisories to airport fixed based operators (FBOs), tenants and users.

The Contractor shall contact the RPR a minimum of 72 Hours prior to any requested closing. **Failure to properly coordinate work activities does not constitute a time extension to the contract.**

Any construction activity within 150 feet of the centerline or 300 feet from each end of an active runway (runway safety area) or within 59 feet of the centerline of an active taxiway or apron (taxilane object free area) requires the closure of the affected area. These safety areas are shown on the phasing plan.

The RPR will arrange for an inspection prior to return to service of any facility, that has been closed for work, on or adjacent thereto, or that has been used for a crossing point or haul route by the Contractor.

MARKING AND LIGHTING

102-4.1 Proper marking and lighting of areas on the airfield associated with the construction shall be the responsibility of the Contractor and shall be described by the SPCD. This will include properly marking and lighting closed runways, taxiways, taxilanes, and aprons, the limits of construction, material storage areas, equipment storage areas, haul routes, parking areas and other areas defined as required for the Contractor's exclusive use. The Contractor shall erect and maintain around the perimeter of these areas suitable marking and warning devices visible for day and night use. Temporary barricades, flagging, and flashing warning lights shall be required at critical access points. The type and location of marking and warning devices will be approved by the RPR.

Special emphasis shall be given to open trenches, excavations, heavy equipment marshalling areas, and stockpiled material located in the airport operations area, which shall be predominantly marked by the Contractor with flags and lighted by approved light units during hours of restricted visibility and darkness. All marking shall be in accordance with current FAA Advisory Circular (AC) 150/5340-1 ~~or latest edition~~.

TRAFFIC CONTROL

102-5.1 VEHICLE IDENTIFICATION. The Contractor shall establish and maintain a list of Contractor and subcontractor vehicles authorized to operate on the site. Personal vehicles are not allowed in the Airport Operations Area (AOA) at any time. To be authorized to operate on the airport, each Contractor or subcontractor's vehicle shall:

a. be marked/flagged for high daytime visibility and lighted for nighttime operations. Vehicles that are not marked and/or lighted shall be escorted by a vehicle appropriately marked and/or lighted. Vehicles requiring escort shall be identified on the list.

be identified with the name and/or logo of the Contractor and be of sufficient size to be identified at a distance. Vehicles needing intermittent identification could be marked with tape or with commercially available magnetically attached markers. Vehicles that are not appropriately identified shall be escorted by a vehicle that conforms to this requirement. Vehicles requiring escort shall be identified on the list.

b. be operated in a manner that does not compromise the safety of either landside or airside airport operations. If, in the opinion of the RPR, any vehicle is operated in a manner not fully consistent with this requirement, the RPR has the right to restrict operation of the vehicle or prohibit its use on the airport.

c. be operated in a manner that does not compromise the safety of either landside or airside airport operations. If, in the opinion of the RPR, any vehicle is operated in a manner not fully consistent with this requirement, the RPR has the right to restrict operation of the vehicle or prohibit its use on the airport.

102-5.2 ACCESS TO THE SITE OF CONSTRUCTION. The Contractor's access to the site shall be as shown on the Contract Layout Plan. No other access points shall be allowed unless approved by the RPR. All Contractor traffic authorized to enter the site shall be experienced in the route or guided by Contractor personnel. The Contractor shall be responsible for traffic control to and from the various construction areas on the site, and for the operation and security of the access gate to the site. A Contractor's flagman or traffic control person shall monitor and coordinate all Contractor traffic at the access gate with Airport Security. The Contractor shall not permit any unauthorized construction personnel or traffic on the site. Access gates to the site shall be locked and secured at all times when not attended by the Contractor. If the Contractor chooses to leave any access gate open, it shall be attended by Contractor personnel who are familiar with the requirements of the Airport Security Program. The Contractor is responsible for the immediate cleanup of any debris deposited along the access route as a result of his construction traffic. Directional signing from the access gate along the delivery route to the storage area, plant site or work site shall be as directed by the RPR. In addition, the following requirements are applicable:

a. All Contractor traffic authorized to travel on the airport shall have been briefed as part of the Contractor's construction safety and security orientation program, be thoroughly familiar with the access procedures and route for travel or be escorted by personnel authorized by the Contractor Safety and Security Officer (CSSO).

b. The Contractor shall install work site identification signs at the authorized access point(s). If, in the opinion of the RPR, directional signs are needed for clarity, they shall be installed along the route authorized for access to each construction site.

c. Under no circumstance will Contractor personnel be permitted to drive their individually owned vehicles to any construction site on the airport. All vehicles must be parked in the area designated for employee parking and out of secured airport property.

d. In addition to the inspection and cleanup required at the end of each shift, the Contractor is responsible for the immediate cleanup of any debris generated along the construction site access route(s) as a result of construction related traffic or operations whether or not created by Contractor personnel.

102-5.3 MATERIAL SUPPLIERS. All material suppliers, subcontractors and visitors to the work site are obligated to follow the same safety and security operating procedures as the Contractor. All material suppliers shall make their deliveries using the same access points and routes as the Contractor and shall be advised of the appropriate delivery procedures at the time the materials order is placed. The Contractor shall not use the Airport address for any delivery but shall use the street address appropriate to the location of the entrance of the work site. If it is not practical to conform to the vehicle identification requirements of Section 102-5.1 and the safety and security operations program requirements of Section 102-2.2, the Contractor shall be prepared to escort all suppliers, subcontractors and visitors while they are on the airport.

102-5.4 PERSONNEL IDENTIFICATION. All employees, agents, vendors, invitees, etc. of the Contractor or subcontractors requiring access to the construction site shall, conform to the Security Program.

102-5.5 TRAFFIC CONTROL DEVICES, WARNING DEVICES AND BARRIERS.

a. Installation. The responsibility for installation and maintenance of adequate traffic control devices, warning devices and barriers, for the protection of the traveling public and workers, as well as to safeguard the work area in general shall rest with the Contractor. The required traffic control devices, warning devices and barriers shall be erected by the Contractor prior to creation of any hazardous condition and in conjunction with any necessary rerouting of traffic. The Contractor shall immediately remove,turn or cover any devices or barriers that do not apply to existing conditions.

The Contractor shall make the RPR aware of any scheduled operation which will affect traffic patterns or safety sufficiently in advance of commencing such operation to permit their review of the plan for installation of traffic control devices, warning devices, or barriers proposed by the Contractor.

The Contractor shall assign one of their employees the responsibility of maintaining the position and condition of all traffic control devices, warning devices and barriers throughout the duration of the contract. The Project RPR shall be kept advised at all times as to the identification and means of contacting this employee on a 24-hour basis.

b. Furnishing of Devices and Barriers. All traffic control devices (including signs), warning devices and barriers shall be furnished by the Contractor.

c. Maintenance of Devices and Barriers. Traffic control devices, warning devices, and barriers shall be kept in the correct position, properly directed, clearly visible and clean at all times. Damaged, defaced or dirty Devices or barriers shall be immediately repaired, replaced or cleaned as directed.

d. Guard/Flagmen. The Contractor shall provide competent flagmen to direct traffic where one-way operation in a single lane is in effect and in other situations as may be required by the standards established. Contractor shall provide competent gate guard(s) during construction hours and inaccordance with the general notes as specified in the plans.

e. Existing Pavement Markings. Where a detour changes the lane use or where normal vehicle paths are altered during construction, all existing pavement markings that will be in conflict with the adjusted vehicle paths shall be removed. Over-painting will not be allowed. The removal may be accomplished by any method that will not materially damage the surface texture of the pavement and which will eliminate the previous marking pattern regardless of weather and light conditions.

The RPR may waive these requirements for detours that will be in use less than 12 hours.

All pavement markings that will be in conflict with “next phase of operation” vehicle paths shall be removed as described above, prior to opening to traffic, when possible. Markings that cannot be removed prior to changing traffic patterns will be removed as soon as practicable. The term “practicable” shall be interpreted as meaning or implying:

1. Marking removal equipment will be scheduled for use immediately following any change in lanes.
2. If darkness or inclement weather interferes with removal operations, such operations will be accomplished during the next daylight period or as soon thereafter as weather conditions permit.
3. If equipment failures occur such equipment will be repaired, replaced, or leased so that the removal can be accomplished by the following day.

f. Portable Runway Closure Markers. Not Anticipated

g. Portable Light Towers. The Contractor shall provide portable light towers, if needed. The towers shall be trailer mounted, that can be folded for easy transport and storage. The towers shall contain a diesel generator to power a minimum 6000 watts and have fuel capacity to operate at full load for a minimum of 48 hours. It shall be designed to be weather proof. The towers shall be telescoping and capable of rotating over 360 degrees and shall have a minimum of 4-1000 watt metal halide floodlights.

h. Temporary Electrical. Not Anticipated

102-5.6 CROSSING GUARDS/FLAGGERS. The Contractor shall provide at that there expense crossing guards to monitor and control traffic when construction vehicles are crossing pavement areas that are available to aircraft operations. The crossing guards must obtain badges from the Airport Operations department. Crossing guards must monitor the ATCT ground frequency at all times and be able to communicate with the ATCT as necessary. The crossing guard must be approved by Airport Operations and may be required to be replaced if Airport Operations determines that the crossing guard cannot safely meet the requirements of the position. There shall be no separate measurement or payment for crossing guards and they shall be considered incidental to the Safety and Security pay item.

GENERAL SAFETY REQUIREMENTS

102-6.1 All Contractor vehicles that are authorized to operate on the airport outside of the designated construction area limits or haul routes as defined herein shall display in full view above the vehicle a flashing amber (yellow) dome-type light or a three-foot by three-foot, or larger, orange and white checkerboard flag, each checkerboard color being one-foot square. Vehicles must be under control of a Contractor mobile (two-way) radio operator (flagmen) monitoring the Airport frequency. Vehicle operators must be vigilant for conflict with any aircraft and give way to any operating aircraft.

All Contractor vehicles that are required to operate outside of the construction area limits as defined herein and cross active runways, taxiways, aprons, or runway approach clear zones shall do so under the direct control of a flagman who is monitoring the Airport frequency. Flagmen and two-way radios shall be furnished by the Contractor. Flagmen shall be instructed in the use of two-way radios prior to use. All aircraft traffic on runways, taxiways and aprons shall have priority over Contractor's traffic.

Construction vehicles not in use for extended periods during the work day, or during nights and weekends (nonwork periods) shall be parked away from active runways, taxiways, and aprons in designated vehicle marshalling areas.

102-6.2 In order to protect all aircraft traffic, aviation related businesses, terminal apron areas, etc. from potential damage caused by foreign object debris (FOD) generated by construction activities, the Contractor shall provide a vacuum truck as required at the startup of construction to daily vacuum all pavements affected by construction. The vacuum truck shall remain on-site for the duration of the project and shall be available at the discretion of the Owner to vacuum pavement areas adjacent to the construction areas to ensure no FOD is present on pavements within 500 feet of any construction area. Protecting the aircraft, airport tenants, users, public, etc. against FOD is a critical safety issue therefore the cost of the vacuum truck will be included in the cost established for this specification item.

CONSTRUCTION CONTROL

102-7.1 A primary and alternate responsible Contractor's representative shall be designated by the Contractor. The Contractor's representatives shall be available locally on a 24-hour basis. Names of the primary and alternate, including phone number, shall be made available to the RPR by the Contractor. The Contractor shall insure that the names and phone numbers are kept current and made available to the RPR.

CONSTRUCTION TECHNIQUES

102-8.1 Construction shall be planned and conducted throughout this project in such a manner as to allow the maintenance of completely safe airport operations. Every effort shall be made to reduce the impact of construction activity on overall airport operations. To this end the Contractor's activities shall be conducted in such a manner so as to preclude, except where absolutely required, open excavations, trenches, ditches and above ground obstacles such as booms on cranes or obstacle markers such as wooden saw horses. The primary responsibility for assuring that the safest possible construction techniques are followed rests with the Contractor Safety and Security Officer (CSSO).

END OF ITEM P-102

Item P-103 Survey and Stakeout

DESCRIPTION

103-1.1 Under this item, the Contractor shall do all necessary surveying required to construct all elements of the work as shown on the Contract Drawings and specified in the proposal and specifications. This shall include but not be limited to stakeout, layout and elevations for pavements, structures, forms and appurtenances as shown and required, consistent with the current practices and shall be performed by qualified personnel acceptable to the Resident Project Representative (RPR). The stakeout survey shall proceed immediately following the award of the Contract or as soon as authorized by the Owner and shall be expeditiously progressed to completion in a manner and at a rate satisfactory to the RPR. The Contractor shall keep the RPR fully informed as to the progress of the stakeout survey. All survey work shall be provided under the direction of a licensed land surveyor.

MATERIALS

103-2.1 All instruments, equipment, stakes and any other material necessary to perform the work satisfactorily shall be provided by the Contractor.
All stakes used shall be of a type approved by the RPR. It shall be the Contractor's responsibility to maintain these stakes in their proper position and location at all times.

CONSTRUCTION METHODS

103-3.1 The Contractor shall trim trees, brush and other interfering objects, not inconsistent with the Contract Drawings, from survey lines in advance of all survey work to permit accurate and unimpeded work by his stakeout survey crews.

The exact position of all work shall be established from control points, baseline transit points or other points of similar nature that are shown on the Contract Drawings and/or modified by the RPR. Any error, apparent discrepancy, or absence in or of data shown or required for accurately accomplishing the stakeout survey shall be referred to the RPR for interpretation or furnishing when such is observed or required.

The Contractor shall place two offset stakes or references at each centerline station and at such intermediate locations as the RPR may direct. From computations and measurements made by the Contractor, these stakes shall be clearly and legibly marked with the correct centerline station number, offset and cut or fill so as to permit the establishment of the exact centerline location and elevation during construction. If markings become faded or blurred for any reason, the markings shall be restored by the Contractor at the request of the RPR. He shall locate and place all cut, fill, slope, fine grade or other stakes and points, as the RPR may direct, for the proper progress of the work. All control points shall be properly guarded and flagged for easy identification.

Drainage structures shall be staked out by the Contractor at the locations and elevations shown on the Contract Drawings or specified by the RPR.

Reference points, baselines, stakes and benchmarks for borrow pits shall be established by the Contractor.

Permanent survey marker locations shall be established and referenced by the Contractor.

The Contractor shall be responsible for the accuracy of his work and shall maintain all reference points, stakes, etc., throughout the life of the work. Damaged or destroyed points, benchmarks or stakes, or any reference points made inaccessible by the progress of the construction, shall be replaced, or transferred by the Contractor. Any of the above points which may be destroyed or damaged shall be transferred by the Contractor before they are damaged or destroyed. All control points shall be referenced by ties to acceptable objects and recorded. Any alterations or revisions in the ties shall be so noted and the information furnished to the RPR immediately. All stakeout survey work shall be referenced to the centerlines shown on the Contract Drawings. All computations necessary to establish the exact position of the work from control points shall be made and preserved by the Contractor. All computations, survey notes and other records necessary to accomplish the work, shall be neatly made. Such computations, survey notes and other records shall be made available to the RPR upon request and shall become the property of the Owner and delivered to the RPR not later than the date of acceptance of the Contract.

The Contractor shall furnish, at his expense, all horizontal and vertical control, all staking and layout of construction work called for on the plans and the RPR and Owner shall not be responsible for such work. However, the Owner and RPR reserve the right to check all said lines, grades, and measurements with their appointed surveyor. Should the Owner's surveyor detect errors in said lines, grades, and measurements, the Contractor shall pay for all said surveying costs and subsequent surveying costs performed to verify correction of errors found in said lines, grades and measurements. Included in this are all blue top staking for subgrade and base course installation. Definition of an error shall be a discrepancy of 1/4" or more. In the case of a discrepancy between the technical specifications and this defined tolerance, this tolerance shall govern.

Prior to the final cross-section survey of the work by the Contractor, the Contractor shall reestablish centerline or baseline points and stationing as required by the RPR.

Prior to the final cross-section survey of any borrow pits, the Contractor shall reestablish the baseline points and stationing, as well as any necessary benchmarks as required by the RPR.

During the progress of the construction work, the Contractor will be required to furnish all of the surveying and stakeout incidental to the proper location by line and grade for each phase of the work. For paving and any other operation requiring extreme accuracy, the Contractor will re-stake with pins or other acceptable hubs located directly adjacent to the work at a spacing directed by the RPR.

Any existing stakes, iron pins, survey monuments or other markers defining property lines which may be disturbed during construction shall be properly tied into fixed reference points before being disturbed and accurately reset in their proper position upon completion of the work.

Just prior to completion of the work, the Contractor shall reestablish, if necessary, and retie all control points as permanently as possible and to the satisfaction of the RPR.

103-3.2 The Contractor shall be required to submit cross sectional data to the RPR at monthly intervals prior to the Contractor submittal of the monthly application for payment so that the RPR can verify the quantities of various earthwork and materials volumes for payment. All cross sectional data provided at any time will be in AutoCad Civil 3D format only. All digital files shall be directly compatible with AutoCAD platforms without conversion. No other formats will be accepted. If the data is submitted in another format other than AutoCAD, no earthwork or other materials volumes will be calculated and approved for payment. The earthwork shall include, but not be limited to, unclassified excavation, embankment, new or existing subbase courses, new or existing base courses, sand/asphalt subgrade, topsoil, etc.

AS-BUILT SURVEY

103-4.1 Upon completion of the Work, after Substantial Completion and before Final Acceptance, the Contractor shall supply to the RPR a complete as-built survey of the entire project site including drainage structures and utilities. All survey points, including horizontal and vertical control, property corners, section corner and reference (hereinafter referred to as "survey point") shall be clearly marked and referenced prior to construction. These survey points must be sufficiently referenced so that they can be reestablished after construction if they are disturbed. All elevation survey data shall be based on the New York State Plane Coordinate System, US Survey Feet (Zone 3101). Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical) Survey Staking, and cross-sectional intervals shall be as described in this manual. The surveyor may perform the as-built survey on the newer datums if the new datums are released in New York State for common use by the time of construction. All survey data shall be based on the New York State Plane Coordinate System, US Survey Feet (Zone 3101). Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical). Additionally, Contractor shall re-establish the Primary and Secondary Airport control points (SACS and PACS) located as described in the Contract Drawings in accordance with current FAA Advisory Circular 150/5300-18.

This as-built survey will be a complete topographic and physical features survey of the entire project site surrounded by the limits of construction plus 25 feet in all directions. Elevations shall be obtained on all rigid pavement joint intersections, runway ends and displaced threshold locations. If any work is done outside the limits of construction for any reason, this limit of survey will be increased to include this area plus 25 feet. A New York State Professional Land Surveyor shall certify this survey has been performed in accordance with New York State Department of Transportation Standard Specifications Section 105-10, New York State Land Surveying Standards and Procedures Manual Chapter 15, and New York Stat Association of Professional Land Surveyors Code of Practice. The survey data must be supplied as a signed and sealed drawing (22” x 34”) at a minimum scale of 1”=50’ and be electronically submitted in digital forms that are directly compatible with AutoCAD platforms without conversion. Signed and sealed copies of all field notes, sketches and calculations must be submitted concurrently with the as-built survey. Larger details shall be provided to clarify any complicated or complex areas. A separate point database file shall be electronically submitted in TXT or ASCIII format, with each point on a single row with comma delimited columns with data ordered as follows: point number, northing, easting, elevation, description.

END OF ITEM P-103

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Item P-152 Excavation, Subgrade, and Embankment

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all materials within the limits of the work required to construct safety areas, runways, taxiways, aprons, and intermediate areas as well as other areas for drainage, building construction, parking, or other purposes in accordance with these specifications and in conformity to the dimensions and typical sections shown on the plans.

152-1.2 Classification. All material excavated shall be classified as defined below:

a. Unclassified excavation. Unclassified excavation shall consist of the excavation and disposal of all material, regardless of its nature which is not otherwise classified and paid for under one of the following items.

b. Drainage excavation. Drainage excavation shall consist of all excavation made for the primary purpose of drainage and includes drainage ditches, such as intercepting, inlet or outlet ditches; temporary levee construction; or any other type as shown on the plans.

c. Borrow excavation. Borrow excavation shall consist of approved material required for the construction of embankments or for other portions of the work in excess of the quantity of usable material available from required excavations. Borrow material shall be obtained from areas designated by the Resident Project Representative (RPR) within the limits of the airport property but outside the normal limits of necessary grading, or from areas outside the airport boundaries.

152-1.3 Unsuitable excavation. Unsuitable material shall be disposed of offsite or in locations identified by the RPR. Materials containing vegetation or organic matter, such as muck, peat, organic silt, or sod shall be considered unsuitable for use in embankment construction. Material suitable for topsoil may be used on the embankment slope when approved by the RPR.

CONSTRUCTION METHODS

152-2.1 General. Before beginning excavation, grading, and embankment operations in any area, the area shall be cleared and grubbed.

The suitability of material to be placed in embankments shall be subject to approval by the RPR. All unsuitable material shall be disposed of in waste areas as shown on the plans. All waste areas shall be graded to allow positive drainage of the area and adjacent areas. The surface elevation of waste areas shall be specified on the plans or approved by the RPR.

When the Contractor's excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the RPR notified per Section 70, paragraph 70-20. At the direction of the RPR, the Contractor shall 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.

Areas outside the limits of the pavement areas where the top layer of soil has become compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches, to loosen and pulverize the soil. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top 6 inches of the subgrade.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. When such facilities are encountered, the Contractor shall notify the RPR, who shall arrange for their removal if necessary. The Contractor, at their own expense, shall satisfactorily repair or pay the cost of all damage to such facilities or structures that may result from any of the Contractor's operations during the period of the contract.

a. Blasting. Blasting shall not be allowed.

152-2.2 Excavation. No excavation shall be started until the work has been staked out by the Contractor and the RPR has obtained from the Contractor, the survey notes of the elevations and measurements of the ground surface. The Contractor and RPR shall agree that the original ground lines shown on the original topographic mapping are accurate or agree to any adjustments made to the original ground lines.

Digital terrain model (DTM) files of the existing surfaces finished surfaces and other various surfaces were used to develop the design plans.

Volumetric quantities were calculated by comparing DTM files of the applicable design surfaces and generating Triangle Volume Reports. Electronic copies of DTM files and a paper copy of the original topographic map will be issued to the successful bidder.

Existing grades on the design cross sections or DTM's, where they do not match the locations of actual spot elevations shown on the topographic map, were developed by computer interpolation from those spot elevations. Prior to disturbing original grade, Contractor shall verify the accuracy of the existing ground surface by verifying spot elevations at the same locations where original field survey data was obtained as indicated on the topographic map. Contractor shall recognize that, due to the interpolation process, the actual ground surface at any particular location may differ somewhat from the interpolated surface shown on the design cross sections or obtained from the DTM's. Contractor's verification of original ground surface, however, shall be limited to verification of spot elevations as indicated herein, and no adjustments will be made to the original ground surface unless the Contractor demonstrates that spot elevations shown are incorrect. For this purpose, spot elevations which are within 1/10 foot of the stated elevations for ground surfaces, or within 1/25 foot for hard surfaces (pavements, buildings, foundations, structures, etc.) shall be considered "no change". Only deviations in excess of these will be considered for adjustment of the original ground surface. If Contractor's verification identifies discrepancies in the topographic map, Contractor shall notify the RPR in writing at least two weeks before disturbance of existing grade to allow sufficient time to verify the submitted information and make adjustments to the design cross sections or DTM's. Disturbance of existing grade in any area shall constitute acceptance by the Contractor of the accuracy of the original elevations shown on the topographic map for that area.

All areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans or by the RPR. All suitable excavated material shall be used in the formation of embankment, subgrade, or other purposes as shown on the plans. All unsuitable material shall be disposed of as shown on the plans or become the property of the Contractor and disposed of offsite at no additional cost to the Owner.

The grade shall be maintained so that the surface is well drained at all times.

When the volume of the excavation exceeds that required to construct the embankments to the grades as indicated on the plans, the excess shall be used to grade the areas of ultimate development or disposed as directed by the RPR. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow areas.

a. Selective grading. When selective grading is indicated on the plans, the more suitable material designated by the RPR shall 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 shall be stockpiled in approved areas until it can be placed. The more suitable material shall then be placed and compacted as specified. Selective grading shall be considered incidental to the work involved. The cost of stockpiling and placing the material shall be included in the various pay items of work involved.

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for safety areas, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches below the subgrade or to the depth specified by the RPR. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed when encountered within the work area. Unsuitable materials shall be disposed of off the airport. This excavated material shall be paid for at the contract unit price per cubic yard for unsuitable excavation. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow areas and compacted to specified densities. The necessary backfill will constitute a part of the embankment. Where rock cuts are made, backfill with select material. Any pockets created in the rock surface shall be drained in accordance with the details shown on the plans. Undercutting will be paid as unclassified excavation.

c. Over-break. Over-break, including slides, is that portion of any material displaced or loosened beyond the finished work as planned or authorized by the RPR. All over-breaks shall be graded or removed by the Contractor and disposed of as directed by the RPR. The RPR shall determine if the displacement of such material was unavoidable and their own decision shall be final. Payment will not be made for the removal and disposal of over-break that the RPR determines as avoidable. Unavoidable over-break will be classified as "Unclassified Excavation."

d. Removal of utilities. The removal of existing structures and utilities required to permit the orderly progress of work will be accomplished by the Contractor as indicated on the plans. All existing foundations shall be excavated at least 2 feet below the top of subgrade or as indicated on the plans, and the material disposed of as directed by the RPR. All foundations thus excavated shall be backfilled with suitable material and compacted as specified for embankment or as shown on the plans.

152-2.3 Borrow excavation. Contractor shall locate and obtain borrow sources, subject to the approval of the RPR. The Contractor shall notify the RPR at least 15 days prior to beginning the excavation so necessary measurements and tests can be made by the Contractor and submitted to the RPR for approval. All borrow pits shall be opened to expose the various strata of acceptable material to allow obtaining a uniform product. Borrow areas shall be drained and left in a neat, presentable condition with all slopes dressed uniformly. Borrow areas shall not create a hazardous wildlife attractant if on or near the airport and shall comply with the standards in AC 150/5200-33, Hazardous Wildlife Attractants on or near Airports and the Construction Safety and Phasing Plan (CSPP).

152-2.4 Drainage excavation. Drainage excavation shall consist of excavating drainage ditches including intercepting, inlet, or outlet ditches; or other types as shown on the plans. The work shall be performed in sequence with the other construction. Ditches shall be constructed prior to starting adjacent excavation operations. All satisfactory material shall be placed in embankment fills; unsuitable material shall be disposed of off Airport property. Hauling and disposal is incidental to embankment in place. All necessary work shall be performed true to final line, elevation, and cross-section. The Contractor shall maintain ditches constructed on the project to the required cross-section and shall keep them free of debris or obstructions until the project is accepted.

152-2.5 Preparation of cut areas or areas where existing pavement has been removed. In those areas on which a subbase or base course is to be placed, the top 12 inches of subgrade shall be compacted to not less than 100 % of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D1557. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

152-2.6 Preparation of embankment area. All sod and vegetative matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be broken up by plowing or scarifying to a minimum depth of 6 inches and shall then be compacted per paragraph 152-2.10.

Sloped surfaces steeper than one (1) vertical to four (4) horizontals shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

No direct payment shall be made for the work performed under this section. The necessary clearing and grubbing and the quantity of excavation removed will be paid for under the respective items of work.

152-2.7 Control Strip. The first half-day of construction of subgrade and/or embankment shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor's expense. Full operations shall not begin until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the RPR.

152-2.8 Formation of embankments. The material shall be constructed in lifts as established in the control strip, but not less than 6 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications.

The lifts shall be placed, to produce a soil structure as shown on the typical cross-section or as directed by the RPR. Materials such as brush, hedge, roots, stumps, grass, and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained due to rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each lift shall be within ±2% of optimum moisture content before rolling to obtain the prescribed compaction. The material shall be moistened or aerated as necessary to achieve a uniform moisture content throughout the lift. Natural drying may be accelerated by blending in dry material or manipulation alone to increase the rate of evaporation.

The Contractor shall make the necessary corrections and adjustments in methods, materials, or moisture content to achieve the specified embankment density.

The contractor will take samples of excavated materials which will be used in embankment for testing and develop a Moisture-Density Relations of Soils Report (Proctor) in accordance with ASTM D1557. A new Proctor shall be developed for each soil type based on visual classification.

Density tests will be taken by the contractor for every 3,000 square yards of compacted embankment for each lift which is required to be compacted, or other appropriate frequencies as determined by the RPR.

If the material has greater than 30% retained on the 3/4-inch sieve, follow AASHTO T-180 Annex Correction of maximum dry density and optimum moisture for oversized particles.

Rolling operations shall be continued until the embankment is compacted to not less than 100% of maximum density for non-cohesive soils, and 95% of maximum density for cohesive soils as determined by ASTM D1557. Under all areas to be paved, the embankments shall be compacted to a depth of 12-inches and to a density of not less than 100% percent of the maximum density as determined by ASTM D1557. As used in this specification, "non-cohesive" shall mean those soils having a plasticity index (PI) of less than 3 as determined by ASTM D4318.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches which shall be prepared for a sodding in accordance with T-904.

The in-place field density shall be determined in accordance with ASTM D1556 or ASTM 6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The Contractor’s laboratory shall perform all density tests in the RPR’s presence and provide the test results upon completion to the RPR for acceptance. If the specified density is not attained, the area represented by the test or as designated by the RPR shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

Compaction areas shall be kept separate, and no lift shall be covered by another lift until the proper density is obtained.

During construction of the embankment, the Contractor shall route all construction equipment evenly over the entire width of the embankment as each lift is placed. Lift placement shall begin in the deepest portion of the embankment fill. As placement progresses, the lifts shall be constructed approximately parallel to the finished pavement grade line.

When rock, concrete pavement, asphalt pavement, and other embankment material are excavated at approximately the same time as the subgrade, the material shall be incorporated into the outer portion of the embankment and the subgrade material shall be incorporated under the future paved areas. Stones, fragmentary rock, and recycled pavement larger than 4 inches in their greatest dimensions will not be allowed in the top 12 inches of the subgrade. Rockfill shall be brought up in lifts as specified or as directed by the RPR and the finer material shall be used to fill the voids forming a dense, compact mass. Rock cement concrete pavement, asphalt pavement, and other embankment material shall not be disposed of except at places and in the manner designated on the plans or by the RPR.

When the excavated material consists predominantly of rock fragments of such size that the material cannot be placed in lifts of the prescribed thickness without crushing, pulverizing, or further breaking down the pieces, such material may be placed in the embankment as directed in lifts not exceeding 2 feet in thickness. Each lift shall be leveled and smoothed with suitable equipment by distribution of spalls and finer fragments of rock. The lift shall not be constructed above an elevation 4 feet below the finished subgrade.

There will be no separate measurement of payment for compacted embankment. All earthworks costs are incidental to placing in lifts, compacting, discing, moisture conditioning, mixing, sloping, and other operations necessary for construction of embankments will be included in the contract price for unclassified excavation, borrow, or other items.

152-2.9 Proof rolling. The purpose of proof rolling the subgrade is to identify any weak areas in the subgrade and not for compaction of the subgrade. Before start of embankment, and **a**fter compaction is completed, the subgrade area shall be proof rolled with a 20-ton Tandem axle Dual Wheel Dump Truck loaded to the legal limit with tires inflated to 80/100/150 psi or a 35-ton Proof Roller with tires spaced not more than 32 inches on-center with tires inflated to 100/125/150 psi in the presence of the RPR. Apply a minimum of four passes of full coverage, or as specified by the RPR, under pavement areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than one-inch or show permanent deformation greater than one-inch shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications. Removal and replacement of soft areas is incidental to this item.

The Contractor shall locate, investigate the depth of and shall protect existing utilities from damage during proof rolling activities.

152-2.10 Compaction requirements. The subgrade under areas to be paved shall be compacted to a depth of 12 inches and to a density of not less than 100 percent of the maximum dry density as determined by ASTM D1557. The subgrade in areas outside the limits of the pavement areas shall be compacted to a depth of 12 inches and to a density of not less than 95 percent of the maximum density as determined by ASTM D1557.

The material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction (except for expansive soils). When the material has greater than 30 percent retained on the 3/4-inch sieve, follow the methods in ASTM D1557. Tests for moisture content and compaction will be taken at a minimum of 1,000 S.Y. of subgrade. Quality assurance testing shall be performed by the RPR.

The in-place field density shall be determined in accordance with ASTM D1556 or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938 within 12 months prior to its use on this contract. The gauge shall be field standardized daily.

Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

If the specified density is not attained, the entire lot shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached.

All cut-and-fill slopes shall be uniformly dressed to the slope, cross-section, and alignment shown on the plans or as directed by the RPR and the finished subgrade shall be maintained.

152-2.11 Finishing and protection of subgrade. Finishing and protection of the subgrade is incidental to this item. Grading and compacting of the subgrade shall be performed so that it will drain readily. All low areas, holes or depressions in the subgrade shall be brought to grade. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans. All ruts or rough places that develop in the completed subgrade shall be graded, re-compacted, and retested. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes.

The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been accepted by the RPR.

152-2.12 Haul. All hauling will be considered a necessary and incidental part of the work. The Contractor shall include the cost 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.

The Contractor's equipment shall not cause damage to any excavated surface, compacted lift or to the subgrade as a result of hauling operations. Any damage caused as a result of the Contractor's hauling operations shall be repaired at the Contractor's expense.

The Contractor shall be responsible for providing, maintaining, and removing any haul roads or routes within or outside of the work area and shall return the affected areas to their former condition, unless otherwise authorized in writing by the Owner. No separate payment will be made for any work or materials associated with providing, maintaining, and removing haul roads or routes.

152-2.13 Surface Tolerances. In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

a. Smoothness. The finished surface shall not vary more than +/- 1/2 inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

b. Grade. The grade and crown shall be measured on a 50-foot grid and shall be within +/-0.05 feet of the specified grade.

On safety areas, turfed areas, and other designated areas within the grading limits where no subbase or base is to be placed, grade shall not vary more than 1/10 feet from specified grade. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing materials, and reshaping.

152-2.14 Topsoil. When topsoil is specified or required as shown on the plans or under Item T-905, it shall be salvaged from stripping or other grading operations. The topsoil shall meet the requirements of Item T-905. If, at the time of excavation or stripping, the topsoil cannot be placed in its final section of finished construction, the material shall be stockpiled at approved locations. Stockpiles shall be located as shown on the plans and the approved CSPP and shall not be placed on areas that subsequently will require any excavation or embankment fill. If, in the judgment of the RPR, it is practical to place the salvaged topsoil at the time of excavation or stripping, the material shall be placed in its final position without stockpiling or further re-handling.

Upon completion of grading operations, stockpiled topsoil shall be handled and placed as shown on the plans and as required in Item T-905. Topsoil shall be paid for as provided in Item T-905. No direct payment will be made for topsoil under Item P-152.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

American Association of State Highway and Transportation Officials (AASHTO)

AASHTO T-180	Standard Method of Test for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18-in. Drop

ASTM International (ASTM)

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

Advisory Circulars (AC)

AC 150/5370-2	Operational Safety on Airports During Construction Software

Software

FAARFIELD – FAA Rigid and Flexible Iterative Elastic Layered Design

U.S. Department of Transportation

FAA RD-76-66 Design and Construction of Airport Pavements on Expansive Soils

END OF ITEM P-152

Item P-154 Subbase Course

DESCRIPTION

154-1.1 This item shall consist of a subbase course composed of granular materials constructed on a prepared subgrade or underlying course in accordance with these specifications, and in conformity with the dimensions and typical cross-section shown on the plans.

MATERIALS

154-2.1 Materials. The subbase material shall consist of hard durable particles or fragments of granular aggregates. The material may be obtained from gravel pits, stockpiles, or may be produced from a crushing and screening plant with proper blending. The materials from these sources shall meet the requirements for gradation, quality, and consistency. The material shall be free from vegetative matter, excessive amounts of clay, and other objectionable substances; uniformly blended; and be capable of being compacted into a dense, stable subbase.

The subbase material shall exhibit a California Bearing Ratio (CBR) value of at least 20 when tested in accordance with ASTM D1883. The subbase material shall meet the gradation specified in the table below.

154-2.2 Sampling and testing.

a. Aggregate base materials. Samples shall be taken by the Contractor per ASTM D75 for initial aggregate subbase requirements and gradation. Material shall meet the requirements in paragraphs 154-2.1. The Contractor shall submit to the Resident Project Representative (RPR) certified test results showing that the aggregate meets the Material requirements of this section. Tests shall be representative of the material to be used for the project.

b. Gradation requirements. The Contractor shall take at least one aggregate subbase sample per day in the presence of the RPR to check the final gradation. Samples shall be taken from the in-place, un-compacted material at sampling locations determined by the RPR on a random basis per ASTM D3665. Sampling shall be per ASTM D75 and tested per ASTM C136 and ASTM C117. Results shall be furnished to the RPR by the Contractor each day during construction. Material shall meet the requirements in paragraph 154-2.1.

154-2.3 Separation Geotextile. Not used.

154-2.4 Geogrid. Not used.

CONSTRUCTION METHODS

154-3.1 General. The subbase course shall be placed where designated on the plans or as directed by the RPR. The material shall be shaped and thoroughly compacted within the tolerances specified.

Granular subbases which, due to grain sizes or shapes, are not sufficiently stable to support the construction equipment without movement, shall be mechanically modified to the depth necessary to provide stability as directed by the RPR. The mechanical modification shall include the addition of a fine-grained medium to bind the particles of the subbase material sufficiently to furnish a bearing strength, so the course will not deform under construction equipment traffic.

154-3.2 Preparing underlying course. Prior to constructing the subbase course, clean the underlying course or subgrade of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances in accordance with Item P-152. Correct ruts, soft yielding spots in the underlying courses, and subgrade areas having inadequate compaction and/or deviations of the surface from the specified requirements, by loosening and removing soft or unsatisfactory material, adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses or subgrades containing sands or gravels, as defined in ASTM D2487, the surface shall be stabilized prior to placement of the overlying course by mixing the overlying course material into the underlying course, and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements for the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until the overlying course is placed. The underlying course shall be checked and accepted by the RPR before placing and spreading operations are started.

To protect the subgrade and to ensure proper drainage, spreading of the subbase shall begin along the centerline of the pavement on a crowned section or on the high side of pavements with a one-way slope.

154-3.3 Control Strip. The first half-day of subbase construction shall be considered as a control strip for the Contractor to demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of this specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor’s demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted, or removed and replaced at the Contractor’s expense. Full operations shall not begin until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved in advance by the RPR.

154-3.4 Placement. The material shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted. The material shall not be placed when the underlying course is soft or yielding.

The material shall meet gradation and moisture requirements prior to compaction. Material may be free-draining and the minimum moisture content shall be established for placement and compaction of the material.

The material shall be constructed in lifts as established in the control strip, but not less than 4 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications.

154-3.5 Compaction. The subbase material shall be compacted, adjusting moisture as necessary, to be within ±2% of optimum moisture. The field density of the compacted material shall be at least 100% of the maximum density as specified in paragraph 154-3.9a. If the specified density is not attained, the area of the lift represented by the test shall be reworked and/or re-compacted and additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

154-3.6 Weather limitation. Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on subbase course shall not be conducted when the subgrade is wet or frozen or the subbase material contains frozen material.

154-3.7 Maintenance. No base or surface course shall be placed on the subbase until the subbase has been accepted by the RPR. The Contractor shall maintain the completed course in satisfactory condition throughout placement of subsequent layers. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, the Contractor shall verify that materials still meet all specification requirements before placement of additional material. Equipment may be routed over completed sections of subbase course, provided the equipment does not damage the subbase course and the equipment is routed over the full width of the completed subbase course. Any damage to the subbase course from routing equipment over the subbase course shall be repaired by the Contractor at their expense.

154-3.8 Surface tolerance. In those areas on which a subbase or base course is to be placed, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and re-compacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. The Contractor shall perform all final smoothness and grade checks in the presence of the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense.

a. Smoothness. The finished surface shall not vary more than +/- 1/2 inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

b. Grade. The grade and crown shall be measured on a 50-foot grid and shall be within +/- 1/20 feet of the specified grade.

154-3.9 Acceptance sampling and testing. The aggregate base course shall be accepted for density and thickness on an area basis. Two test shall be made for density and thickness for each 1200 square yards. Sampling locations will be determined on a random basis per ASTM D3665.

a. Density. The Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM D1557. The in-place field density shall be determined per ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test shall be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

When the material has greater than 30 percent retained on the 3/4 inch sieve, use methods in ASTM D1557 and the procedures in AASHTO T180 Annex for correction of maximum dry density and optimum moisture for oversized particles.

b. Thickness. The thickness of the base course shall be within +0 and -1/2 inch of the specified thickness as determined by depth tests taken by the Contractor in the presence of the RPR for each area. Where the thickness is deficient by more than 1/2-inch, the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches, adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C117	Standard Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
ASTM D2487	Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D4253	Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D4759	Practice for Determining the Specification Conformance of Geosynthetics
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

American Association of State Highway and Transportation Officials (AASHTO)

M 288	Geotextile Specification for Highway Applications

END OF ITEM P-154

Item P-209 Crushed Aggregate Base Course

DESCRIPTION

209-1.1 This item consists of a base course composed of crushed aggregate base constructed on a prepared course in accordance with these specifications and in conformity to the dimensions and typical cross-sections shown on the plans.

MATERIALS

209-2.1 Crushed aggregate base. Crushed aggregate shall consist of clean, sound, durable particles of crushed stone, crushed gravel, and shall be free from coatings of clay, silt, organic material, clay lumps or balls or other deleterious materials or coatings. The method used to produce the crushed gravel shall result in the fractured particles in the finished product as consistent and uniform as practicable. Fine aggregate portion, defined as the portion passing the No. 4 sieve shall consist of fines from the coarse aggregate crushing operation. The fine aggregate shall be produced by crushing stone, gravel that meet the coarse aggregate requirements for wear and soundness. Aggregate base material requirements are listed in the following table.

Crushed Aggregate Base Material Requirements

Material Test	Requirement	Standard
Coarse Aggregate		
Resistance to Degradation	Loss: 45% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate **or** Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Percentage of Fractured Particles	Minimum 90% by weight of particles with at least two fractured faces and 100% with at least one fractured face[1]	ASTM D5821
Flat Particles, Elongated Particles, or Flat and Elongated Particles	10% maximum, by weight, of flat, elongated, or flat and elongated particles [2]	ASTM D4791
Bulk density of slag	Weigh not less than 70 pounds per cubic foot	ASTM C29
Clay lumps and friable particles	Less than or equal to 3 percent	ASTM C142
Fine Aggregate		
Liquid limit	Less than or equal to 25	ASTM D4318
Plasticity Index	Not more than five (5)	ASTM D4318

[1] The area of each face shall 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 shall be at least 30 degrees to count as two fractured faces.

[2] A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

209-2.2 Gradation requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in the following table when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

Gradation of Aggregate Base

Sieve Size	Design Range Percentage by Weight passing	Contractor's Final Gradation	Job Control Grading Band Tolerances[1] (Percent)
2 inch	100		0
1-1/2 inch	95-100		±5
1 inch	70-95		±8
3/4 inch	55-85		±8
No. 4	30-60		±8
No. 40[2]	10-30		±5
No. 200[2]	0-10		±3

[1]The "Job Control Grading Band Tolerances for Contractor's Final Gradation" in the table shall be applied to "Contractor's Final Gradation" to establish a job control grading band. The full tolerance still applies if application of the tolerances results in a job control grading band outside the design range.

[2]The fraction of material passing the No 200 (75 µm) sieve shall not exceed two-thirds the fraction passing the No 40 (425 µm) sieve.

209-2.3 Sampling and Testing.

a. Aggregate base materials. The Contractor shall take samples of the aggregate base in accordance with ASTM D75 to verify initial aggregate base requirements and gradation. Material shall meet the requirements in paragraph 209-2.1. This sampling and testing will be the basis for approval of the aggregate base quality requirements.

b. Gradation requirements. The gradation of the aggregate base material shall meet the requirements of the gradation given in 209-2.2 when tested per ASTM C117 and ASTM C136. The gradation shall be well graded from coarse to fine as defined by ASTM D2487 and shall not vary from the lower limit on one sieve to the high limit on an adjacent sieve or vice versa.

209-2.4 Separation Geotextile - Not used.

CONSTRUCTION METHODS

209-3.1 Control strip. The first half-day of construction shall be considered the control strip. The Contractor shall demonstrate, in the presence of the RPR, that the materials, equipment, and construction processes meet the requirements of the specification. The sequence and manner of rolling necessary to obtain specified density requirements shall be determined. The maximum compacted thickness may be increased to a maximum of 12 inches upon the Contractor's demonstration that approved equipment and operations will uniformly compact the lift to the specified density. The RPR must witness this demonstration and approve the lift thickness prior to full production.

Control strips that do not meet specification requirements shall be reworked, re-compacted or removed and replaced at the Contractor's expense. Full operations shall not continue until the control strip has been accepted by the RPR. The Contractor shall use the same equipment, materials, and construction methods for the remainder of construction, unless adjustments made by the Contractor are approved by the RPR.

209-3.2 Preparing underlying subgrade and/or subbase. The underlying subgrade and/or subbase shall be checked and accepted by the RPR before base course placing and spreading operations begin. Re-proof rolling of the subgrade or proof rolling of the subbase in accordance with Item P-152, at the Contractor's expense, may be required by the RPR if the Contractor fails to ensure proper drainage or protect the subgrade and/or subbase. Any ruts or soft, yielding areas due to improper drainage conditions, hauling, or any other cause, shall be corrected before the base course is placed. To ensure proper drainage, the spreading of the base shall begin along the centerline of the pavement on a crowned section or on the high side of the pavement with a one-way slope.

209-3.3 Production. The aggregate shall be uniformly blended and, when at a satisfactory moisture content per paragraph 209-3.5, the approved material may be transported directly to the placement.

209-3.4 Placement. The aggregate shall be placed and spread on the prepared underlying layer by spreader boxes or other devices as approved by the RPR, to a uniform thickness and width. The equipment shall have positive thickness controls to minimize the need for additional manipulation of the material. Dumping from vehicles that require re-handling shall not be permitted. Hauling over the uncompacted base course shall not be permitted.

The aggregate shall meet gradation and moisture requirements prior to compaction. The base course shall be constructed in lifts as established in the control strip, but not less than 4 inches nor more than 12 inches of compacted thickness.

When more than one lift is required to establish the layer thickness shown on the plans, the construction procedure described here shall apply to each lift. No lift shall be covered by subsequent lifts until tests verify that compaction requirements have been met. The Contractor shall rework, re-compact and retest any material placed which does not meet the specifications at the Contractor's expense.

209-3.5 Compaction. Immediately after completion of the spreading operations, compact each layer of the base course, as specified, with approved compaction equipment. The number, type, and weight of rollers shall be sufficient to compact the material to the required density within the same day that the aggregate is placed on the subgrade.

The field density of each compacted lift of material shall be at least 100% of the maximum density of laboratory specimens prepared from samples of the subbase material delivered to the jobsite. The laboratory specimens shall be compacted and tested in accordance with ASTM D1557. The moisture content of the material during placing operations shall be within ±2 percentage points of the optimum moisture content as determined by ASTM D6938. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

209-3.6 Weather limitations. Material shall not be placed unless the ambient air temperature is at least 40°F and rising. Work on base course shall not be conducted when the subgrade or subbase is wet or frozen or the base material contains frozen material.

209-3.7 Maintenance. The base course shall be maintained in a condition that will meet all specification requirements. When material has been exposed to excessive rain, snow, or freeze-thaw conditions, prior to placement of additional material, the Contractor shall verify that materials still meet all specification requirements. Equipment may be routed over completed sections of base course, provided that no damage results and the equipment is routed over the full width of the completed base course. Any damage resulting to the base course from routing equipment over the base course shall be repaired by the Contractor at the Contractor's expense.

209-3.8 Surface tolerances. After the course has been compacted, the surface shall be tested for smoothness and accuracy of grade and crown. Any portion lacking the required smoothness or failing in accuracy of grade or crown shall be scarified to a depth of at least 3 inches, reshaped and recompacted to grade until the required smoothness and accuracy are obtained and approved by the RPR. Any deviation in surface tolerances shall be corrected by the Contractor at the Contractor's expense. The smoothness and accuracy requirements specified here apply only to the top layer when base course is constructed in more than one layer.

a. Smoothness. The finished surface shall not vary more than 3/8-inch when tested with a 12-foot straightedge applied parallel with and at right angles to the centerline. The straightedge shall be moved continuously forward at half the length of the 12-foot straightedge for the full length of each line on a 50-foot grid.

b. Grade. The grade and crown shall be measured on a 50-foot grid and shall be within +0 and -1/2 inch of the specified grade.

209-3.9 Acceptance sampling and testing. Crushed aggregate base course shall be accepted for density and thickness on an area basis. Two tests shall be made for density and thickness for each 5,000 square feet. Sampling locations will be determined on a random basis per ASTM D3665

a. Density. The Contractor's laboratory shall perform all density tests in the RPR's presence and provide the test results upon completion to the RPR for acceptance.

Each area shall be accepted for density when the field density is at least 100% of the maximum density of laboratory specimens compacted and tested per ASTM D1557. The in-place field density shall be determined per ASTM D1556 or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. If the specified density is not attained, the area represented by the failed test must be reworked and/or recompacted and two additional random tests made. This procedure shall be followed until the specified density is reached. Maximum density refers to maximum dry density at optimum moisture content unless otherwise specified.

b. Thickness. Depth tests shall be made by test holes at least 3 inches in diameter that extend through the base. The thickness of the base course shall be within +0 and -1/2 inch of the specified thickness as determined by depth tests taken by the Contractor in the presence of the RPR for each area. Where the thickness is deficient by more than 1/2-inch, the Contractor shall correct such areas at no additional cost by scarifying to a depth of at least 3 inches, adding new material of proper gradation, and the material shall be blended and recompacted to grade. The Contractor shall replace, at his expense, base material where depth tests have been taken.

EFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

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 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 C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM D75	Standard Practice for Sampling Aggregates
ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)

ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4491	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4643	Standard Test Method for Determination of Water Content of Soil and Rock by Microwave Oven Heating
ASTM D4751	Standard Test Methods for Determining Apparent Opening Size of a Geotextile
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D7928	Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

American Association of State Highway and Transportation Officials (AASHTO)

M288	Standard Specification for Geosynthetic Specification for Highway Applications

END OF ITEM P-209

Item P-403 Asphalt Mix Pavement Surface Course

DESCRIPTION

403-1.1 This item shall consist of pavement courses composed of mineral aggregate and asphalt binder mixed in a central mixing plant and placed on a prepared course in accordance with these specifications and shall conform to the lines, grades, thicknesses, and typical cross-sections shown on the plans. Each course shall be constructed to the depth, typical section, and elevation required by the plans and shall be rolled, finished, and approved before the placement of the next course.

MATERIALS

403-2.1 Aggregate. Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The aggregates should have no known history of detrimental pavement staining due to ferrous sulfides, such as pyrite. Coarse aggregate is the material retained on the No. 4 sieve. Fine aggregate is the material passing the No. 4 sieve.

a. Coarse aggregate. Coarse aggregate shall consist of sound, tough, durable particles, free from films of matter that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. Coarse aggregate material requirements are given in the table below.

Coarse Aggregate Material Requirements

Material Test	Requirement	Standard
Resistance to Degradation	Loss: 40% maximum for surface, asphalt binder, and leveling course Loss: 50% maximum for base course	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate **or** Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Clay lumps and friable particles	1.0% maximum	ASTM C142
Percentage of Fractured Particles	For pavements designed for aircraft gross weights of 60,000 pounds or more: Minimum 75% by weight of particles with at least two fractured faces and 85% with at least one fractured face[1]	ASTM D5821
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles with a value of 5:1 [2]	ASTM D4791
Bulk density of slag[3]	Weigh not less than 70 pounds per cubic foot	ASTM C29.

[1] The area of each face shall 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 shall be at least 30 degrees to count as two fractured faces.

[2] A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

[3] Only required if slag is specified.

b. Fine aggregate. Fine aggregate shall consist of clean, sound, tough, durable, angular shaped particles produced by crushing stone, slag, or gravel and shall be free from coatings of clay, silt, or other objectionable matter. Natural (non-manufactured) sand may be used to obtain the gradation of the aggregate blend or to improve the workability of the mix. Fine aggregate material requirements are listed in the table below.

Fine Aggregate Material Requirements

Material Test	Requirement	Standard
Liquid limit	25 maximum	ASTM D4318
Plasticity Index	4 maximum	ASTM D4318
Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate	Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate	ASTM C88
Clay lumps and friable particles	1.0% maximum	ASTM C142
Sand equivalent	45 minimum	ASTM D2419
Natural Sand	15% maximum by weight of total aggregate	ASTM D1073

c. Sampling. ASTM D75 shall be used in sampling coarse and fine aggregate, and ASTM C183 shall be used in sampling mineral filler.

403-2.2 Mineral filler. Mineral filler (baghouse fines) may be added in addition to material naturally present in the aggregate. Mineral filler shall meet the requirements of ASTM D242.

Mineral filler Requirements

Material Test	Requirement	Standard
Plasticity Index	4 maximum	ASTM D4318

403-2.3 Asphalt binder. Asphalt binder shall conform to ASTM D6373 Performance Grade (PG) **64E-22**.

Asphalt Binder PG Plus Test Requirements

Material Test	Requirement	Standard
Elastic Recovery	75% minimum	ASTM D6084[1]

[1]Follow procedure B on RTFO aged binder.

403-2.4 Anti-stripping agent. Any anti-stripping agent or additive (anti-strip) shall be heat stable and shall not change the asphalt binder grade beyond specifications. Anti-strip shall be an approved material of the Department of Transportation of the State in which the project is located.

COMPOSITION

403-3.1 Composition of mixture. The asphalt plant mix shall be composed of a mixture of well-graded aggregate, filler and anti-strip agent if required, and asphalt binder. The several aggregate fractions shall 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).

403-3.2 Job mix formula (JMF) laboratory. The laboratory used to develop the JMF shall possess a current certificate of accreditation, listing D3666 from a national accrediting authority and all test methods required for developing the JMF, and listed on the accrediting authority's website. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the RPR prior to start of construction.

403-3.3 Job mix formula (JMF). No asphalt mixture shall be placed until an acceptable mix design has been submitted to the RPR for review and accepted in writing. The RPR's review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

When the project requires asphalt mixtures of differing aggregate gradations and/or binders, a separate JMF shall be submitted for each mix. Add anti-stripping agent to meet tensile strength requirements.

The JMF shall be prepared by an accredited laboratory that meets the requirements of paragraph 403-3.2. The asphalt mixture shall be designed using procedures contained in Asphalt Institute MS-2 Mix Design Manual, 7th Edition. Samples shall be prepared and compacted using the gyratory compactor in accordance with ASTM D6925.

Should a change in sources of materials be made, a new JMF must be submitted to the RPR for review and accepted in writing before the new material is used. After the initial production JMF has been approved by the

RPR and a new or modified JMF is required for whatever reason, the subsequent cost of the new or modified JMF, including a new control strip when required by the RPR, will be borne by the Contractor.

The RPR may request samples at any time for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

The JMF shall be submitted in writing by the Contractor at least **30** days prior to the start of paving operations. The JMF shall be developed within the same construction season using aggregates proposed for project use.

The submitted JMF shall be dated, and stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items as a minimum:

- Manufacturer's Certificate of Analysis (COA) for the asphalt binder used in the JMF in accordance with paragraph 403-2.3. Certificate of asphalt performance grade is with modifier already added, if used and must indicate compliance with ASTM D6373. For plant modified asphalt binder, certified test report indicating grade certification of modified asphalt binder.
- Manufacturer's Certificate of Analysis (COA) for the anti-stripping agent if used in the JMF in accordance with paragraph 403-2.4.
- Certified material test reports for the course and fine aggregate and mineral filler in accordance with paragraphs 403-2.1 and 403-2.2.
- Percent passing each sieve size for individual gradation of each aggregate cold feed and/or hot bin; percent by weight of each cold feed and/or hot bin used; and the total combined gradation in the JMF.
- Specific Gravity and absorption of each course and fine aggregate.
- Percent natural sand.
- Percent fractured faces.
- Percent by weight of flat particles**,** elongated particles, and flat and elongated particles (and criteria).
- Percent of asphalt.
- Number of blows or gyrations.
- Laboratory mixing and compaction temperatures.
- Supplier recommended mixing and compaction temperatures.
- Plot of the combined gradation on the 0.45 power gradation curve.
- Graphical plots of air voids, voids in the mineral aggregate (VMA), and unit weight versus asphalt content. To achieve minimum VMA during production, the mix design needs to account for material breakdown during production.
- Tensile Strength Ratio (TSR).
- Type and amount of Anti-strip agent when used.
- Asphalt Pavement Analyzer (APA) results.
- Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season shall not be accepted.

Table 1. Asphalt Design Criteria

Test Property	Value	Test Method
Number of blows/gyrations	**50**	
Air voids (%)	3.5	ASTM D3203
Percent voids in mineral aggregate (VMA), minimum	See Table 2	ASTM D6995
TSR[1]	not less than 80 at a saturation of 70-80%	ASTM D4867
~~Asphalt Pavement Analyzer (APA)[2,3]~~	~~Less than 10 mm @ 4000 passes~~	~~AASHTO T340 at 250 psi hose pressure at 64°C test temperature~~

1 Test specimens for TSR shall be compacted at 7 ± 1.0 % air voids. In areas subject to freeze-thaw, use freeze-thaw conditioning in lieu of moisture conditioning per ASTM D4867.

2 AASHTO T340 at 100 psi hose pressure at 64°C test temperature may be used in the interim. If this method is used the required Value shall be less than 13/64 inches @ 8000 passes

~~3 Where APA not available, use Hamburg wheel test (AASHTO T 324) 10 mm@ 20,000 passes at 50°C.~~

The mineral aggregate shall 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 2 when tested in accordance with ASTM C136 and ASTM C117.

The gradations in Table 2 represent the limits that shall determine the suitability of aggregate for use from the sources of supply, be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa.

Table 2. Aggregate - Asphalt Pavements

Sieve Size	Percentage by Weight Passing Sieve	
	Gradation 2	~~Gradation 3 (Leveling)~~
1 inch	--	~~--~~
3/4 inch	100	~~--~~
1/2 inch	90-100	~~100~~
3/8 inch	72-88	~~90-100~~
No. 4	53-73	~~58-78~~
No. 8	38-60	~~40-60~~
No. 16	26-48	~~28-48~~
No. 30	18-38	~~18-38~~
No. 50	11-27	~~11-27~~
No. 100	6-18	~~6-18~~
No. 200	3-6	~~3-6~~
Voids in Mineral Aggregate (VMA)[1]	15	~~16~~
	Asphalt Percent:	
Stone or gravel	5.0 – 7.5	~~5.5 – 8.0~~
Slag	6.5 – 9.5	~~7.0–10.5~~
Recommended Minimum Construction Lift Thickness	2 inch	~~1 ½ inch~~

[1]To achieve minimum VMA during production, the mix design needs to account for material breakdown during production.

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute MS-2 Mix Design Manual, 7th Edition.

403-3.4 Reclaimed Asphalt Pavement (RAP). RAP shall not be used.

403-3.5 Control strip. Full production shall not begin until an acceptable control strip has been constructed and accepted in writing by the RPR. The Contractor shall prepare and place a quantity of asphalt according to the JMF. The underlying grade or pavement structure upon which the control strip is to be constructed shall be the same as the remainder of the course represented by the control strip.

The Contractor will not be allowed to place the control strip until the Contractor quality control program (CQCP), showing conformance with the requirements of paragraph 403-5.1, has been accepted, in writing, by the RPR.

The control strip will consist of at least 250 tons or 1/2 sublot, whichever is greater. The control strip shall be placed in two lanes of the same width and depth to be used in production with a longitudinal cold joint. The cold joint must be cut back in accordance with paragraph 403-4.13 using the same procedure that will be used during production. The cold joint for the control strip will be an exposed construction joint at least four (4) hours old or when the mat has cooled to less than 160°F. The equipment used in construction of the control strip shall be the same type, configuration and weight to be used on the project.

The control strip shall be evaluated for acceptance as a single lot in accordance with the acceptance criteria in paragraph 403-6.1 and 403-6.2. The control strip shall be divided into equal sublots. As a minimum, the control strip shall consist of three (3) sublots.

The control strip will be considered acceptable by the RPR if the gradation, asphalt content, and VMA are within the action limits specified in paragraph 403-5.5a; and Mat density, air voids, and joint density meet the requirements specified in paragraphs 403-6.2.

If the control strip is unacceptable, necessary adjustments to the JMF, plant operation, placing procedures, and/or rolling procedures shall be made and another control strip shall be placed. Unacceptable control strips shall be removed at the Contractor's expense.

The control strip will be considered one lot for payment based upon the average of a minimum of 3 samples (no sublots required for control strip).Payment will only be made for an acceptable control strip in accordance with paragraph 403-8.1.

CONSTRUCTION METHODS

403-4.1 Weather limitations. The asphalt shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 4. The temperature requirements may be waived by the RPR, if requested; however, all other requirements including compaction shall be met.

Table 4. Surface Temperature Limitations of Underlying Course

Mat Thickness	Base Temperature (Minimum)
	Degrees F
3 inches or greater	40
Greater than 2 inches but less than 3 inches	45

403-4.2 Asphalt plant. Plants used for the preparation of asphalt shall conform to the requirements of American Association of State Highway and Transportation Officials (AASHTO) M156 including the following items:

a. Inspection of plant. The RPR, or RPR's authorized representative, shall 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.

b. Storage bins and surge bins. The asphalt mixture stored in storage and/or surge bins shall meet the same requirements as asphalt mixture loaded directly into trucks. Asphalt mixture shall not be stored in storage and/or surge bins for a period greater than twelve (12) hours. If the RPR determines there is an excessive heat loss, segregation or oxidation of the asphalt mixture due to temporary storage, temporary storage shall not be allowed.

403-4.3 Aggregate stockpile management. Aggregate stockpiles shall be constructed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used.

A continuous supply of materials shall be provided to the work to ensure continuous placement.

403-4.4 Hauling equipment. Trucks used for hauling asphalt shall have tight, clean, and smooth metal beds. To prevent the asphalt from sticking to the truck beds, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other material approved by the RPR. Petroleum products shall not be used for coating truck beds. Each truck shall 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 shall be insulated or heated and covers shall be securely fastened. Haul time shall be limited to 3 hours from loading into truck to time of placement.

403-4.4.1 Material transfer vehicle (MTV). Material transfer Vehicles shall be required due to the improvement in smoothness and decrease in both physical and thermal segregation. To transfer the material from the hauling equipment to the paver, 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 shall 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.

403-4.5 Asphalt pavers. Asphalt pavers shall be self-propelled with an activated heated screed, capable of spreading and finishing courses of asphalt that will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface. The asphalt paver shall be equipped with a control system capable of automatically maintaining the specified screed grade and elevation.

If 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 shall be discontinued.

The paver shall be capable of paving to a minimum width specified in paragraph 403-4.11.

403-4.6 Rollers. The number, type, and weight of rollers shall be sufficient to compact the asphalt to the required density while it is still in a workable condition without crushing of the aggregate, depressions or other damage to the pavement surface. Rollers shall be in good condition, capable of operating at slow speeds to avoid displacement of the asphalt. All rollers shall be specifically designed and suitable for compacting asphalt concrete and shall be properly used. Rollers that impair the stability of any layer of a pavement structure or underlying soils shall not be used.

403-4.6.1 Density device. The Contractor shall 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 shall also supply a qualified technician during all paving operations to calibrate the density gauge and obtain accurate density readings for all new asphalt. These densities shall be supplied to the RPR upon request at any time during construction. No separate payment will be made for supplying the density gauge and technician.

403-4.7 Preparation of asphalt binder. The asphalt binder shall be heated in a manner that will avoid local overheating and provide a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of the unmodified asphalt binder delivered to the mixer shall be sufficient to provide a suitable viscosity for adequate coating of the aggregate particles, but shall not exceed 325°F when added to the aggregate. The temperature of modified asphalt binder shall be no more than 350°F when added to the aggregate.

403-4.8 Preparation of mineral aggregate. The aggregate for the asphalt shall be heated and dried. The maximum temperature and rate of heating shall be such that no damage occurs to the aggregates. The temperature of the aggregate and mineral filler shall not exceed 350°F when the asphalt binder is added. Particular care shall be taken that aggregates high in calcium or magnesium content are not damaged by overheating. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

403-4.9 Preparation of asphalt mixture. The aggregates and the asphalt binder shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall 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 shall 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 shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer. The moisture content of all asphalt upon discharge shall not exceed 0.5%.

403-4.10 Application of Prime and Tack Coat. Immediately before placing the asphalt mixture, the underlying course shall be cleaned of all dust and debris.

A prime coat in accordance with Item P-602 shall be applied to aggregate base prior to placing the asphalt mixture.

A tack coat shall be applied in accordance with Item P-603 to all vertical and horizontal asphalt and concrete surfaces prior to placement of subsequent lifts of asphalt mixture.

403-4.11 Laydown plan, transporting, placing, and finishing. Prior to the placement of the asphalt, the Contractor shall prepare a laydown plan with the sequence of paving lanes and width to minimize the number of cold joints; the location of any temporary ramps; laydown temperature; and estimated time of completion for each portion of the work (milling, paving, rolling, cooling, etc.). The laydown plan and any modifications shall be approved by the RPR.

Deliveries shall be scheduled so that placing and compacting of asphalt is uniform with minimum stopping and starting of the paver. Hauling over freshly placed material shall not be permitted until the material has been compacted, as specified, and allowed to cool to approximately ambient temperature. The Contractor, at their expense, shall be responsible for repair of any damage to the pavement caused by hauling operations.

Contractor shall survey each lift of asphalt surface course and certify to RPR that every lot of each lift meets the grade tolerances of paragraph 403-6.2e before the next lift can be placed.

Edges of existing asphalt pavement abutting the new work shall be saw cut and the cut off material and laitance removed. Apply a tack coat in accordance with P-603 before new asphalt material is placed against it.

The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Placement of the asphalt mix shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope unless shown otherwise on the laydown plan as accepted by the RPR. The asphalt mix shall be placed in consecutive adjacent lanes having a minimum width of **15** feet except where edge lanes require less width to complete the area. Additional screed sections attached to widen the paver to meet the minimum lane width requirements must include additional auger sections to move the asphalt mixture uniformly along the screed extension.

The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 1 foot; however, the joint in the surface top course shall be at the centerline of crowned pavements. Transverse joints in one course shall be offset by at least 10 feet from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 10 feet. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the asphalt may be spread and luted by hand tools.

The RPR may at any time, reject any batch of asphalt, on the truck or placed in the mat, which is rendered unfit for use due to contamination, segregation, incomplete coating of aggregate, or overheated asphalt mixture. 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 RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

Areas of segregation in the surface course, as determined by the RPR, shall be removed and replaced at the Contractor's expense. The area shall be removed by saw cutting and milling a minimum of the construction lift thickness as specified in paragraph 403-3.3, Table 2 for the approved mix design. The area to be removed and replaced shall be a minimum width of the paver and a minimum of 10 feet long.

403-4.12 Compaction of asphalt mixture. After placing, the asphalt mixture shall be thoroughly and uniformly compacted by self-propelled rollers. The surface shall be compacted as soon as possible when the asphalt 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 shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any surface defects and/or displacement occurring as a result of the roller, or from any other cause, shall be corrected at the Contractor's expense.

Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall 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 asphalt to the roller, the wheels shall be equipped with a scraper and kept moistened with water as necessary.

In areas not accessible to the roller, the mixture shall be thoroughly compacted with approved power tampers.

Any asphalt that becomes loose and broken, mixed with dirt, contains check-cracking, or in any way defective shall be removed and replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching shall not be allowed**.**

403-4.13 Joints. The formation of all joints shall be made in such a manner as to ensure a continuous bond between the courses and obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

The roller shall not pass over the unprotected end of the freshly laid asphalt except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall 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 shall be coated with an asphalt tack coat before placing any fresh asphalt against the joint.

Longitudinal joints which are have been left exposed for more than four (4) hours; the surface temperature has cooled to less than 175°F; or are irregular, damaged, uncompacted or otherwise defective shall be cut back with a cutting wheel or pavement saw a maximum of 3 inches to expose a clean, sound, uniform vertical surface for the full depth of the course. All cutback material and any laitance produced from cutting joints shall be removed from the project. An asphalt tack coat or other product approved by the RPR shall be applied to the clean, dry joint prior to placing any additional fresh asphalt against the joint. The cost of this work shall be considered incidental to the cost of the asphalt.

403-4.14 Saw-cut grooving. Saw-cut grooving is not required.

403-4.15 Diamond grinding. Not Used.

403-4.16 Nighttime Paving Requirements. The Contractor shall provide adequate lighting during any nighttime construction. A lighting plan shall be submitted by the Contractor and approved by the RPR prior to the start of any nighttime work. All work shall be in accordance with the approved CSPP and lighting plan.

CONTRACTOR QUALITY CONTROL (CQC)

403-5.1 General. The Contractor shall develop a CQCP in accordance with Item C-100. No partial payment will be made for materials that are subject to specific QC requirements without an approved CQCP.

403-5.2 Contractor quality control (QC) facilities. The Contractor shall provide or contract for testing facilities in accordance with Item C-100. The RPR shall be permitted unrestricted access to inspect the Contractor's QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC 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 shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

403-5.3 Quality Control (QC) testing. The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to these specifications and as set forth in the approved CQCP. The testing program shall 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 QC Testing Plan shall be developed as part of the CQCP**.**

a. Asphalt content. A minimum of two tests shall be performed per day in accordance with ASTM D6307 or ASTM D2172 for determination of asphalt content. When using ASTM D6307, the correction factor shall be determined as part of the first test performed at the beginning of plant production; and as part of every tenth test performed thereafter. The asphalt content for the day will be determined by averaging the test results.

b. Gradation. Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of extracted aggregate in accordance with ASTM D5444 and ASTM C136, and ASTM C117.

c. Moisture content of aggregate. The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C566.

d. Moisture content of asphalt. The moisture content of the asphalt shall be determined once per lot in accordance with AASHTO T329 or ASTM D1461.

e. Temperatures. Temperatures shall 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 asphalt at the plant, and the asphalt at the job site.

f. In-place density monitoring. The Contractor shall 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.

g. Smoothness for Contractor Quality Control.

The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing pavement with variances less than 1/4 inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. If the smoothness criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues

The Contractor may use a 12-foot straightedge, a rolling inclinometer meeting the requirements of ASTM E2133 or rolling external reference device that can simulate a 12-foot straightedge approved by the RPR. Straight-edge testing shall start 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. Testing shall be continuous across all joints. The surface irregularity shall 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 the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using the FAA profile program, ProFAA, or FHWA ProVal, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement shall be evaluated separately for conformance with the plans.

(1) Transverse measurements. Transverse measurements shall be taken for each day's production placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet or more often as determined by the RPR. The joint between lanes shall be tested separately to facilitate smoothness between lanes.

(2) Longitudinal measurements. Longitudinal measurements shall be taken for each day's production 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 third points of paving lanes when widths of paving lanes are 20 feet or greater. When placement abuts previously placed material the first measurement shall start with one half the length of the straight edge on the previously placed material.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4 inch shall be corrected with diamond grinding per paragraph 403-4.15 or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in paragraph 403-6.1d(3) Areas that have been ground shall be sealed with a surface treatment in accordance with Item P-608. To avoid the surface treatment creating any conflict with runway or taxiway markings, it may be necessary to seal a larger area.

Control charts shall be kept to show area of each day's placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor's machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day's production, production shall be stopped until corrective measures are implemented by the Contractor.

h. Grade. Grade shall be evaluated daily to allow adjustments to paving operations when grade measurements do not meet specifications. As a minimum, grade shall be evaluated prior to the placement of the first lift and then prior to and after placement of the surface lift.

Measurements will be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and longitudinal spacing as shown on cross-sections and plans. The final surface of the pavement will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch vertically. The documentation will be provided by the Contractor to the RPR by the end of the following working day.

Areas with humps or depressions that exceed grade or smoothness criteria and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2 inch less than the thickness specified on the plans. Grinding shall be in accordance with paragraph 403-4.15.

The Contractor shall repair low areas or areas that cannot be corrected by grinding by removal of deficient areas to the depth of the final course plus 1/2 inch and replacing with new material. Skin patching is not allowed.

403-5.4 Sampling. When directed by the RPR, the Contractor shall 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 shall be in accordance with standard procedures specified.

403-5.5 Control charts. The Contractor shall maintain linear control charts both for individual measurements and range (i.e., difference between highest and lowest measurements) for aggregate gradation, asphalt content, and VMA. The VMA for each day shall be calculated and monitored by the QC laboratory.

Control charts shall be posted in a location satisfactory to the RPR and kept current. As a minimum, the control charts shall 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 shall 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 RPR may suspend production or acceptance of the material.

a. Individual measurements. Control charts for individual measurements shall be established to maintain process control within tolerance for aggregate gradation, asphalt content, and VMA. The control charts shall use the JMF 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	±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	±0.45%	±0.70%
Minimum VMA	-0.5%	-1.0%

b. Range. Control charts for range shall be established to control process variability for the test parameters and Suspension Limits listed below. The range shall 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 shall 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
(n = 2)

Sieve	Suspension Limit
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%

c. Corrective action. The CQCP shall indicate that appropriate action shall be taken when the process is believed to be out of tolerance. The Plan shall 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 shall 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.

403-5.6 Quality control (QC) reports. The Contractor shall maintain records and shall submit reports of QC activities daily in accordance with the CQCP described in Item C-100.

MATERIAL ACCEPTANCE

403-6.1. Quality Assurance Acceptance sampling and testing. Unless otherwise specified, all acceptance sampling and testing necessary to determine conformance with the requirements specified in this section will be performed by the RPR at no cost to the Contractor except that coring as required in this section shall be completed and paid for by the Contractor.

a. Quality Assurance (QA) testing laboratory. The QA testing laboratory performing these acceptance tests will be accredited in accordance with ASTM D3666. The QA laboratory accreditation will be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing will be listed on the lab accreditation.

b. Lot Size. A standard lot will be equal to one day's production divided into approximately equal sublots of between 400 to 600 tons. When only one or two sublots are produced in a day's production, the sublots will be combined with the production lot from the previous or next day.

Where more than one plant is simultaneously producing asphalt for the job, the lot sizes will apply separately for each plant.

c. Asphalt air voids. Plant-produced asphalt will be tested for air voids on a sublot basis.

(1) Sampling. Material from each sublot shall be sampled in accordance with ASTM D3665. Samples shall be taken from material deposited into trucks at the plant or at the job site in accordance with ASTM D979. The sample of asphalt 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 maintain the material at or above the compaction temperature as specified in the JMF.

(2) Testing. Air voids will be determined for each sublot in accordance with ASTM D3203 for a set of three compacted specimens prepared in accordance with ASTM D6925.

d. In-place asphalt mat and joint density. Each sublot will be tested for in-place mat and joint density as a percentage of the theoretical maximum density (TMD).

(1) Sampling. The Contractor will cut minimum 5 inches diameter samples in accordance with ASTM D5361. The Contractor shall furnish all tools, labor, and materials for cleaning, and filling the cored pavement. Laitance produced by the coring operation shall be removed immediately after coring, and core holes shall be filled within one day after sampling in a manner acceptable to the RPR.

(2) Bond. Each lift of asphalt shall be bonded to the underlying layer. If cores reveal that the surface is not bonded, additional cores shall be taken as directed by the RPR to determine the extent of unbonded areas. Unbonded areas shall be removed by milling and replaced at no additional cost as directed by the RPR.

(3) Thickness. Thickness of each lift of surface course will be evaluated by the RPR for compliance to the requirements shown on the plans after any necessary corrections for grade. Measurements of thickness will be made using the cores extracted for each sublot for density measurement. The maximum allowable deficiency at any point will not be more than 1/4 inch less than the thickness indicated for the lift. Average thickness of lift, or combined lifts, will not be less than the indicated thickness. Where the thickness tolerances are not met, the lot or sublot shall 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 RPR to circumscribe the deficient area.

(4) Mat density. One core shall be taken from each sublot. Core locations will be determined by the RPR in accordance with ASTM D3665. Cores for mat density shall not be taken closer than one foot (30 cm) from a transverse or longitudinal joint. The bulk specific gravity of each cored sample will be determined in accordance with ASTM D2726. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each sublot sample by the TMD for that sublot.

(5) Joint density. One core centered over the longitudinal joint shall be taken for each sublot which contains a longitudinal joint. Core locations will be determined by the RPR in accordance with ASTM D3665. The bulk specific gravity of each core sample will be determined in accordance with ASTM D2726. The percent compaction (density) of each sample will be determined by dividing the bulk specific gravity of each joint density sample by the average TMD for the lot. The TMD used to determine the joint density at joints formed between lots will be the lower of the average TMD values from the adjacent lots.

403-6.2 Acceptance criteria.

a. General. Acceptance will be based on the implementation of the Contractor Quality Control Program (CQCP) and the following characteristics of the asphalt and completed pavements: air voids, mat density, joint density, and grade**.**

b. Air voids. Acceptance of each lot of plant produced material for air voids will be based upon the average air void from the sublots. If the average air voids of the lot are equal to or greater than 2% and equal to or less than 5%, then the lot will be acceptable. If the average is below 2% or greater than 5%, the lot shall be removed and replaced at the Contractor's expense.

c. Mat density. Acceptance of each lot of plant produced material for mat density will be based on the average of all of the densities taken from the sublots. If the average mat density of the lot so established equals or exceeds 94%, the lot will be acceptable. If the average mat density of the lot is below 94%, the lot shall be removed and replaced at the Contractor's expense.

d. Joint density. Acceptance of each lot of plant produced asphalt for joint density will be based on the average of all of the joint densities taken from the sublots. If the average joint density of the lot so established equals or exceeds 92%, the lot will be acceptable. If the average joint density of the lot is less than 92%, the Contractor shall stop production and evaluate the method of compacting joints. Production may resume once the reason for poor compaction has been determined and appropriate measures have been taken to ensure proper compaction.

e. Grade. The final finished surface of the pavement of the completed project shall be surveyed to verify that the grade elevations and cross-sections shown on the plans do not deviate more than 1/2 inch vertically.

Cross-sections of the pavement shall be taken at a minimum 50-foot longitudinal spacing and at all longitudinal grade breaks. Minimum cross-section grade points shall include grade at centerline, ± 10 feet of centerline, and edge of taxiway pavement.

The survey and documentation shall be stamped and signed by a licensed surveyor. Payment for sublots that do not meet grade for over 25% of the sublot shall not be more than 95%.

403-6.3 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 RPR. A retest will consist of all the sampling and testing procedures contained in paragraphs 403-6.1. Only one resampling per lot will be permitted.

(1) A redefined mat density will be calculated for the resampled lot. The number of tests used to calculate the redefined mat density will include the initial tests made for that lot plus the retests.

(2) The cost for resampling and retesting shall be borne by the Contractor.

b. Payment for resampled lots. The redefined mat density for a resampled lot will be used to evaluate the acceptance of that lot in accordance with paragraph 403-6.2.

c. Outliers. Check for outliers in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded and density determined using the remaining test values.

403-6.4 Leveling course. The leveling course is the first variable thickness lift placed to correct surface irregularities prior to placement of subsequent courses. The leveling course shall meet the aggregate gradation in Table 2, paragraph 403-3.3. The leveling course shall meet the requirements of paragraph 403-3.3, 403-6.1b for air voids, but shall not be subject to the density requirements of paragraph 403-6.1c. The leveling course shall be compacted with the same effort used to achieve density of the control strip. The leveling course shall not exceed the lift thickness associated with each gradation in Table 2, paragraph 403-3.3.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

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 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 D242	Standard Specification for Mineral Filler for Bituminous Paving Mixtures
ASTM D946	Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D979	Standard Practice for Sampling Bituminous Paving Mixtures
ASTM D1073	Standard Specification for Fine Aggregate for Bituminous Paving Mixtures
ASTM D1074	Standard Test Method for Compressive Strength of Bituminous 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 D2172	Standard Test Method for Quantitative Extraction of Bitumen from 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 D3381	Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction
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 D4125	Standard Test Methods for Asphalt Content of Bituminous mixtures by the Nuclear Method
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4552	Standard Practice for Classifying Hot-Mix Recycling Agents
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 D5581	Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6 inch-Diameter Specimen)
ASTM D5821	Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6307	Standard Test Method for Asphalt Content of Hot-Mix Asphalt by Ignition Method
ASTM D6373	Standard Specification for Performance Graded Asphalt Binder
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 D6926	Standard Practice for Preparation of Bituminous Specimens Using Marshall Apparatus
ASTM D6927	Standard Test Method for Marshall Stability and Flow of Bituminous Mixtures
ASTM D6995	Standard Test Method for Determining Field VMA based on the Maximum Specific Gravity of the Mix (Gmm)
ASTM E11	Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves
ASTM E178	Standard Practice for Dealing with Outlying Observations
ASTM E2133	Standard Test Method for Using a Rolling Inclinometer to Measure Longitudinal and Transverse Profiles of a Traveled Surface

American Association of State Highway and Transportation Officials (AASHTO)

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
AASHTO T 340	Standard Method of Test for Determining the Rutting Susceptibility of Hot Mix Asphalt (APA) Using the Asphalt Pavement Analyzer (APA)

Asphalt Institute (AI)

MS-2	Mix Design Manual, 7th Edition
MS-26	Asphalt Binder Handbook AI State Binder Specification Database

FAA Orders

5300.1	Modifications to Agency Airport Design, Construction, and Equipment Standards

Federal Highway Administration (FHWA)

Long Term Pavement Performance Binder program

Software

FAARFIELD

END OF ITEM P-403

Rigid Pavement

1.1 ITEM P-501 CEMENT CONCRETE PAVEMENT

DESCRIPTION

501-1.1 This work shall consist of pavement composed of cement concrete without reinforcement constructed on a prepared underlying surface in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross-sections shown on the plans. The terms cement concrete, hydraulic cement concrete, and concrete are interchangeable in this specification.

MATERIALS

501-2.1 Aggregates.

a. Reactivity. Fine and Coarse aggregates to be used in PCC on this project shall be tested and evaluated by the Contractor for alkali-aggregate reactivity in accordance with both ASTM C1260 and ASTM C1567. Tests must be representative of aggregate sources which will be providing material for production. ASTM C1260 and ASTM C1567 tests may be run concurrently.

(1) Coarse aggregate and fine aggregate shall be tested separately in accordance with ASTM C1260, however, the length of test shall be extended to 28 days (30 days from casting). Tests must have been completed within 6 months of the date of the concrete mix submittal.

(2) The combined coarse and fine aggregate shall 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 the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion 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 shall be evaluated and tested.

(3) If lithium nitrate is proposed for use with or without supplementary cementitious materials, the aggregates shall be tested in accordance with Corps of Engineers (COE) Concrete Research Division (CRD) C662 in lieu of ASTM C1567. If lithium nitrate admixture is used, it shall be nominal 30% ±0.5% weight lithium nitrate in water. If the expansion does not exceed 0.10% at 28 days, the proposed combined materials will be accepted. If the expansion 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 shall be evaluated and tested.

b. Fine aggregate. Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C33 and the parameters identified in the fine aggregate material requirements below. Fine aggregate material requirements and deleterious limits are shown in the table below.

Fine Aggregate Material Requirements		
Soundness of Aggregates by Use of Sodium Sulfate **or** Magnesium Sulfate	Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate	ASTM C88
Sand Equivalent	**[** 45 **]** minimum	ASTM D2419
Fineness Modulus (FM)	2.50 ≤ FM ≤ 3.40	ASTM C136
Limits for Deleterious Substances in Fine Aggregate for Concrete		
Clay lumps and friable particles	1.0% maximum	ASTM C142
Coal and lignite	0.5% using a medium with a density of Sp. Gr. of 2.0	ASTM C123
Total Deleterious Material	1.0% maximum	

c. Coarse aggregate. The maximum size coarse aggregate shall be **1-inch**.

Aggregates delivered to the mixer shall be clean, hard, uncoated aggregates consisting of crushed stone, crushed or uncrushed gravel, air-cooled iron blast furnace slag, crushed recycled concrete pavement, or a combination. The aggregates shall have no known history of detrimental pavement staining. Steel blast furnace slag shall not be permitted. Coarse aggregate material requirements and deleterious limits are shown in the table below; washing may be required to meet aggregate requirements.

Coarse Aggregate Material Requirements

Material Test	Requirement	Standard
Resistance to Degradation	Loss: 40% maximum	ASTM C131
Soundness of Aggregates by Use of Sodium Sulfate **or** Magnesium Sulfate	Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate	ASTM C88
Flat, Elongated, or Flat and Elongated Particles	8% maximum, by weight, of flat, elongated, or flat and elongated particles at 5:1 for any size group coarser than 3/8 (9.5 mm) sieve [1]	ASTM D4791
Bulk density of slag [2]	Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)	ASTM C29

[1] A flat particle is one having a ratio of width to thickness greater than five (5); an elongated particle is one having a ratio of length to width greater than five (5).

[2] Only required if slag is specified.

The amount of deleterious material in the coarse aggregate shall not exceed the following limits:

Limits for Deleterious Substances in Coarse Aggregate

Deleterious material	ASTM	Percentage by Mass
Clay Lumps and friable particles	ASTM C142	1.0
Material finer than No. 200 sieve (75 μm)	ASTM C117	1.0[1]
Lightweight particles	ASTM C123 using a medium with a density of Sp. Gr. of 2.0	0.5
Chert[2] (less than 2.40 Sp Gr.)	ASTM C123 using a medium with a density of Sp. Gr. of 2.40)	**0.1**

[1] The limit for material finer than 75-μm is allowed to be increased to 1.5% for crushed aggregates consisting of dust of fracture that is essentially free from clay or shale. Test results supporting acceptance of increasing limit to 1.5% with statement indicating material is dust of fracture must be submitted with Concrete mix. Acceptable techniques to characterizing these fines include methylene blue adsorption or X-ray diffraction analysis.

[2] Chert and aggregates with less than 2.4 specific gravity.

[3] The limit for chert may be increased to 1.0 percent by mass in areas not subject to severe freeze and thaw.

d. Combined aggregate gradation. This specification is targeted for a combined aggregate gradation developed following the guidance presented in United States Air Force Engineering Technical Letter (ETL) 97-5: Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements. Base the aggregate grading upon a combination of all the aggregates (coarse and fine) to be used for the mixture proportioning. Three aggregate sizes may be required to achieve an optimized combined gradation that will produce a workable concrete mixture for its intended use. Use aggregate gradations that produce concrete mixtures with well-graded or optimized aggregate combinations. The Contractor shall submit complete mixture information necessary to calculate the volumetric components of the mixture. The combined aggregate grading shall meet the following requirements:

(1) The materials selected and the proportions used shall be such that when the Coarseness Factor (CF) and the Workability Factor (WF) are plotted on a diagram as described in paragraph 501-2.1d(4) below, the point thus determined shall fall within the parallelogram described therein.

(2) The CF shall be determined from the following equation:

CF = (cumulative percent retained on the 3/8 in. (9.5 mm) sieve)(100) / (cumulative percent retained on the No. 8 (2.36 mm) sieve)

(3) The WF is defined as the percent passing the No. 8 (2.36 mm) sieve based on the combined gradation. However, WF shall 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 shall 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 shall 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 shall be changed as necessary. The point determined by the plotting of the CF and WF may be adjusted during production ±3 WF and ±5 CF. Adjustments to gradation may not take the point outside of the parallelogram.

e. Contractors combined aggregate gradation. The Contractor shall submit their combined aggregate gradation using the following format:

Contractor's Combined Aggregate Gradation

Sieve Size	Contractor's Concrete mix Gradation (Percent passing by weight)
2 inch (50 mm)	*
1-1/2 inch (37.5 mm)	*
1 inch (25.0 mm)	*
3/4 inch (19.0 mm)	*
1/2 inch (12.5 mm)	*
3/8 inch (9.5 mm)	*
No. 4 (4.75 mm)	*
No. 8 (2.36 mm)	*
No. 16 (1.18 mm)	*
No. 30 (600 µm)	*
No. 50 (300 µm)	*
No. 100 (150 µm)	*

Table remains blank until the Contractor submits the concrete mix.

501-2.2 Cement. Cement shall conform to the requirements of ASTM **C150** Type **II**.

501-2.3 Cementitious materials.

a. Fly ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 15% and a total alkali content less than 3% per ASTM C311. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix, and shall 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 Resident Project Representative (RPR).

b. Slag cement (ground granulated blast furnace (GGBF)). Slag cement shall conform to ASTM C989, Grade 100 or Grade 120. Slag cement shall 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 shall 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 shall have a loss on ignition not exceeding 6%. Class N pozzolan for use in mitigating Alkali-Silica Reactivity shall have a total available alkali content less than 3%.

d. Ultrafine fly ash and ultrafine pozzolan. Not used.

501-2.4 Joint seal. The joint seal for the joints in the concrete pavement shall meet the requirements of Item P-605 and shall be of the type specified in the plans.

501-2.5 Isolation joint filler. Premolded joint filler for isolation joints shall conform to the requirements of ASTM D1751 or ASTM D1752 and shall be where shown on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the RPR. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the RPR.

501-2.6 Steel reinforcement. Reinforcing shall consist of deformed bars conforming to the requirements of ASTM **A615**. Bar mats shall confirm to the requirements of ASTM **A184**.

501-2.7 Dowel and tie bars. Dowel bars shall be plain steel bars conforming to ASTM A615 and shall be free from burring or other deformation restricting slippage in the concrete.

a. Dowel Bars. Before delivery to the construction site each dowel bar shall be epoxy coated per ASTM A1078, Type 1, with a coating thickness after curing greater than 10 mils. Patched ends are not required for Type 1 coated dowels. The dowels shall be coated with a bond-breaker recommended by the manufacturer. Dowel sleeves or inserts are not permitted. Grout retention rings shall be fully circular metal or plastic devices capable of supporting the dowel until the grout hardens.

b. Tie Bars. Tie bars shall be deformed steel bars and conform to the requirements of ASTM A615. Tie bars designated as Grade 60 in ASTM A615 or ASTM A706 shall be used for construction requiring bent bars.

501-2.8 Water. Water used in mixing or curing shall be potable. If water is taken from other sources considered non-potable, it shall meet the requirements of ASTM C1602.

501-2.9 Material for curing concrete. Curing materials shall conform to one of the following specifications:

a. Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C309, Type 2, Class A, or Class B.

b. White polyethylene film for curing concrete shall conform to the requirements of ASTM C171.

c. White burlap-polyethylene sheeting for curing concrete shall conform to the requirements of ASTM C171.

d. Waterproof paper for curing concrete shall conform to the requirements of ASTM C171.

501-2.10 Admixtures. Admixtures shall conform to the following specifications:

a. Air-entraining admixtures. Air-entraining admixtures shall meet the requirements of ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entraining agent and any water reducer admixture shall be compatible.

b. Water-reducing admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D.

c. Other admixtures. The use of set retarding and set-accelerating admixtures shall be approved by the RPR prior to developing the concrete mix. Retarding admixtures shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating admixtures shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

d. Lithium Nitrate. The lithium admixture shall be a nominal 30% aqueous solution of Lithium Nitrate, with a density of 10 pounds/gallon (1.2 kg/L), and shall have the approximate chemical form as shown below:

Lithium Admixture

Constituent	Limit (Percent by Mass)
$LiNO_3$ (Lithium Nitrate)	30 ±0.5
SO_4 (Sulfate Ion)	0.1 (max)
Cl (Chloride Ion)	0.2 (max)
Na (Sodium Ion)	0.1 (max)
K (Potassium Ion)	0.1 (max)

The lithium nitrate admixture dispensing and mixing operations shall be verified and certified by the lithium manufacturer's representative.

501-2.11 Epoxy-resin. All epoxy-resin materials shall 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 shall meet the following requirements:

a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.

b. Material for use as patching materials for complete filling of spalls and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.

c. Material for use for injecting cracks shall be Type IV, Grade 1.

d. Material for bonding freshly mixed Portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

501-2.12 Bond Breaker. Not used.

CONCRETE MIX

501-3.1. General. No concrete shall be placed until an acceptable concrete mix has been submitted to the RPR for review and the RPR has taken appropriate action. The RPR's review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

501-3.2 Concrete Mix Laboratory. The laboratory used to develop the concrete mix shall 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 must be included in the lab accreditation. A copy of the laboratory's current accreditation and accredited test methods shall be submitted to the RPR prior to start of construction.

501-3.3 Concrete Mix Proportions. Develop the mix using the procedures contained in Portland Cement Association (PCA) publication, "Design and Control of Concrete Mixtures." Concrete shall be proportioned to achieve a 28-day flexural strength that meets or exceeds the acceptance criteria contained in paragraph 501-6.6 for a flexural strength of **650** psi per ASTM C78.

The minimum cementitious material shall be adequate to ensure a workable, durable mix. The minimum cementitious material (cement plus fly ash, or slag cement) shall be **470** pounds per cubic yard (280 kg per cubic meter). The ratio of water to cementitious material, including free surface moisture on the aggregates but not including moisture absorbed by the aggregates shall be between 0.38 – 0.45 by weight.

Flexural strength test specimens shall be prepared in accordance with ASTM C192 and tested in accordance with ASTM C78. At the start of the project, the Contractor shall determine an allowable slump as determined by ASTM C143 not to exceed 2 inches (50 mm) for slip-form placement. For fixed-form placement, the slump shall not exceed 3 inches (75 mm). For hand placement, the slump shall not exceed 4 inches (100 mm).

The results of the concrete mix shall include a statement giving the maximum nominal coarse aggregate size and the weights and volumes of each ingredient proportioned on a one cubic yard (meter) basis. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

If a change in source(s) is made, or admixtures added or deleted from the mix, a new concrete mix must be submitted to the RPR for approval.

The RPR may request samples at any time for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

501-3.4 Concrete Mix submittal. The concrete mix shall be submitted to the RPR at least 30 days prior to the start of operations. The submitted concrete mix shall not be more than **180** days old and must use the materials to be used for production for the project. Production shall not begin until the concrete mix is approved in writing by the RPR.

Each of the submitted concrete mixes (i.e, slip form, side form machine finish and side form hand finish) shall be stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items and quantities as a minimum:

- Certified material test reports for aggregate in accordance with paragraph 501-2.1. Certified reports must include all tests required; reporting each test, test method, test result, and requirement specified (criteria).
- Combined aggregate gradations and analysis; and including plots of the fine aggregate fineness modulus.
- Reactivity Test Results.

- Coarse aggregate quality test results, including deleterious materials.
- Fine aggregate quality test results, including deleterious materials.
- Mill certificates for cement and supplemental cementitious materials.
- Certified test results for all admixtures, including Lithium Nitrate if applicable.
- Specified flexural strength, slump, and air content.
- Recommended proportions/volumes for proposed mixture and trial water-cementitious materials ratio, including actual slump and air content.
- Flexural and compressive strength summaries and plots, including all individual beam and cylinder breaks.
- Correlation ratios for acceptance testing and Contractor QC testing, when applicable.
- Historical record of test results documenting production standard deviation, when applicable.

501-3.5 Cementitious materials.

a. Fly ash. When fly ash is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall 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 shall 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.

c. Raw or calcined natural pozzolan. Natural pozzolan may be used in the concrete mix. When pozzolan is used as a partial replacement for cement, the replacement rate shall be determined from laboratory trial mixes, and shall 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 shall not exceed 10% by weight of total cementitious material.

501-3.6 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 shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The percentage of air in the mix shall be **3%**. Air content shall 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 shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.

c. Other admixtures. Set controlling, and other approved admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted with the materials to be used in the work, in accordance with ASTM C494.

d. Lithium nitrate. Lithium nitrate shall 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 501-2.10d.

CONSTRUCTION METHODS

501-4.1 Control Strip. The control strip(s) shall be to the next planned joint after the initial 250 feet (75 m) of each type of pavement construction (slip-form pilot lane, slip-form fill-in lane, or fixed form). The Contractor shall demonstrate, in the presence of the RPR, that the materials, concrete mix, equipment, construction processes, and quality control processes meet the requirements of the specifications. The concrete mixture shall be extruded from the paver meeting the edge slump tolerance and with little or no finishing. Pilot, fill-in, and fixed-form control strips will be accepted separately. Minor adjustments to the mix design may be required to place an acceptable control strip. The production mix will be the adjusted mix design used to place the acceptable control strip. Upon acceptance of the control strip by the RPR, the Contractor must use the same equipment, materials, and construction methods for the remainder of concrete paving. Any adjustments to processes or materials must be approved in advance by the RPR. Acceptable control strips will meet edge slump tolerance and surface acceptable with little or no finishing, air content within action limits, strength equal or greater than requirements of P501-3.3. The control strip will be considered one lot for payment (no sublots required for control strip).

501-4.2 Equipment. The Contractor is responsible for the proper operation and maintenance of all equipment necessary for handling materials and performing all parts of the work to meet this specification.

a. Plant and equipment. The plant and mixing equipment shall conform to the requirements of ASTM C94 and/or ASTM C685. Each truck mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades. The truck mixers shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4 inch (19 mm) or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

Equipment for transferring and spreading concrete from the transporting equipment to the paving lane in front of the finishing equipment shall be provided. The equipment shall be specially manufactured, self-propelled transfer equipment which will accept the concrete outside the paving lane and will 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.

b. Finishing equipment.

(1) Slip-form. The standard method of constructing concrete pavements shall be with an approved slip-form paving equipment designed and operated to spread, consolidate, screed, and 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 shall be a heavy duty, self-propelled machine designed specifically for paving and finishing high quality concrete pavements.

(2) Fixed-form. On projects requiring less than 10,000 cubic yards (7650 cubic meters) of concrete pavement or irregular areas at locations inaccessible to slip-form paving equipment, concrete pavement may be placed with equipment specifically designed for placement and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR. Hand screeding and float finishing may only be used on small irregular areas as allowed by the RPR.

c. Vibrators. Vibrator shall be the internal type. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation or voids. The number, spacing, and frequency shall be as necessary to provide a dense and homogeneous pavement and meet the recommendations of American Concrete Institute (ACI) 309R, Guide for Consolidation of Concrete. Adequate power to operate all vibrators shall be available on the paver. The vibrators shall be automatically controlled so that they shall be stopped as forward motion ceases. The Contractor shall provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status shall occur a minimum of two times per day or when requested by the RPR.

Hand held vibrators may only be used in irregular areas and shall meet the recommendations of ACI 309R, Guide for Consolidation of Concrete.

d. Concrete saws. The Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions. The Contractor shall 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.

e. Fixed forms. Straight side fixed forms shall be made of steel and shall be furnished in sections not less than 10 feet (3 m) in length. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms with battered top surfaces and bent, twisted or broken forms shall not be used. Built-up forms shall not be used, except as approved by the RPR. The top face of the form shall not vary from a true plane more than 1/8 inch (3 mm) in 10 feet (3 m), and the upstanding leg shall not vary more than 1/4 inch (6 mm). The forms shall 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 RPR. The forms shall extend the full depth of the pavement section.

501-4.3 Form setting. Forms shall be set to line and grade as shown on the plans, sufficiently in advance of the concrete placement, to ensure continuous paving operation. Forms shall be set to withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the concrete placement.

501-4.4 Base surface preparation prior to placement. Any damage to the prepared base, subbase, and subgrade shall be corrected full depth by the Contractor prior to concrete placement. The underlying surface shall be entirely free of frost when concrete is placed. Base width shall extend up to 3 feet to support the paver track and avoid any noticeable displacement of the paver. The prepared grade shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from concrete.

501-4.5 Handling, measuring, and batching material. Aggregate stockpiles shall be constructed and managed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant. Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Store and maintain all aggregates at a uniform moisture content prior to use. A continuous supply of materials shall be provided to the work to ensure continuous placement.

501-4.6 Mixing concrete. The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials are placed into the drum until the drum is emptied into the truck. All concrete shall be mixed and delivered to the site in accordance with the requirements of ASTM C94 or ASTM C685.

Mixed concrete from the central mixing plant shall 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 discharged from the truck should 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. In no case shall the temperature of the concrete when placed exceed 90°F (32°C). 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 is not exceeded.

501-4.7 Weather Limitations on mixing and placing. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

a. Cold weather. Unless authorized in writing by the RPR, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40°F (4°C) and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35°F (2°C).

The aggregate shall be free of ice, snow, and frozen lumps before entering the mixer. The temperature of the mixed concrete shall not be less than 50°F (10°C) at the time of placement. Concrete shall not be placed on frozen material nor shall 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 shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

Curing during cold weather shall be in accordance with paragraph 501-4.13d.

b. Hot weather. During periods of hot weather when the maximum daily air temperature exceeds 85°F (30°C), the following precautions shall be taken.

The forms and/or the underlying surface shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90°F (32°C). The aggregates and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

The concrete placement shall be protected from exceeding an evaporation rate 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 shall immediately take such additional measures as necessary to protect the concrete surface. If the Contractor's measures are not effective in preventing plastic cracking, paving operations shall be immediately stopped.

Curing during hot weather shall be in accordance with paragraph 501-4.13e.

c. Temperature management program. Prior to the start of paving operation for each day of paving, the Contractor shall provide the RPR with a Temperature Management Program for the concrete to be placed to assure that uncontrolled cracking is avoided. (Federal Highway Administration HIPERPAV 3 is one example of a temperature management program.) As a minimum, the program shall address the following items:

(1) Anticipated tensile strains in the fresh concrete as related to heating and cooling of the concrete material.

(2) Anticipated weather conditions such as ambient temperatures, wind velocity, and relative humidity; and anticipated evaporation rate using Figure 19-9, PCA, Design and Control of Concrete Mixtures.

(3) Anticipated timing of initial sawing of joint.

(4) Anticipated number and type of saws to be used.

d. **Rain.** The Contractor shall have available materials for the protection of the concrete during inclement weather. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils (0.1 mm) thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

501-4.8 Concrete Placement. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 3 feet (1 m). The finished concrete product must be dense and homogeneous, without segregation and conforming to the standards in this specification. Backhoes and grading equipment shall not be used to distribute the concrete in front of the paver. Front end loaders will not be used. All concrete shall 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 (3.8 MPa) or a compressive strength of 3,100 psi (21.4 MPa), based on the average of four field cured specimens per 2,000 cubic yards (1,530 cubic meters) of concrete placed. The Contractor must determine that the above minimum strengths are adequate to protection the pavement from overloads due to the construction equipment proposed for the project.

The Contractor shall have available materials for the protection of the concrete during cold, hot and/or inclement weather in accordance with paragraph 501-4.7.

a. Slip-form construction. The concrete shall be distributed uniformly into final position by a self-propelled slip-form paver without delay. The alignment and elevation of the paver shall be regulated from outside reference lines established for this purpose. The paver shall vibrate the concrete for the full width and depth of the strip of pavement being placed and the vibration shall be adequate to provide a consistency of concrete that will stand normal to the surface with sharp well-defined edges. The sliding forms shall be rigidly held together laterally to prevent spreading of the forms. The plastic concrete shall 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 shall 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 shall be uniform and shall not exceed 18 inches (0.5 m).

The term internal vibration means vibrating units located within the specified thickness of pavement section.

The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without, segregation, voids, or vibrator trails and the amplitude of vibration shall 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 should be adjusted proportionately with the rate of travel to result in a uniform density and air content. The paving machine shall be equipped with a tachometer or other suitable device for measuring and indicating the actual frequency of vibrations.

The concrete shall be held at a uniform consistency. The slip-form paver shall be operated with as nearly a continuous forward movement as possible and all operations of mixing, delivering, and spreading concrete shall 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 shall also be stopped immediately. No tractive force shall be applied to the machine, except that which is controlled from the machine.

When concrete is being placed adjacent to an existing pavement, that part of the equipment which is supported on the existing pavement shall 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.

Not more than 15% of the total free edge of each 500-foot (150 m) segment of pavement, or fraction thereof, shall have an edge slump exceeding 1/4 inch (6 mm), and none of the free edge of the pavement shall 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 shall 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 will be removed the full width of the slip form lane and replaced at the expense of the Contractor as directed by the RPR.

b. Fixed-form construction. Forms shall be drilled in advance of being placed to line and grade to accommodate tie bars / dowel bars where these are specified.

Immediately in advance of placing concrete and after all subbase operations are completed, side forms shall be trued and maintained to the required line and grade for a distance sufficient to prevent delay in placing.

Side forms shall 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 shall be applied to the concrete immediately after the forms have been removed.

Side forms shall be thoroughly cleaned and coated with a release agent each time they are used and before concrete is placed against them.

Concrete shall be spread, screed, shaped and consolidated by one or more self-propelled machines. These machines shall uniformly distribute and consolidate concrete without segregation so that the completed pavement will conform to the required cross-section with a minimum of handwork.

The number and capacity of machines furnished shall be adequate to perform the work required at a rate equal to that of concrete delivery. The equipment must be specifically designed for placement and finishing using stationary side forms. Methods and equipment shall be reviewed and accepted by the RPR.

Concrete for the full paving width shall be effectively consolidated by internal vibrators. The rate of vibration of each vibrating unit shall be sufficient to consolidate the pavement without segregation, voids, or leaving vibrator trails.

Power to vibrators shall be connected so that vibration ceases when forward or backward motion of the machine is stopped.

c. Consolidation. Concrete shall 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 shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 2 inches (50 mm). Vibrators shall not be used to transport or spread the concrete. For each paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall 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) or over-consolidation (vibrator trails, segregation, or any other evidence) shall require the immediate stopping of the paving operation and adjustment of the equipment or procedures as approved by the RPR.

If a lack of consolidation of the hardened concrete is suspected by the RPR, referee testing may be required. Referee testing of hardened concrete will be performed by the RPR by cutting cores from the finished pavement after a minimum of 24 hours curing. The RPR shall visually examine the cores for evidence of lack of consolidation. Density determinations will be made by the RPR based on the water content of the core as taken. ASTM C642 shall 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 shall be responsible for all referee testing cost if they fail to meet the required density.

The average density of the cores shall be at least 97% of the original concrete mix density, with no cores having a density of less than 96% of the original concrete mix 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 shall be employed so that the density of the hardened concrete conforms to the above requirements.

501-4.9 Strike-off of concrete and placement of reinforcement. Following the placing of the concrete, it shall be struck off to conform to the cross-section shown on the plans and to an elevation that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of reinforcing steel fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off, and screed. If any portion of the bottom layer of concrete has been placed more than 30 minutes without being covered with the top layer or if initial set has taken place, it shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements.

501-4.10 Joints. Joints shall be constructed as shown on the plans and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on the plans. Joints shall not vary more than 1/2-inch (12 mm) from their designated position and shall be true to line with not more than 1/4-inch (6 mm) variation in 10 feet (3 m). The surface across the joints shall be tested with a 12-foot (3 m) straightedge as the joints are finished and any irregularities in excess of 1/4 inch (6 mm) shall be corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on the plans.

a. Construction. Longitudinal construction joints shall be slip-formed or formed against side forms as shown in the plans.

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.

b. Contraction. Contraction joints shall be installed at the locations and spacing as shown on the plans. Contraction joints shall 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 shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Grooving or sawing shall produce a slot at least 1/8 inch (3 mm) wide and to the depth shown on the plans.

c. Isolation (expansion). Isolation joints shall be installed as shown on the plans. The premolded filler of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint. The filler shall be fastened uniformly along the hardened joint face with no buckling or debris between the filler and the concrete interface, including a temporary filler for the sealant reservoir at the top of the slab. The edges of the joint shall be finished and tooled while the concrete is still plastic. Thickened-edge shall be used at isolation joints with no dowels.

d. Dowels and Tie Bars for Joints

(1) Tie bars. Tie bars shall consist of deformed bars installed in joints as shown on the plans. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on the plans. They shall be held in position parallel to the pavement surface and in the middle of the slab depth and within the tolerances in paragraph 501-4.10(f.). 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 shall not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed.

(2) Dowel bars. Dowel bars shall be placed across joints in the proper horizontal and vertical alignment as shown on the plans. The dowels shall be coated with a bond-breaker or other lubricant recommended by the manufacturer and approved by the RPR. Dowels bars at longitudinal construction joints shall be bonded in drilled holes.

(3) Placing dowels and tie bars. Horizontal spacing of dowels shall be within a tolerance of ±3/4 inch (19 mm). The vertical location on the face of the slab shall be within a tolerance of ±1/2 inch (12 mm). The method used to install dowels shall ensure that the horizontal and vertical alignment will not be greater than 1/4 inch per feet (6 mm per 0.3 m), except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes shall be measured to a level surface. Horizontal alignment shall be checked perpendicular to the joint edge. The portion of each dowel intended to move within the concrete or expansion cap shall be wiped clean and coated with a thin, even film of lubricating oil or light grease before the concrete is placed. Dowels shall be installed as specified in the following subparagraphs.

Dowels and tie bars shall not be placed closer than 0.6 times the dowel bar or tie bar length to the planned joint line. If the last regularly spaced longitudinal dowel and/or tie bar is closer than that dimension, it shall be moved away from the joint to a location 0.6 times the dowel bar and/or tie bar length, but not closer than 6 inches (150 mm) to its nearest neighbor.

(a) Contraction joints. Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal frames or basket assemblies of an approved type. The basket assemblies shall 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, dowels and tie bars in contraction joints may be installed by insertion into the plastic concrete using approved equipment and procedures per the paver manufacturer’s design. Approval of installation methods will be based on the results of the control strip showing that the dowels and tie bars are installed within specified tolerances as verified by cores or non-destructive rebar location devices approved by the RPR. Non-destructive rebar location devices include the MIT scanner, Pachometer, R-Meter, etc.

(b) 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 shall 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.

(c) Joints in hardened concrete. Install dowels in hardened concrete by bonding the dowels into holes drilled into the concrete. The concrete shall have cured for seven (7) days or reached a minimum compressive strength of 3100 psi ((21.4 MPa) or flexural strength of 450 psi (3.1 MPa) before drilling begins. Holes 1/8 inch (3 mm) greater in diameter than the dowels shall be drilled into the hardened concrete using rotary-core drills. Rotary-percussion drills may be used, provided that excessive spalling does not occur. Spalling beyond the limits of the grout retention ring will require modification of the equipment and operation. Depth of dowel hole shall be within a tolerance of ±1/2 inch (12 mm) of the dimension shown on the drawings. On completion of the drilling operation, the dowel hole shall be blown out with oil-free, compressed air. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall 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 shall be held in alignment at the collar of the hole by means of a suitable metal or plastic grout retention ring fitted around the dowel.

e. Sawing of joints. Sawing shall 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 shall continue without interruption until all joints have been sawn. All slurry and debris produced in the sawing of joints shall be removed by vacuuming and washing. Curing compound or system shall be reapplied in the initial saw-cut and maintained for the remaining cure period.

Joints shall be cut in locations as shown on the plans. The initial joint cut shall be a minimum 1/8 inch (3 mm) wide and to the depth shown on the plans. Prior to placement of joint sealant or seals, the top of the joint shall be widened by sawing as shown on the plans.

501-4.11 Finishing. Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off of the paver. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, edging of joints, and then texturing. Finishing shall be by the machine method. The hand method shall 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 shall be kept to an absolute minimum. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Equipment, mixture, and/or procedures which produce more than 1/4 inch (6 mm) of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall 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 shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way. Fog (mist) sprays or other surface applied finishing aids specified to prevent plastic shrinkage cracking, approved by the RPR, may be used in accordance with the manufacturers requirements.

a. Machine finishing with slipform pavers. The slipform paver shall 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 shall 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 shall be allowed. Equipment, mixture, and/or procedures which produce more than 1/4 inch (6 mm) of mortar-rich surface shall be immediately modified as necessary to eliminate this condition or operations shall cease. Remove excessive slurry from the surface with a cutting straightedge and wipe off the edge. Any slurry which does run down the vertical edges shall be immediately removed by hand, using stiff brushes or scrapers. No slurry, concrete or concrete mortar shall 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.

b. Machine finishing with fixed forms. The machine shall be designed to straddle the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall 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 shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

c. 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 RPR’s approval.

Bridge deck finishers shall have a minimum operating weight of 7500 pounds (3400 kg) and shall have a transversely operating carriage containing a knock-down auger and a minimum of two immersion vibrators. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.

d. 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.

e. Straightedge testing and surface correction. After the pavement has been struck off and while the concrete is still plastic, it shall be tested for trueness with a 12-foot (3.7-m) finishing straightedge swung from handles capable of spanning at least one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance in excess of 1/8 inch (3 mm) thick shall be removed from the surface of the pavement and wasted. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the smoothness requirements. Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross-section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment.

501-4.12 Surface texture. The surface of the pavement shall be finished as designated below for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. The texture shall be uniform in appearance and approximately 1/16 inch (2 mm) in depth. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the RPR.

a. Brush or broom finish. Shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface.

b. Burlap drag finish. Burlap, at least 15 ounces per square yard (555 grams per square meter), will typically produce acceptable texture. To obtain a textured surface, the transverse threads of the burlap shall be removed approximately one foot (30 cm) from the trailing edge. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface.

c. Artificial turf finish. Not used.

501-4.13 Curing. Immediately after finishing operations are completed and bleed water is gone from the surface, all exposed surfaces of the newly placed concrete shall 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, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period.

When a two-saw-cut method is used to construct the contraction joint, the curing compound shall be applied to the saw-cut immediately after the initial cut has been made. The sealant reservoir shall 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 shall be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets shall be kept moist for the duration of the curing period.

a. Impervious membrane method. Curing with liquid membrane compounds should not occur until bleed and surface moisture has evaporated. All exposed surfaces of the pavement shall 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 shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of one gallon (4 liters) to not more than 150 square feet (14 sq m). The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application, the compound shall be stirred continuously by 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 RPR, a double application rate shall be used to ensure coverage. Should the film become damaged from any cause, including sawing operations, within the required curing period, the damaged portions shall be repaired immediately with additional compound or other approved means. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface.

b. White burlap-polyethylene sheets. The surface of the pavement shall be entirely covered with the sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully saturated and in position for seven (7) days after the concrete has been placed.

c. Water method. The entire area shall be covered with burlap or other water absorbing material. The material shall be of sufficient thickness to retain water for adequate curing without excessive runoff. The material shall be kept wet at all times and maintained for seven (7) days. When the forms are stripped, the vertical walls shall also be kept moist. It shall be the responsibility of the Contractor to prevent ponding of the curing water on the subbase.

d. Concrete protection for cold weather. Maintain the concrete at a 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 7-day curing period. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather; and any concrete damaged shall be removed and replaced at the Contractor's expense.

e. Concrete protection for hot weather. Concrete should be continuous moisture cured for the entire curing period and shall 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 shall 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 RPR.

501-4.14 Removing forms. Unless otherwise specified, forms shall 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 shall be cured in accordance with paragraph 501-4.13.

If honeycombed areas are evident when the forms are removed, materials, placement, and consolidation methods must be reviewed and appropriate adjustments made to assure adequate consolidation at the edges of future concrete placements. Honeycombed areas that extend into the slab less than approximately 1 inch (25 mm), shall be repaired with an approved grout, as directed by the RPR. Honeycombed areas that extend into the slab greater than a depth of 1 inch (25 mm) shall be considered as defective work and shall be removed and replaced in accordance with paragraph 501-4.19.

~~**501-4.15 Saw-cut grooving.** If shown on the plans, grooved surfaces shall be provided in accordance with the requirements of Item P-621.~~

501-4.16 Sealing joints. The joints in the pavement shall be sealed in accordance with Item **P-605**.

501-4.17 Protection of pavement. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents until accepted by the RPR. This shall 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 shall be repaired or the pavement replaced at the Contractor's expense.
Aggregates, rubble, or other similar construction materials shall not be placed on airfield pavements. Traffic shall 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 RPR.

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, the joints are protected, the concrete has attained a minimum field cured flexural strength of [450 psi (3100 kPa)], and the slab edge is protected.

All new and existing pavement carrying construction traffic or equipment shall be kept clean and spillage of concrete and other materials shall be cleaned up immediately.

Damaged pavements shall be removed and replaced at the Contractor’s expense. Slabs shall be removed to the full depth, width, and length of the slab.

501-4.18 Opening to construction traffic. The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a flexural strength of 450 pounds per square inch (3100 kPa). when tested in accordance with ASTM C78. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion.

501-4.19 Repair, removal, or replacement of slabs. New pavement slabs that are broken or contain cracks or are otherwise defective or unacceptable as defined by acceptance criteria in paragraph 501-6.6 shall be removed and replaced or repaired, as directed by the RPR, at the Contractor’s expense. Spalls along joints shall be repaired as specified. Removal of partial slabs is not permitted. Removal and replacement shall be full depth, shall be full width of the slab, and the limit of removal shall be normal to the paving lane and to each original transverse joint. The RPR 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 shall be have a diameter of 2 inches (50 mm) to 4 inches (100 mm), shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with a bonding agent, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the Owner. Repair of cracks as described in this section shall not be allowed if in the opinion of the RPR the overall condition of the pavement indicates that such repair is unlikely to achieve an acceptable and durable finished pavement. No repair of cracks shall 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.

a. Shrinkage cracks. Shrinkage cracks which do not exceed one-third of the pavement depth shall be cleaned and either high molecular weight methacrylate (HMWM) applied; or epoxy resin (Type IV, Grade 1) pressure injected using procedures recommended by the manufacturer and approved by the RPR. Sandblasting of the surface may be required following the application of HMWM to restore skid resistance. Care shall be taken to ensure that the crack is not widened during epoxy resin injection. All epoxy resin injection shall take place in the presence of the RPR. Shrinkage cracks which exceed one-third the pavement depth shall be treated as full depth cracks in accordance with paragraphs 501-4.19b and 501-19c.

b. 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 shall be removed and replaced at no cost to the Owner, when there are any full depth cracks, or cracks greater than one-third the pavement depth, that extend into the interior area.

c. Cracks close to and parallel to joints. All full-depth cracks within 6 inches (150 mm) either side of the joint and essentially parallel to the original joints, shall be treated as follows.

(1) Full depth cracks and original joint not cracked. The full-depth crack shall be treated as the new joint and the original joint filled with an epoxy resin.

i. Full-depth crack. The joint sealant reservoir for the crack shall 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). The crack shall be sawed with equipment specially designed to follow random cracks. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent raveling or spalling. The joint shall be sealed with sealant in accordance with P-605 or as directed by the RPR.

ii. Original joint. If the original joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall 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 shall be cleaned and 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 shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

(2) Full depth cracks and original joint cracked. 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 shall be removed and replaced.

d. Removal and replacement of full slabs. Make a full depth cut perpendicular to the slab surface along all edges of the slab with a concrete saw cutting any dowels or tie-bars. Remove damaged slab protecting adjacent pavement from damage. Damage to adjacent slabs may result in removal of additional slabs as directed by the RPR at the Contractor’s expense.

The underlying material shall be repaired, re-compacted and shaped to grade.

Dowels of the size and spacing specified for other joints in similar pavement on the project shall be installed along all four (4) edges of the new slab in accordance with paragraph 501-4.10d.

Placement of concrete shall be as specified for original construction. The joints around the new slab shall be prepared and sealed as specified for original construction.

e. Spalls along joints.

(1) Spalls less than one inch wide and less than the depth of the joint sealant reservoir, shall be filled with joint sealant material.

(2) Spalls larger than one inch and/or deeper than the joint reservoir, but less than ½ the slab depth, and less than 25% of the length of the adjacent joint shall be repaired as follows:

i. Make 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 shall be straight lines forming rectangular areas surrounding the spalled area.

ii. Remove unsound concrete and at least 1/2 inch (12 mm) of visually sound concrete between the saw cut and the joint or crack with a light chipping hammer.

iii. Clean cavity with high-pressure water jets supplemented with compressed air as needed to remove all loose material.

iv. Apply a prime coat of epoxy resin, Type III, Grade I, to the dry, cleaned surface of all sides and bottom of the cavity, except any joint face.

v. Fill the cavity with low slump concrete or mortar or with epoxy resin concrete or mortar.

vi. An insert or other bond-breaking medium shall be used to prevent bond at all joint faces.

vii. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and sealed with the sealer specified for the joints.

(3) Spalls deeper than 1/2 of the slab depth or spalls longer than 25% of the adjacent joint require replacement of the entire slab.

f. Diamond grinding of Concrete surfaces. Diamond grinding shall be completed prior to pavement grooving. Diamond grinding of the hardened concrete should not be performed until the concrete is at least 14 days old and has achieved full minimum strength. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints will not be permitted. The depth of diamond grinding shall 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.

Diamond grinding shall be performed with a machine specifically designed for diamond grinding capable of cutting a path at least 3 feet (0.9 m) wide. The saw blades shall be 1/8-inch (3-mm) wide with sufficient number of flush cut blades that create grooves between 0.090 and 0.130 inches (2 and 3.5 mm) wide; and peaks and ridges approximately 1/32 inch (1 mm) higher than the bottom of the grinding cut. The Contractor shall determine the number and type of blades based on the hardness of the aggregate. Contractor shall demonstrate to the RPR that the grinding equipment will produce satisfactory results prior to making corrections to surfaces.

Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The slurry resulting from the grinding operation shall be continuously removed and the pavement left in a clean condition. All grinding shall be at the expense of the Contractor.

CONTRACTOR QUALITY CONTROL (CQC)

501-5.1 Quality control program. The Contractor shall develop a Quality Control Program in accordance with Item C-100. No partial payment will be made for materials that are subject to specific quality control requirements without an approved quality control program.

501-5.2 Contractor Quality Control (CQC). The Contractor shall provide or contract for testing facilities in accordance with Item C-100. The RPR shall be permitted unrestricted access to inspect the Contractor's QC facilities and witness QC activities. The RPR will advise the Contractor in writing of any noted deficiencies concerning the QC 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 shall be suspended immediately and will not be permitted to resume until the deficiencies are satisfactorily corrected.

501-5.3 Contractor QC testing. The Contractor shall perform all QC tests necessary to control the production and construction processes applicable to this specification and as set forth in the CQCP. The testing program shall include, but not necessarily be limited to, tests for aggregate gradation, aggregate moisture content, slump, and air content. A QC Testing Plan shall be developed and approved by the RPR as part of the CQCP.

The RPR 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 RPR, and if it can be demonstrated in the laboratory, in the presence of the RPR, that such material was erroneously rejected, payment will be made for the material at the contract unit price.

a. Fine aggregate.

(1) Gradation. A sieve analysis shall 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 shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C70 or ASTM C566.

(3) Deleterious substances. Fine aggregate as delivered to the mixer shall be tested for deleterious substances in fine aggregate for concrete as specified in paragraph 501-2.1b, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

b. Coarse Aggregate.

(1) Gradation. A sieve analysis shall be made at least twice daily for each size of aggregate. Tests shall 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 shall be made per week to check the calibration. If direct measurements are made in lieu of using an electric meter, two tests shall be made per day. Tests shall be made in accordance with ASTM C566.

(3) Deleterious substances. Coarse aggregate as delivered to the mixer shall be tested for deleterious substances in coarse aggregate for concrete as specified in paragraph 501-2.1c, prior to production of the control strip, and a minimum of every 30-days during production or more frequently as necessary to control deleterious substances.

c. Slump. One test shall be made for each sublot. Slump tests shall be performed in accordance with ASTM C143 from material randomly sampled from material discharged from trucks at the paving site. Material samples shall be taken in accordance with ASTM C172.

d. Air content. One test shall be made for each sublot. Air content tests shall 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 shall be taken in accordance with ASTM C172.

e. Unit weight and Yield. One test shall be made for each sublot. Unit weight and yield tests shall be in accordance with ASTM C138. The samples shall be taken in accordance with ASTM C172 and at the same time as the air content tests.

f. Temperatures. Temperatures shall be checked at least four times per lot at the job site in accordance with ASTM C1064.

g. Smoothness for Contractor Quality Control.

The Contractor shall perform smoothness testing in transverse and longitudinal directions daily to verify that the construction processes are producing pavement with variances less than ¼ inch in 12 feet, identifying areas that may pond water which could lead to hydroplaning of aircraft. If the smoothness criteria is not met, appropriate changes and corrections to the construction process shall be made by the Contractor before construction continues

The Contractor may use a 12-foot (3.7 m) "straightedge, a rolling inclinometer meeting the requirements of ASTM E2133 or rolling external reference device that can simulate a 12-foot (3.7m) straightedge approved by the RPR. Straight-edge testing shall start 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. Testing shall be continuous across all joints. The surface irregularity shall 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 the two high points. If the rolling inclinometer or external reference device is used, the data may be evaluated using either the FAA profile program, ProFAA, or FHWA profile program ProVal, using the 12-foot straightedge simulation function.

Smoothness readings shall not be made across grade changes or cross slope transitions. The transition between new and existing pavement shall be evaluated separately for conformance with the plans.

(1) Transverse measurements. Transverse measurements shall be taken for each day's production placed. Transverse measurements shall be taken perpendicular to the pavement centerline each 50 feet (15 m) or more often as determined by the RPR. The joint between lanes shall be tested separately to facilitate smoothness between lanes.

(2) Longitudinal measurements. Longitudinal measurements shall be taken for each day's production placed. Longitudinal tests shall be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet (6 m); and at the third points of paving lanes when widths of paving lanes are 20 ft (6 m) or greater. When placement abuts previously placed material the first measurement shall start with one half the length of the straight edge on the previously placed material.

Deviations on the final surface course in either the transverse or longitudinal direction that will trap water greater than 1/4 inch (6 mm) shall be corrected with diamond grinding per paragraph 501-4.19f or by removing and replacing the surface course to full depth. Grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. All areas in which diamond grinding has been performed shall be subject to the final pavement thickness tolerances specified in paragraph 501-6.6.

Control charts shall be kept to show area of each day's placement and the percentage of corrective grinding required. Corrections to production and placement shall be initiated when corrective grinding is required. If the Contractor's machines and/or methods produce significant areas that need corrective actions in excess of 10 percent of a day's production, production shall be stopped until corrective measures are implemented by the Contractor.

h. Grade. Grade will be evaluated prior to and after placement of the concrete surface.

Measurements will be taken at appropriate gradelines (as a minimum at center and edges of paving lane) and longitudinal spacing as shown on cross-sections and plans. The final surface of the pavement will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm) vertically and 0.1 feet (30 mm) laterally . The documentation will be provided by the Contractor to the RPR within 48 hours.

Areas with humps or depression that that exceed grade or smoothness and that retain water on the surface must be ground off provided the course thickness after grinding is not more than 1/2 inch (12 mm) less than the thickness specified on the plans. If these areas cannot be corrected with grinding then the slabs that are retaining water must be removed and replaced in accordance with paragraph 501-4.19d. Grinding shall be in accordance with paragraph 501-4.19f. All corrections will be at the Contractors expense.

501-5.4 Control charts. The Contractor shall maintain linear control charts for fine and coarse aggregate gradation, slump, and air content. The Contractor shall also maintain a control chart plotting the coarseness factor/workability factor from the combined gradations in accordance with paragraph 501-2.1d.

Control charts shall be posted in a location satisfactory to the RPR and shall be kept up to date at all times. As a minimum, the control charts shall 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 shall 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 RPR may halt production or acceptance of the material.

a. Fine and coarse aggregate gradation. The Contractor shall record the running average of the last five gradation tests for each control sieve on linear control charts. Superimposed on the control charts shall be the action and suspension limits. Gradation tests shall be performed by the Contractor per ASTM C136. The Contractor shall take at least two samples per lot to check the final gradation. Sampling shall be per ASTM D75 from the flowing aggregate stream or conveyor belt.

b. Slump and air content. The Contractor shall 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.

c. Combined gradation. The Contractor shall maintain a control chart plotting the coarseness factor and workability factor on a chart in accordance with paragraph 501-2.1d.

Control Chart Limits[1]

Control Parameter	Individual Measurements	
	Action Limit	Suspension Limit
Gradation[2]	*[3]	*[3]
Coarseness Factor (CF)	±3.5	±5
Workability Factor (WF)	±2	±3
Slump	+0.5 to -1 inch (+13 to -25 mm)	+1 to -1.5 inch (+25 to -38 mm)
Air Content	±1.5%	±2.0%

[1] Control charts shall developed and maintained for each control parameter indicated.
[2] Control charts shall be developed and maintained for each sieve size.
[3] Action and suspension limits shall be determined by the Contractor.

501-5.5 Corrective action at Suspension Limit. The CQCP shall indicate that appropriate action shall be taken when the process is believed to be out of control. The CQCP shall detail what action will be taken to bring the process into control and shall contain sets of rules to gauge when a process is out of control. As a minimum, a process shall be deemed out of control and corrective action taken if any one of the following conditions exists.

a. Fine and coarse aggregate gradation. When two consecutive averages of five tests are outside of the suspension limits, immediate steps, including a halt to production, shall be taken to correct the grading.

b. Coarseness and Workability factor. When the CF or WF reaches the applicable suspension limits, the Contractor, immediate steps, including a halt to production, shall be taken to correct the CF and WF.

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 shall be adjusted.

d. Slump. The Contractor shall halt production and make appropriate adjustments whenever:

(1) one point falls outside the Suspension Limit line for individual measurements

OR

(2) two points in a row fall outside the Action Limit line for individual measurements.

d. Air content. The Contractor shall halt production and adjust the amount of air-entraining admixture whenever:

(1) one point falls outside the Suspension Limit line for individual measurements

OR

(2) two points in a row fall outside the Action Limit line for individual measurements.

MATERIAL ACCEPTANCE

501-6.1 Quality Assurance (QA) Acceptance sampling and testing. 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 RPR. The Contractor shall provide adequate facilities for the initial curing of beams. The Contractor shall bear the cost of providing initial curing facilities and coring and filling operations, per paragraph 501-6.5b(1).

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. 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.

501-6.2 Quality Assurance (QA) testing laboratory. Quality assurance testing organizations performing these acceptance tests will be accredited in accordance with ASTM C1077. The quality assurance 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 will be submitted to the RPR prior to start of construction.

501-6.3 Lot size. Concrete will be accepted for strength and thickness on a lot basis. A lot will consist of a day's production not to exceed 2,000 cubic yards (1530 cubic meters). Each lot will be divided into approximately equal sublots with individual sublots between 400 to 600 cubic yards. Where three sublots are produced, they will constitute a lot. Where one or two sublots are produced, they will be incorporated into the previous or next lot. Where more than one plant is simultaneously producing concrete for the job, the lot sizes will apply separately for each plant.

501-6.4 Partial lots. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot or for 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 will constitute a lot. Where one or two sublots have been produced, they will be incorporated into the next lot or the previous lot and the total number of sublots will be used in the acceptance criteria calculation, that is, n=5 or n=6.

501-6.5 Acceptance Sampling and Testing.

a. Strength.

(1) Sampling. One sample will be taken for each sublot from the concrete delivered to the job site. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. The concrete will be sampled in accordance with ASTM C172.

(2) Test Specimens. The RPR will be responsible for the casting, initial curing, transportation, and curing of specimens in accordance with ASTM C31. Two (2) specimens will be made from each sample and slump, air content, unit weight, and temperature tests will be conducted for each set of strength specimens. Within 24 to 48 hours, the samples will be transported from the field to the laboratory while in the molds. Samples will be cured in saturated lime water.

The strength of each specimen will be determined in accordance with **ASTM C78**. The strength for each sublot will be computed by averaging the results of the two test specimens representing that sublot.

(3) Acceptance. Acceptance of pavement for strength will be determined by the RPR in accordance with paragraph 501-6.6b(1). All individual strength tests within a lot will be checked for outliers in accordance with ASTM E178, at a significance level of 5%. Outliers will be discarded and the remaining test values will be used to determine acceptance in accordance with paragraph 501-6.5b.

b. Pavement thickness.

(1) Sampling. One core will be taken by the Contractor for each sublot in the presence of the RPR. Sampling locations will be determined by the RPR in accordance with random sampling procedures contained in ASTM D3665. Areas, such as thickened edges, with planned variable thickness, will be excluded from sample locations.

Cores shall be a minimum 4 inch (100 mm) in diameter neatly cut with a core drill. The Contractor will furnish all tools, labor, and materials for cutting samples and filling the cored hole. Core holes will be filled by the Contractor with a non-shrink grout approved by the RPR within one day after sampling.

(2) Testing. The thickness of the cores will be determined by the RPR by the average caliper measurement in accordance with ASTM C174. Each core shall be photographed and the photograph included with the test report.

(3) Acceptance. Acceptance of pavement for thickness will be determined by the RPR in accordance with paragraph 501-6.6.

501-6.6 Acceptance criteria.

a. General. Acceptance will be based on the following characteristics of the completed pavement discussed in paragraph 501-6.5b:

(1) Strength

(2) Thickness

(3) Grade

(4) Profilograph smoothness **-** Not used.

(5) Adjustments for repairs

Acceptance for strength, thickness, and grade, will be based on the criteria contained in accordance with paragraph 501-6.6b(1), 501-6.6b(2), and 501-6.6b(3), respectively.

b. Acceptance criteria.

(1) Strength. The strength for each sublot shall be computed by averaging the results of that sublot. When sublot strength equals or exceeds the strength as specified in paragraph 501-3.3, the lot will be acceptable.

(**2) Thickness.** If sublot thickness is not be less than ½ inch (12 mm) from plan thickness, the lot will be acceptable.

(3) Grade. The final finished surface of the pavement of the completed project will not vary from the gradeline elevations and cross-sections shown on the plans by more than 1/2 inch (12 mm) vertically **[** or 0.1 feet (30 mm) laterally **]**. The documentation, stamped and signed by a licensed surveyor shall be in accordance with paragraph 501-5.3h. Payment for sublots that do not meet grade for over 25% of the sublot shall reduced by 5% and not be more than 95%.

(4) Profilograph roughness for QA Acceptance. Not used.

(5) Adjustments for repair. Sublots with spall repairs, crack repairs, or partial panel replacement, will be limited to no more than 95% payment.

(6) Adjustment for grinding. For sublots with grinding over 25% of a sublot, payment will be reduced 5%.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
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 A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
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 A1035	Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel 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 C29	Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate

ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
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 C94	Standard Specification for Ready-Mixed Concrete
ASTM C114	Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C117	Standard Test Method for Materials Finer than 75-μm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C123	Standard Test Method for Lightweight Particles in Aggregate
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
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 C150	Standard Specification for Portland Cement
ASTM C171	Standard Specification for Sheet Materials for Curing 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 C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C295	Standard Guide for Petrographic Examination of Aggregates for Concrete

ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C566	Standard Test Method for Total Evaporable Moisture Content of Aggregates by Drying
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 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 C685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
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 C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1064	Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1157	Standard Performance Specification for Hydraulic Cement
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1365	Standard Test Method for Determination of the Proportion of Phases in Portland Cement and Portland-Cement Clinker Using X-Ray Powder Diffraction Analysis
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 D75	Standard Practice for Sampling Aggregates
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
ASTM D2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate

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
ASTM E2133	Standard Test Method for Using a Rolling Inclinometer to Measure Longitudinal and Transverse Profiles of a Traveled Surface

American Concrete Institute (ACI)

ACI 305R	Guide to Hot Weather Concreting
ACI 306R	Guide to Cold Weather Concreting
ACI 309R	Guide for Consolidation of Concrete

Advisory Circulars (AC)

AC 150/5320-6	Airport Pavement Design and Evaluation

Federal Highway Administration (FHWA)

HIPERPAV 3, version 3.2

Portland Concrete Association (PCA)

PCA	Design and Control of Concrete Mixtures, 16th Edition

U.S. Army Corps of Engineers (USACE) Concrete Research Division (CRD)

CRD C662	Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

United States Air Force Engineering Technical Letter (ETL)

ETL 97-5	Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield Pavements

END ITEM P-501

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SECTION 32 P-602 EMULSIFIED ASPHALT PRIME COAT

DESCRIPTION

602-1.1 This item shall consist of an application of emulsified asphalt material on the prepared base course in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

602-2.1 Emulsified Asphalt material. The emulsified asphalt material shall be as specified in ASTM D3628 for use as a prime coat appropriate to local conditions. The Contractor shall provide a copy of the manufacturer's Certificate of Analysis (COA) for the emulsified asphalt material. The COA shall be provided to and approved by the Resident Project Representative (RPR) before the emulsified asphalt material is applied. The furnishing of the COA for the emulsified 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.

CONSTRUCTION METHODS

602-3.1 Weather limitations. The emulsified asphalt prime coat shall be applied only when the existing surface is dry; the atmospheric temperature is 50°F or above, and the temperature has not been below 35°F for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the RPR.

602-3.2 Equipment. The equipment shall include a self-powered pressure asphalt material distributor and equipment for heating asphalt material.

Provide a distributor with pneumatic tires of such size and number that the load produced on the base surface does not exceed 65.0 psi of tire width to prevent rutting, shoving or otherwise damaging the base, surface, or other layers in the pavement structure. Design and equip the distributor to spray the asphalt material in a uniform coverage at the specified temperature, at readily determined and controlled rates from 0.05 to 1.0 gallons per square yard, with a pressure range of 25 to 75 psi and with an allowable variation from the specified rate of not more than ±5%, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying asphalt material manually to areas inaccessible to the distributor. Equip the distributor to circulate and agitate the asphalt material during the heating process. If the distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper.

A power broom and power blower suitable for cleaning the surfaces to which the asphalt coat is to be applied shall be provided.

Asphalt distributors must be calibrated annually 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 RPR.

602-3.3 Application of emulsified asphalt material. Immediately before applying the prime coat, the full width of the surface to be primed shall be swept with a power broom to remove all loose dirt and other objectionable material.

The asphalt emulsion material shall be uniformly applied with an asphalt distributor at the rate of 0.07 to 0.12 gallons per square yard depending on the base course surface texture. The type of asphalt material and application rate shall be approved by the RPR prior to application.

Following application of the emulsified asphalt material and prior to application of the succeeding layer of pavement, allow the asphalt coat to cure and to obtain evaporation of any volatiles or moisture. Maintain the coated surface until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and recoating deficient areas. Allow the prime coat to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Furnish and spread sand to effectively blot up and cure excess asphalt material. The Contractor shall remove blotting sand prior to asphalt concrete lay down operations at no additional expense to the Owner. Keep traffic off surfaces freshly treated with asphalt material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

602-3.4 Trial application rates. The Contractor shall apply a minimum of three lengths of at least 100 feet for the full width of the distributor bar to evaluate the amount of emulsified asphalt material that can be satisfactorily applied with the equipment. Apply three different application rates of emulsified asphalt materials within the application range specified in paragraph 602-3.3. Other trial applications can be made using various amounts of material as directed by the RPR. The trial application is to demonstrate the equipment can uniformly apply the emulsified asphalt material within the rates specified and determine the application rate for the project.

602-3.5 Freight and waybills. The Contractor shall submit waybills and delivery tickets during the progress of the work. Before the final estimate is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM D2995	Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors
ASTM D3628	Standard Practice for Selection and Use of Emulsified Asphalts

END OF ITEM P-602

Item P-603 Emulsified Asphalt Tack Coat

DESCRIPTION

603-1.1 This item shall consist of preparing and treating an asphalt or concrete surface with asphalt material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

MATERIALS

603-2.1 Asphalt materials. The asphalt material shall be an emulsified asphalt as specified in ASTM D3628 as an asphalt application for tack coat appropriate to local conditions. The emulsified asphalt shall not be diluted. The Contractor shall provide a copy of the manufacturer's Certificate of Analysis (COA) for the asphalt material to the Resident Project Representative (RPR) before the asphalt material is applied for review and acceptance. The furnishing of COA 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.

CONSTRUCTION METHODS

603-3.1 Weather limitations. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is 50°F or above; the temperature has not been below 35°F for the 12 hours prior to application; and when the weather is not foggy or rainy. The temperature requirements may be waived when directed by the RPR.

603-3.2 Equipment. The Contractor shall provide equipment for heating and applying the emulsified asphalt material. The emulsion 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 emulsion. 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 equipment will be tested under pressure for leaks and to ensure proper set-up before use to verify truck set-up (via a test-shot area), including but not limited to, nozzle tip size appropriate for application, spray-bar height and pressure and pump speed, 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 minimum 12-foot spreader spray bar with individual nozzle control with computer-controlled application rates. The distributor truck shall have an easily accessible thermometer that constantly monitors the temperature of the emulsion, and have an operable mechanical tank gauge that can be used to cross-check the computer accuracy. If the distributor is not equipped with an operable quick shutoff valve, the prime operations shall be started and stopped on building paper.

The distributor truck shall be equipped to effectively heat and mix the material to the required temperature prior to application as required. Heating and mixing shall be done in accordance with the manufacturer's recommendations. Do not overheat or over mix the material.

The distributor shall be equipped with a hand sprayer.

Asphalt distributors must be calibrated annually 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 RPR.

A power broom and/or power blower suitable for cleaning the surfaces to which the asphalt tack coat is to be applied shall be provided.

603-3.3 Application of emulsified asphalt material. The emulsified asphalt shall not be diluted. Immediately before applying the emulsified asphalt tack coat, the full width of surface to be treated shall be swept with a power broom and/or power blower to remove all loose dirt and other objectionable material.

The emulsified asphalt material shall be uniformly applied with an asphalt distributor at the rates appropriate for the conditions and surface specified in the table below. The type of asphalt material and application rate shall be approved by the RPR prior to application.

Emulsified Asphalt

Surface Type	Residual Rate, gal/SY (L/square meter)	Emulsion Application Bar Rate, gal/SY (L/square meter)
New asphalt	0.02-0.05	0.03-0.07
Existing asphalt	0.04-0.07	0.06-0.11
Milled Surface	0.04-0.08	.0.06-0.12
Concrete	0.03-0.05	0.05-0.08

After application of the tack coat, the surface shall be allowed to cure without being disturbed for the period of time necessary to permit drying and setting of the tack coat. This period shall be determined by the RPR. The Contractor shall protect the tack coat and maintain the surface until the next course has been placed. When the tack coat has been disturbed by the Contractor, tack coat shall be reapplied at the Contractor's expense.

603-3.4 Freight and waybills The Contractor shall submit waybills and delivery tickets, during progress of the work. Before the final statement is allowed, file with the RPR certified waybills and certified delivery tickets for all emulsified asphalt materials used in the construction of the pavement covered by the contract. Do not remove emulsified asphalt material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM D1250 Standard Guide for Use of the Petroleum Measurement Tables

ASTM D2995 Standard Practice for Estimating Application Rate and Residual Application Rate of Bituminous Distributors

ASTM D3628 Standard Practice for Selection and Use of Emulsified Asphalts

END ITEM P-603

Item P-610 Concrete for Miscellaneous Structures

DESCRIPTION

610-1.1 This item shall consist of concrete and reinforcement, as shown on the plans, prepared and constructed in accordance with these specifications. This specification shall be used for all concrete other than airfield pavement which are cast-in-place.

MATERIALS

610-2.1 General. Only approved materials, conforming to the requirements of these specifications, shall be used in the work. Materials may be subject to inspection and tests at any time during their preparation or use. The source of all materials shall be approved by the Resident Project Representative (RPR) before delivery or use in the work. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and test. Materials shall be stored and handled to ensure preservation of their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed in them.

The use of pit-run aggregates shall not be permitted unless the pit-run aggregate has been screened and washed, and all fine and coarse aggregates stored separately and kept clean. The mixing of different aggregates from different sources in one storage stockpile or alternating batches of different aggregates shall not be permitted.

a. Reactivity. Fine aggregate and coarse aggregates to be used in all concrete shall have been tested separately within six months of the project in accordance with ASTM C1260. Test results shall be submitted to the RPR. The aggregate shall be considered innocuous if the expansion of test specimens, tested in accordance with ASTM C1260, does not exceed 0.08% at 14 days (16 days from casting). If the expansion either or both test specimen is greater than 0.08% at 14 days, but less than 0.20%, a minimum of 25% of Type F fly ash, or between 40% and 55% of slag cement shall be used in the concrete mix.

If the expansion is greater than 0.20% the aggregates shall not be used, and test results for other aggregates must be submitted for evaluation.

610-2.2 Coarse aggregate. The coarse aggregate for concrete shall meet the requirements of ASTM C33 and the requirements of Table 4, Class Designation 5S; and the grading requirements shown below, as required for the project.

Coarse Aggregate Grading Requirements

Maximum Aggregate Size	ASTM C33, Table 3 Grading Requirements (Size No.)
1 1/2 inch	467 or 4 and 67
1 inch	57
3/4 inch	67
1/2 inch	7

610-2.2.1 Coarse Aggregate susceptibility to durability (D) cracking. Coarse aggregate may only be accepted from sources that have a 20-year service history for the same gradation to be supplied with no history of D-Cracking. Aggregates that do not have a 20-year record of service free from major repairs (less than 5% of slabs replaced) in similar conditions without D-cracking shall not be used unless the material currently being produced has a durability factor greater than or equal to 95 per ASTM C666. The Contractor shall submit a current certification and test results to verify the aggregate acceptability. Test results will only be accepted from a State Department of Transportation (DOT) materials laboratory or an accredited laboratory. Certification and test results which are not dated or which are over one (1) year old or which are for different gradations will not be accepted.

Crushed granite, calcite cemented sandstone, quartzite, basalt, diabase, rhyolite or trap rock are considered to meet the D-cracking test requirements but must meet all other quality tests specified in Item P-501.

610-2.3 Fine aggregate. The fine aggregate for concrete shall meet all fine aggregate requirements of ASTM C33.

610-2.4 Cement. Cement shall conform to the requirements of ASTM C150 Type II.

610-2.5 Cementitious materials.

a. Fly ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 15% 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 shall not be acceptable. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix, and shall 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 RPR.

b. Slag cement (ground granulated blast furnace (GGBF)). Slag cement shall conform to ASTM C989, Grade 100 or Grade 120. Slag cement shall be used only at a rate between 25% and 55% of the total cementitious material by mass.

610-2.6 Water. Water used in mixing or curing shall be from potable water sources. Other sources shall be tested in accordance with ASTM C1602 prior to use.

610-2.7 Admixtures. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the RPR 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 RPR 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.

a. Air-entraining admixtures. Air-entraining admixtures shall meet the requirements of ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entrainment agent and any water reducer admixture shall be compatible.

b. Water-reducing admixtures. Water-reducing admixture shall 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 shall not be used.

c. Other chemical admixtures. The use of set retarding, and set-accelerating admixtures shall be approved by the RPR. Retarding shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

610-2.8 Premolded joint material. Premolded joint material for expansion joints shall meet the requirements of ASTM D1751**.**

610-2.9 Joint filler. The filler for joints shall meet the requirements of Item P-605, unless otherwise specified.

610-2.10 Steel reinforcement. Reinforcing shall consist of Reinforcing Steel and bar mats conforming to the requirements of ASTM A 615 and ASTM A 185, respectively**.**

610-2.11 Materials for curing concrete. Curing materials shall conform to ASTM C309 .

CONSTRUCTION METHODS

610-3.1 General. The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified here. All machinery and equipment used by the Contractor on the work, shall be of sufficient size to meet the requirements of the work. All work shall be subject to the inspection and approval of the RPR.

610-3.2 Concrete Mixture. The concrete shall develop a compressive strength of 4000 psi in 28 days as determined by test cylinders made in accordance with ASTM C31 and tested in accordance with ASTM C39. The concrete shall contain not less than 470 pounds of cementitious material per cubic yard. The water cementitious ratio shall not exceed 0.45 by weight. The air content of the concrete shall be 5% +/- 1.2% as determined by ASTM C231 and shall have a slump of not more than 4 inches as determined by ASTM C143.

Concrete produced by a reputable local supplier of ready-mix or transit mix concrete designed for a minimum compressive strength of 3,000 psi or as given in the project plans, may be used when approved by the Engineer. The Contractor shall submit the ready mix or transit mix design to the Engineer at least 30-days prior to use of concrete on the project.

610-3.3 Mixing. Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C94 or ASTM C685.

The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below 40°F without the RPRs approval. If approval is granted for mixing under such conditions, aggregates or water, or both, shall be heated and the concrete shall be placed at a temperature not less than 50°F nor more than 100°F. The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his expense.

Retempering of concrete by adding water or any other material is not permitted.

The rate of delivery of concrete to the job shall be sufficient to allow uninterrupted placement of the concrete.

610-3.4 Forms. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the RPR. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as shown on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes. The Contractor shall be responsible for their adequacy.

The internal form ties shall be arranged so no metal will show in the concrete surface or discolor the surface when exposed to weathering when the forms are removed. All forms shall be wetted with water or with a non-staining mineral oil, which shall be applied immediately before the concrete is placed. Forms shall be constructed so they can be removed without injuring the concrete or concrete surface.

610-3.5 Placing reinforcement. All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concrete placement. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.

610-3.6 Embedded items. Before placing concrete, all embedded items shall be firmly and securely fastened in place as indicated. All embedded items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The concrete shall be spaded and consolidated around and against embedded items. The embedding of wood shall not be allowed.

610-3.7 Concrete Consistency. The Contractor shall monitor the consistency of the concrete delivered to the project site; collect each batch ticket; check temperature; and perform slump tests on each truck at the project site in accordance with ASTM C143.

610-3.8 Placing concrete. All concrete shall be placed during daylight hours, unless otherwise approved. The concrete shall not be placed until the depth and condition of foundations, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved by the RPR. Concrete shall be placed as soon as practical after mixing, but in no case later than one (1) hour after water has been added to the mix. The method and manner of placing shall avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. The concrete shall not be dropped from a height of more than 5 feet. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Do not subject concrete to procedures which cause segregation. Concrete shall be placed on clean, damp surfaces, free from running water, or on a properly consolidated soil foundation.

610-3.9 Vibration. Vibration shall follow the guidelines in American Concrete Institute (ACI) Committee 309R, Guide for Consolidation of Concrete.

610-3.10 Joints. Joints shall be constructed as indicated on the plans.

610-3.11 Finishing. All exposed concrete surfaces shall be true, smooth, and free from open or rough areas, depressions, or projections. All concrete horizontal plane surfaces shall be brought flush to the proper elevation with the finished top surface struck-off with a straightedge and floated.

610-3.12 Curing and protection. All concrete shall be properly cured in accordance with the recommendations in American Concrete Institute (ACI) 308R, Guide to External Curing of Concrete. The concrete shall be protected from damage until project acceptance.

610-3.13 Cold weather placing. When concrete is placed at temperatures below 40°F, follow the cold weather concreting recommendations found in ACI 306R, Cold Weather Concreting.

610-3.14 Hot weather placing. When concrete is placed in hot weather greater than 85ºF, follow the hot weather concreting recommendations found in ACI 305R, Hot Weather Concreting.

QUALITY ASSURANCE (QA)

610-4.1 Quality Assurance sampling and testing. Concrete for each day's placement will be accepted on the basis of the compressive strength specified in paragraph 610-3.2. The RPR will sample the concrete in accordance with ASTM C172; test the slump in accordance with ASTM C143; test air content in accordance with ASTM C231; make and cure compressive strength specimens in accordance with ASTM C31; and test in accordance with ASTM C39. The QA testing agency will meet the requirements of ASTM C1077. Contractor will be required to make all cylinders, provide initial cure, and deliver to the RPR's testing laboratory within 48 hours. Contractor shall make 2 cylinders for breaking at 7 days and 2 cylinders for breaking at 28 days.

The Contractor shall provide adequate facilities for the initial curing of cylinders.

610-4.2 Defective work. Any defective work that cannot be satisfactorily repaired as determined by the RPR, shall be removed and replaced at the Contractor's expense. Defective work includes, but is not limited to, uneven dimensions, honeycombing and other voids on the surface or edges of the concrete.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
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 A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884	Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C114	Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM C143	Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C171	Standard Specification for Sheet Materials for Curing Concrete
ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C989	Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1017	Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1157	Standard Performance Specification for Hydraulic Cement
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1365	Standard Test Method for Determination of the Proportion of Phases in Portland Cement and Portland-Cement Clinker Using X-Ray Powder Diffraction Analysis
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types)
ASTM D1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

American Concrete Institute (ACI)

ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting

ACI 308R	Guide to External Curing of Concrete
ACI 309R	Guide for Consolidation of Concrete

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Item P-620 Runway and Taxiway Marking

DESCRIPTION

620-1.1 This item shall consist of the preparation and painting of numbers, markings, and stripes on the surface of runways, taxiways, and aprons, in accordance with these specifications and at the locations shown on the plans, or as directed by the Resident Project Representative (RPR). The terms "paint" and "marking material" as well as "painting" and "application of markings" are interchangeable throughout this specification.

MATERIALS

620-2.1 Materials acceptance. The Contractor shall furnish manufacturer's certified test reports, for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. This certification along with a copy of the paint manufacturer's surface preparation; marking materials, including adhesion, flow promoting and/or floatation additive; and application requirements must be submitted and approved by the Resident Project Representative (RPR) prior to the initial application of markings. The reports can be used for material acceptance or the RPR may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the RPR upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers that are easily quantifiable for inspection by the RPR.

620-2.2 Marking materials.

Table 1. Marking Materials

Paint[1]				Glass Beads[2]	
Type	**Color**	**Fed Std. 595 Number**	**Application Rate Maximum**	**Type**	**Application Rate Minimum**
I or II	White	37925	115 ft^2/gal	III	10 lb./gal
I or II	Yellow	33538	115 ft^2/gal	III	10 lb./gal
I or II	Black	37038	115 ft^2/gal	N/A	N/A
I or II	White	37925	230 ft^2/gal	N/A	N/A
I or II	Yellow	33538	230 ft^2/gal	N/A	N/A

[1] **See paragraph 620-2.2a**

[2] **See paragraph 620-2.2b**

a. Paint. Paint shall be waterborne in accordance with the requirements of this paragraph. Paint colors shall comply with Federal Standard No. 595.

Waterborne. Paint shall meet the requirements of Federal Specification TT-P-1952F, Type I or Type II. The non-volatile portion of the vehicle for all paint types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis.

b. Reflective media. Glass beads for white and yellow paint shall meet the requirements for Federal Specification TT-B-1325D Type III.

Glass beads for red and pink paint shall meet the requirements for Type I, Gradation A or Type IV, Gradation A.

Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

Glass beads shall not be used in black and green paint or temporary (white or yellow) markings.

Federal Specification TT-B-1325D, Type III. Initial readings typically yield 600 mcd/m²/lux on white markings and 300 mcd/m²/lux on yellow markings at installation and once in service, the reflectance values are approximately the same as Type I beads.

CONSTRUCTION METHODS

620-3.1 Weather limitations. Painting shall only be performed when the surface is dry, and the ambient temperature and the pavement surface temperature meet the manufacturer's recommendations in accordance with paragraph 620-2.1. Painting operations shall be discontinued when the ambient or surface temperatures does not meet the manufacturer's recommendations. Markings shall not be applied when the wind speed exceeds 10 mph unless windscreens are used to shroud the material guns. Markings shall not be applied when weather conditions are forecasts to not be within the manufacturers' recommendations for application and dry time.

620-3.2 Equipment. Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead dispensing machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type or airless type marking machine with automatic glass bead dispensers suitable for application of traffic paint. It shall produce an even and uniform film thickness and appearance of both paint and glass beads at the required coverage and shall apply markings of uniform cross-sections and clear-cut edges without running or spattering and without over spray. The marking equipment for both paint and beads shall be calibrated daily.

620-3.3 Preparation of surfaces. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other contaminates that would reduce the bond between the paint and the pavement. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the RPR. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

a. Preparation of new pavement surfaces. The area to be painted shall be cleaned by broom, blower, water blasting, or by other methods approved by the RPR to remove all contaminants, minimizing damage to the pavement surface. This work shall be incidental to painting.

b. Preparation of pavement to remove existing markings. Existing pavement markings shall be removed by rotary grinding, water blasting, or by other methods approved by the RPR minimizing damage to the pavement surface. The removal area may need to be larger than the area of the markings to eliminate ghost markings. After removal of markings on asphalt pavements, apply a fog seal or seal coat to 'block out' the removal area to eliminate 'ghost' markings. This work shall be considered pavement marking removal.

c. Preparation of pavement markings prior to remarking. Prior to remarking existing markings, loose existing markings must be removed minimizing damage to the pavement surface, with a method approved by the RPR. After removal, the surface shall be cleaned of all residue or debris. This work shall be considered pavement marking removal.

Prior to the application of markings, the Contractor shall certify in writing that the surface is dry and free from dirt, grease, oil, laitance, or other foreign material that would prevent the bond of the paint to the pavement or existing markings. This certification along with a copy of the paint manufactures application and surface preparation requirements must be submitted to the RPR prior to the initial application of markings.

620-3.4 Layout of markings. The proposed markings shall be laid out in advance of the paint application. The locations of markings to receive glass beads shall be shown on the plans.

620-3.5 Application. A period of 30 days shall elapse between placement of surface course or seal coat and application of the permanent paint markings. Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the RPR.

The edges of the markings shall not vary from a straight line more than 1/2 inch in 50 feet, and marking dimensions and spacing shall be within the following tolerances:

Marking Dimensions and Spacing Tolerance

Dimension and Spacing	Tolerance
36 inch or less	±1/2 inch
greater than 36 inch to 6 feet	±1 inch
greater than 6 feet to 60 feet	±2 inch
greater than 60 feet	±3 inch

The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine at the rate shown in Table 1. The addition of thinner will not be permitted.

Glass beads shall be distributed upon the marked areas at the locations shown on the plans to receive glass beads immediately after application of the paint. A dispenser shall be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Glass beads shall be applied at the rate shown in Table 1. Glass beads shall not be applied to black paint or green paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made. Different bead types shall not be mixed. Regular monitoring of glass bead embedment and distribution should be performed.

Where temporary markings are required or to facilitate the Contractor's schedule and to reduce the amount of runway and taxiway closure time, the Contractor may apply one coat of temporary markings at a 30 percent application rate immediately after placement of the asphalt or rejuvenator and initial cooling or drying and apply the second coat as final markings after the asphalt cure time. Reflective Beads are not required for temporary markings.

620-3.6 Application--preformed thermoplastic airport pavement markings.

Preformed thermoplastic pavement markings not used.

620-3.7 Control strip. Prior to the full application of airfield markings, the Contractor shall prepare a control strip in the presence of the RPR. The Contractor shall demonstrate the surface preparation method and all striping equipment to be used on the project. The marking equipment must achieve the prescribed application rate of paint and population of glass beads (per Table 1) that are properly embedded and evenly distributed across the full width of the marking. Prior to acceptance of the control strip, markings must be evaluated during darkness to ensure a uniform appearance.

620-3.8 Retro-reflectance. Reflectance shall be measured with a portable retro-reflectometer meeting ASTM E1710 (or equivalent). A total of 6 reading shall be taken over a 6 square foot area with 3 readings taken from each direction. The average shall be equal to or above the minimum levels of all readings which are within 30% of each other.

Minimum Retro-Reflectance Values

Material	Retro-reflectance mcd/m²/lux		
	White	**Yellow**	**Red**
Initial Type I	300	175	35
Initial Type III	600	300	35
Initial Thermoplastic	225	100	35
All materials, remark when less than[1]	100	75	10

[1] ‘Prior to remarking determine if removal of contaminants on markings will restore retro-reflectance.

620-3.9 Protection and cleanup. After application of the markings, all markings shall be protected from damage until dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings. The Contractor shall remove from the work area all debris, waste, loose reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the RPR. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and federal environmental statutes, and regulations.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM D476	Standard Classification for Dry Pigmentary Titanium Dioxide Products
ASTM D968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1652	Standard Test Method for Epoxy Content of Epoxy Resins
ASTM D2074	Standard Test Method for Total, Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method
ASTM D2240	Standard Test Method for Rubber Property - Durometer Hardness
ASTM D7585	Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments
ASTM E303	Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester
ASTM E1710	Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer
ASTM E2302	Standard Test Method for Measurement of the Luminance Coefficient Under Diffuse Illumination of Pavement Marking Materials Using a Portable Reflectometer

ASTM G154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

Code of Federal Regulations (CFR)

40 CFR Part 60, Appendix A-7, Method 24	Determination of volatile matter content, water content, density, volume solids, and weight solids of surface coatings
29 CFR Part 1910.1200	Hazard Communication

Federal Specifications (FED SPEC)

FED SPEC TT-B-1325D	Beads (Glass Spheres) Retro-Reflective
FED SPEC TT-P-1952F	Paint, Traffic and Airfield Marking, Waterborne
FED STD 595	Colors used in Government Procurement

Commercial Item Description

A-A-2886B	Paint, Traffic, Solvent Based

Advisory Circulars (AC)

AC 150/5340-1	Standards for Airport Markings
AC 150/5320-12	Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces

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Item T-904 Sodding

DESCRIPTION

904-1.1 This item shall consist of furnishing, hauling, and placing approved live sod on prepared areas in accordance with this specification at the locations shown on the plans or as directed by the RPR.

MATERIALS

904-2.1 Sod. Sod furnished by the Contractor shall have a good cover of living or growing grass. This shall be interpreted to include grass that is seasonally dormant during the cold or dry seasons and capable of renewing growth after the dormant period. All sod shall be obtained from areas where the soil is reasonably fertile and contains a high percentage of loamy topsoil. Sod shall be cut or stripped from living, thickly matted turf relatively free of weeds or other undesirable foreign plants, large stones, roots, or other materials that might be detrimental to the development of the sod or to future maintenance. At least 70% of the plants in the cut sod shall be composed of the species stated in the special provisions, and any vegetation more than 6 inches in height shall be mowed to a height of 3 inches or less before sod is lifted. Sod, including the soil containing the roots and the plant growth showing above, shall be cut uniformly to a thickness not less than that stated in the special provisions.

904-2.2 Lime. Not required.

904-2.3 Fertilizer. Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified and shall meet the requirements of applicable state laws. They shall be furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

- **a.** A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
- **b.** A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
- **c.** A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be 10-10-10 commercial fertilizer and shall be spread at the rate of 400 lbs. per acre.

904-2.4 Water. The water shall be sufficiently free from oil, acid, alkali, salt, or other harmful materials that would inhibit the growth of grass.

904-2.5 Soil for repairs. The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the RPR before being placed.

CONSTRUCTION METHODS

904-3.1 General. Areas to be solid, strip, or spot sodded shall be shown on the plans. Areas requiring special ground surface preparation such as tilling and those areas in a satisfactory condition that are to remain undisturbed shall also be shown on the plans.

Suitable equipment necessary for proper preparation of the ground surface and for the handling and placing of all required materials shall be on hand, in good condition, and shall be approved by the RPR before the various operations are started. The Contractor shall demonstrate to the RPR before starting the various operations that the application of required materials will be made at the specified rates.

904-3.2 Preparing the ground surface. After grading of areas has been completed and before applying fertilizer and limestone, areas to be sodded shall be raked or otherwise cleared of stones larger than 2 inches in any diameter, sticks, stumps, and other debris which might interfere with sodding, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes occurs after grading of areas and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage. This may include filling gullies, smoothing irregularities, and repairing other incidental damage.

904-3.3 Applying fertilizer and ground limestone. Following ground surface preparation, fertilizer shall be uniformly spread at a rate which will provide not less than the minimum quantity of each fertilizer ingredient, as stated in the special provisions. If use of ground limestone is required, it shall then be spread at a rate that will provide not less than the minimum quantity stated in the special provisions. These materials shall be incorporated into the soil to a depth of not less than 2 inches by discing, raking, or other suitable methods. Any stones larger than 2 inches in any diameter, large clods, roots, and other litter brought to the surface by this operation shall be removed.

904-3.4 Obtaining and delivering sod. After inspection and approval of the source of sod by the RPR, the sod shall be cut with approved sod cutters to such a thickness that after it has been transported and placed on the prepared bed, but before it has been compacted, it shall have a uniform thickness of not less than 2 inches. Sod sections or strips shall be cut in uniform widths, not less than 10 inches, and in lengths of not less than 18 inches, but of such length as may be readily lifted without breaking, tearing, or loss of soil. Where strips are required, the sod must be rolled without damage with the grass folded inside. The Contractor may be required to mow high grass before cutting sod.

The sod shall be transplanted within 24 hours from the time it is stripped, unless circumstances beyond the Contractor's control make storing necessary. In such cases, sod shall be stacked, kept moist, and protected from exposure to the air and sun and shall be kept from freezing. Sod shall be cut and moved only when the soil moisture conditions are such that favorable results can be expected. Where the soil is too dry, approval to cut sod may be granted only after it has been watered sufficiently to moisten the soil to the depth the sod is to be cut.

904-3.5 Laying sod. Sodding shall be performed only during the seasons when satisfactory results can be expected. Frozen sod shall not be used, and sod shall not be placed upon frozen soil. Sod may be transplanted during periods of drought with the approval of the RPR, provided the sod bed is watered to moisten the soil to a depth of at least 4 inches immediately prior to laying the sod.

The sod shall be moist and shall be placed on a moist earth bed. Pitch forks shall not be used to handle sod and dumping from vehicles shall not be permitted. The sod shall be carefully placed by hand, edge to edge and with staggered joints, in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward. The sod shall immediately be pressed firmly into contact with the sod bed by tamping or rolling with approved equipment to provide a true and even surface, and ensure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Where the sod may be displaced during sodding operations, the workmen, when replacing it, shall work from ladders or treaded planks to prevent further displacement. Screened soil of good quality shall be used to fill all cracks between sods. The quantity of the fill soil shall not cause smothering of the grass. Where the grades are such that the flow of water will be from paved surfaces across sodded areas, the surface of the soil in the sod after compaction shall be set approximately one inch below the pavement edge. Where the flow will be over the sodded areas and onto the paved surfaces around manholes and inlets, the surface of the soil in the sod after compaction shall be placed flush with pavement edges.

On slopes steeper than one (1) vertical to 2-1/2 horizontal and in v-shaped or flat-bottom ditches or gutters, the sod shall be pegged with wooden pegs not less than 12 inches in length and have a cross-sectional area of not less than 3/4 sq inch. The pegs shall be driven flush with the surface of the sod.

904-3.6 Watering. Adequate water and watering equipment must be on hand before sodding begins, and sod shall be kept moist until it has become established and its continued growth assured. In all cases, watering shall be done in a manner that will avoid erosion from the application of excessive quantities and will avoid damage to the finished surface.

904-3.7 Establishing turf. The Contractor shall provide general care for the sodded areas as soon as the sod has been laid and shall continue until final inspection and acceptance of the work. All sodded areas shall be protected against traffic or other use by warning signs or barricades approved by the RPR. The Contractor shall mow the sodded areas with approved mowing equipment, depending upon climatic and growth conditions and the needs for mowing specific areas. Weeds or other undesirable vegetation shall be mowed, and the clippings raked and removed from the area.

904-3.8 Repairing. When the surface has become gullied or otherwise damaged during the period covered by this contract, the affected areas shall be repaired to re-establish the grade and the condition of the soil, as directed by the RPR, and shall then be sodded as specified in paragraph 904-3.5.

REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM International (ASTM)

ASTM C602	Standard Specification for Agricultural Liming Materials

Advisory Circulars (AC)

AC 150/5200-33	Hazardous Wildlife Attractants on or Near Airports

FAA/United States Department of Agriculture

Wildlife Hazard Management at Airports, A Manual for Airport Personnel

END OF ITEM T-904

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DIVISION 02

SECTION 024114

CUTTING, PATCHING AND REMOVAL

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for cutting, patching and removal of existing construction.

1.02 QUALITY ASSURANCE

A. Cutting, patching and removal shall be performed by workers skilled in the specific trades involved.

B. Site Conditions

1. Except for portions shown to be relocated or retained by the Authority, remove and transport off Authority property all portions of the existing construction shown on the Contract Drawings to be removed in accordance with Division 01 clause entitled "Recycling of Construction Debris Material".
2. All construction debris shall become the Contractor's property.
3. Prior to start of Work, make an inspection accompanied by the Engineer to determine physical condition of adjacent construction that is to remain.

1.03 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

All materials required for patching shall be new. Patching materials shall match in every respect adjacent portions of the existing construction, unless otherwise shown on the Contract Drawings.

PART 3. EXECUTION

3.01 PROTECTION

A. Protect existing adjacent surfaces to remain and finished surfaces at all times and repair or replace, if damaged, at no additional cost to the Authority and to the satisfaction of the Engineer.

B. Protect all existing construction to remain and new construction including utilities, finishes and equipment from water, damage, weakening or other disturbance.

3.02 CUTTING, PATCHING AND REMOVAL

A. Perform all cutting, patching and removal as shown on the Contract Drawings. Work shall be performed in accordance with the approved methods using approved materials.

B. Do not cut or remove more than is necessary to accommodate the new construction or alteration.

C. Maintain the integrity of all construction at all times.

D. Do not allow removed materials and debris to accumulate at the construction site; remove them at the end of each work period or daily. All areas adjacent to, and leading to and from the site shall be kept free of removed materials and debris.

E. Do not burn, bury, or dispose of in storm drains, wetlands or waterways on Authority property debris of any type.

F. Dispose of debris resulting from removal operations in accordance with all local laws and regulations that would apply if the Authority were a private corporation.

END OF SECTION

DIVISION 03

SECTION 033010

PORTLAND CEMENT CONCRETE, LONG FORM

PART 1. GENERAL

1.01 SUMMARY

This Section and its Appendices specify requirements for Portland cement concrete mix proportions, materials used in concrete mixes, placing, finishing, curing, control joints, end result property requirements of the in-place concrete, and the evaluation of these properties through Quality Acceptance (QA) testing and inspection performed by the Authority for determining Adjustments to Contract Compensation. The requirements herein establish minimum standards for concrete construction. This does not relieve the Contractor from following more stringent standards to achieve the quality acceptance limits for applicable performance parameters and their respective Percent Within Limit (PWL) measurements.

1.02 REFERENCES

The following is a listing of the publications and certification programs referenced in this Section.

	American Association of State Highway and Transportation Officials (AASHTO)
AASHTO HB	Standard Specifications for Highway Bridges.
AASHTO M 182	Standard Specification for Burlap Cloth Made from Jute or Kenaf, and Cotton Mats.
AASHTO T 277	Standard Method of Test for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
AASHTO T 318	Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
AASHTO re:source	American Association of State Highway and Transportation Officials Accreditation Program.
	American Concrete Institute (ACI)
ACI 207.1R	Guide to Mass Concrete.
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
ACI 213	Guide for Structural Lightweight-Aggregate Concrete.
ACI 222R	Protection of Metals in Concrete Against Corrosion.
ACI 301	Specifications for Structural Concrete.
ACI 302.1R	Guide to Concrete Floor and Slab Construction.
ACI 303.1	Specification for Cast-in-Place Architectural Concrete.
ACI 304R	Guide for Measuring, Mixing, Transporting, and Placing Concrete. Chapter 8: Concrete Placed Under Water.
ACI 305R	Guide to Hot Weather Concreting.
ACI 306R	Guide to Cold Weather Concreting.

ACI 308.1	Standard Practice for Curing Concrete.
ACI 309R	Guide for Consolidation of Concrete.
ACI 318	Building Code Requirements for Structural Concrete.
ACI 548.4	Standard Specification for Latex-Modified Concrete (LMC) Overlays.
	ASTM International (ASTM)
ASTM C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field.
ASTM C 33	Standard Specification for Concrete Aggregates.
ASTM C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
ASTM C 78	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
ASTM C 88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
ASTM C 94	Standard Specification for Ready-Mixed Concrete.
ASTM C 114	Standard Test Methods for Chemical Analysis of Hydraulic Cement.
ASTM C 131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM C 138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
ASTM C 143	Standard Test Method for Slump of Hydraulic-Cement Concrete.
ASTM C 150	Standard Specification for Portland Cement.
ASTM C 156	Standard Test Method for Water Loss from a Mortar Specimen Through Liquid Membrane-Forming Curing Compounds for Concrete.
ASTM C 157	Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
ASTM C 171	Standard Specification for Sheet Materials for Curing Concrete.
ASTM C 172	Standard Practice for Sampling Freshly Mixed Concrete.
ASTM C 173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
ASTM C 174	Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.
ASTM C 192	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
ASTM C 227	Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
ASTM C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
ASTM C 260	Standard Specification for Air-Entraining Admixtures for Concrete.

ASTM C 309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
ASTM C 311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland-Cement Concrete.
ASTM C 330	Standard Specification for Lightweight Aggregates for Structural Concrete.
ASTM C 403	Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
ASTM C 494	Standard Specification for Chemical Admixtures for Concrete.
ASTM C 535	Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM C 566	Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying.
ASTM C 567	Standard Test Method for Determining Density of Structural Lightweight Concrete.
ASTM C 618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
ASTM C 685	Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
ASTM C 979	Standard Specification for Pigments for Integrally Colored Concrete.
ASTM C 989	Standard Specification for Slag Cement for Use in Concrete and Mortars.
ASTM C 1064	Standard Test Method for Temperature of Freshly Mixed Hydraulic Cement Concrete.
ASTM C 1074	Standard Practice for Estimating Concrete Strength by the Maturity Method.
ASTM C 1116	Standard Specification for Fiber-Reinforced Concrete.
ASTM C 1152	Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete.
ASTM C 1202	Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration.
ASTM C 1218	Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
ASTM C 1240	Specification for Silica Fume Used in Cementitious Mixtures.
ASTM C 1293	Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
ASTM C 1399	Standard Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete.
ASTM C 1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
ASTM C 1583	Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).
ASTM C 1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

ASTM C 1610	Standard Test Method for Static Segregation of Self-Consolidating Concrete Using Column Technique.
ASTM C 1611	Standard Test Method for Slump Flow of Self-Consolidating Concrete.
ASTM C 1758	Standard Practice for Fabricating Test Specimens with Self-Consolidating Concrete.
ASTM D 1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
ASTM D 1752	Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
ASTM D 3665	Standard Practice for Random Sampling of Construction Materials.
ASTM D 4580	Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding.
ASTM D 4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
ASTM D 4833	Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
ASTM D 5199	Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
ASTM E 965	Standard Test Method for Measuring Pavement Macrotexture Depth Using a Volumetric Technique.
ASTM E 1347	Standard Test Method for Color and Color-Difference Measurement by Tristimulus Colorimetry.
ASTM CCRL	Cement and Concrete Reference Laboratory.

Federal Aviation Administration (FAA) Advisory Circular (AC)

FAA AC 150/ 5370, Item P-501	Standards for Specifying Construction of Airports - Portland Cement Concrete (PCC) Pavement - Contractor Quality Control.

New Jersey Department of Transportation (NJDOT)

Standard Specifications for Road and Bridge Construction 2007.

New York State Department of Transportation (NYSDOT)

Materials Method NY9.4.

Standard Specifications 501-2.03.

US Army Corps of Engineers (USACE)

Handbook for Concrete and Cement.

CRD-C 572-74	Specifications for Polyvinylchloride Waterstop.

1.03 ENVIRONMENTAL CONDITIONS

A. Cold Weather Requirements

1. Cold weather concrete construction shall conform to ACI 306R.
2. Prepare and submit a Cold Weather Concrete Construction Plan, and have it approved by the Engineer prior to concrete placements when the ambient temperature falls below 50 degrees Fahrenheit. This Plan shall conform to ACI 306R and shall include, but not be limited, to the following:
   a. Methods and demonstration of how the in situ concrete temperature shall be maintained at a minimum 50 degrees Fahrenheit and monitored, or at temperatures specified in ACI 306R, Table 3.1, whichever is more stringent.

b. Demonstrate that the specified concrete properties can be achieved within the specified time requirements herein while maintaining a minimum curing temperature of 50 degrees Fahrenheit.

3. Do not mix or place concrete when the ambient temperature is below 35 degrees Fahrenheit, or when conditions indicate that the temperature will fall below 35 degrees Fahrenheit within 72 hours, unless the areas to receive fresh concrete are insulated or enclosed, and maintain the concrete at a minimum temperature at 50 degrees Fahrenheit or in accordance with Table 3.1 in ACI 306R.

4. Reinforcement, forms and soils with which concrete will be in contact shall not be frozen and shall be maintained completely frost-free. If required, apply heat to raise their temperature to a minimum of 35 degrees Fahrenheit. The use of chemicals to eliminate frost shall not be permitted.

B. Hot Weather Requirements

1. Hot weather concrete construction shall conform to ACI 305R.

2. Prepare and submit a Hot Weather Concrete Construction Plan and have it approved by the Engineer prior to concrete placements when the ambient temperature exceeds 80 degrees Fahrenheit. This Plan shall conform to ACI 305R and shall include, but not be limited to, the following:

a. Methods and demonstration of how the concrete batch temperature shall be kept below 90 degrees Fahrenheit.

b. Actions and methods that will be implemented to prevent rapid evaporation of surface moisture.

c. Proper use of evaporation retarders, water reducers, and hydration retarders with redosing charts and procedures.

d. Curing procedures and the products that will be utilized in accordance with 3.04 herein.

3. Do not place concrete for pavements, overlays, bridge decks or ramps when the ambient temperature exceeds 85 degrees Fahrenheit; schedule Work so that concrete can be placed during the coolest part of the day.

4. Do not place concrete for structural decks, slabs or pavements when the rate of concrete surface evaporation exceeds 0.15 pounds per foot squared per hour, as defined in ACI 305R, Figure 2.1.5. If ambient conditions exceed this limit, demonstrate through the use of windscreens, fogging or other suitable means that the concrete evaporation rate will be maintained below 0.15 pounds per foot squared per hour.

5. If the concrete temperature reaches 92 degrees Fahrenheit as measured at the construction site in accordance with ASTM C 1064, it will be rejected.

1.04 QUALITY CONTROL

A. General

1. Quality Control (QC) is the Contractor's process of inspecting, testing, measuring, and documenting that ensures that structures are constructed in accordance with approved shop drawings and the Contract documents. Maintain a level of QC sufficient to consistently achieve the end result performance properties specified herein. In addition:

a. Submit the approved mix proportions including an automated, time-date stamp on each delivery ticket indicating the batch weights of all batching constituents.

b. Ensure that all plant mixing equipment and trucks are calibrated and approved by either the New Jersey or New York State Department of Transportation. Documentation of such conformance shall be available to the Engineer at all times.

c. When placing aeronautical pavement concrete, the Quality Control plan shall conform to the provisions of the current FAA AC 150/5370 Item P-501 - Contractor Quality Control.

2. Quality Control Personnel

a. Quality Control personnel shall not have any direct production responsibilities related to the Contract.

b. Ensure that all personnel performing field concrete testing are certified ACI Concrete Field Testing Technicians - Grade I.

c. Ensure that all personnel performing laboratory concrete testing are appropriately certified as ACI Strength Testing Technician, or Concrete Laboratory Testing Technician - Level I or Level II, as required for testing being performed.

d. Ensure that the independent testing laboratory engaged to perform any field and laboratory testing is in the AASHTO re:source accreditation program and ASTM Cement and Concrete Reference Laboratory (CCRL) inspected. Ensure that independent laboratory personnel are appropriately certified as in 1.04 A.2.b and c.

B. Quality Control Plan: Prepare and submit a Quality Control Plan a minimum of 14 days prior to the pre-concrete placement meeting specified in 1.06. Placement will not be permitted before the Quality Control Plan has been approved by the Engineer. The Quality Control Plan shall include the following:

1. Quality Control Organization

a. An organization chart showing all QC personnel and a description of how these personnel will interact and communicate with and report to other management or field construction personnel. Include names, company name and each person's function, telephone number and email address.

b. The QC organization chart shall include a Program Administrator who shall ensure that all QC procedures are followed and enforced and who shall have a minimum of 5 years of experience on projects of size and scope comparable to the Work of the Contract. The Program Administrator shall be a full-time employee of the Contractor or a consultant engaged by the Contractor. Additional qualifications shall include, but not be limited to, the following:

(1) Professional Engineer, Engineer-In-Training, Bachelor of Science in Civil Engineering, Civil Engineering Technology or a total of five years of experience with airport and/or highway concrete construction.

(2) ACI Concrete Construction Special Inspector certified.

2. Intended project progress schedule for each mix and application, including quantities and a submittal schedule in accordance with the GENERAL PROVISIONS clauses entitled "Progress Schedule and "Shop Drawings Catalog Cuts and Samples".

3. Quality Control Testing Plan, including a list of testing standards and the frequency at which each test will be performed. The QC Testing plan shall include, at a minimum, the following:

a. Plant gradation and moisture content testing for fine and coarse aggregates in accordance with ASTM C 136 and ASTM C 566, respectively. Perform both tests:

(1) Prior to production.

(2) Every 3 hours during production or every 100 cubic yards of concrete produced (whichever is longer in time).

(3) When aggregates are used from a new stockpile that has not been tested for gradation or moisture content.

b. Field sampling and testing of fresh concrete during placements.

c. Laboratory testing.

4. Documentation of Quality Control activities, including the location where recorded test results and other information such as mill test certificates for all cementitious material will be stored, which shall be made available to the Engineer at any time upon request.

5. Procedures for corrective action when QC and/or QA test results do not conform to the requirements of the Contract.

6. Procedures for addressing Non-Conformance Reports issued. Procedures shall include:

a. Remediation/repair procedure.

b. Documented root cause analysis of any non-conformance issues and preventative measures taken to avoid repetition of errors.

c. Product data sheets for repair materials.

1.05 TRIAL BATCHING AND TEST POUR VERIFICATIONS

A. Trial Batching

1. The Engineer may prepare and test trial batches as specified herein and in accordance with ACI 301, Section 4. At the Engineer's request, submit representative samples of all materials in sufficient quantities to the Authority's Materials Engineering Unit. In the event of a conflict between tests performed by the Engineer and tests performed by or for the Contractor, tests performed by the Engineer shall govern.

2. The Engineer may perform the following tests to verify trial batches submitted by the Contractor: compressive strength, flexural strength, permeability by the Rapid Chloride Permeability (RCP) Coulomb test, air content, unit weight, water content of freshly mixed concrete using the microwave oven drying test, shrinkage, chloride ion concentration, corrosion inhibitor concentration, bond strength, slump, time of set, gradation of fine and coarse aggregates, and the fineness modulus of the fine aggregate.

B. Test Pours

1. Perform a test pour/mock-up for each type of structural element, such as pavements, structural slabs, columns and beams. Test pour(s) shall be conducted a minimum of 14 calendar days prior to production. Perform all test pours/mock-ups using the same personnel, equipment, procedures and materials that will be used for full production. The test pours shall demonstrate and verify proper workability, placement technique, consolidation, finishability, setting characteristics, curing procedures, and shall confirm that specified physical properties and tolerances are attained for the approved mix proportions.

a. Tremie Concrete Applications: Construct a mock-up to demonstrate acceptable tremie technique and concrete consolidation and to verify that specified compressive strength is achieved. Compressive strength verification shall be performed by testing three in-place cores taken at locations designated by the Engineer.

b. Architectural Cast-in-Place Concrete: Construct a full-scale mock-up test section in accordance with 2.02 C.3 demonstrating finish, texture and color. If, in the sole opinion of the Engineer, the mock-up test section is acceptable, follow the procedures established during the mock-up test section during production.

c. Flatwork (Pavements and Structural Slabs): The minimum test pour size shall be a length of 100 feet of full depth pavement and width of the screed proposed for use.

d. All Other Structural Elements: Test pour size shall be as shown on the Contract Drawings for the cross sectional area, including the location of all steel reinforcement. However, solely at the option of the Engineer, the length of the member may be reduced from its design size, provided it is adequate to demonstrate the requirements of 1.05 B.1.

2. A test section will be considered acceptable if, in the sole opinion of the Engineer, it meets the specified requirements for surface preparation, batching, mixing, placement, consolidation, curing, finish and applicable performance properties of the concrete.

3. In the event that the Engineer deems the test section unsatisfactory, remove the test section and repeat the test section at no additional cost to the Authority.

4. The test pour location will be determined by the Engineer at the pre-concrete placement meeting, and will be located close to, if not within, the area of placement Work, unless otherwise shown on the Contract Drawings.

1.06 PRE-CONCRETE PLACEMENT MEETING

A. A pre-concrete placement meeting shall be conducted at the construction site by the Contractor a minimum of 20 days prior to the first pour to review the Contractor's submitted mix proportions, hot and cold weather concreting plans (as applicable), curing procedures plan, test pours, and to discuss the methods and procedures that are needed to achieve the specified concrete quality. Notify and coordinate with the Engineer and send a detailed agenda to all attendees a minimum of 15 days prior to the meeting. Arrange and pay all costs for the Contractor's superintendent and a qualified representative from each segment of the concrete operations to be present, including, but not limited to, the following:

1. Concrete supplier.
2. Laboratory representative responsible for the concrete proportion mix and Quality Control.
3. Contractor's Program Administrator for Quality Control.
4. Entity performing concrete Work.
5. Admixtures and curing compound suppliers.
6. Entity performing concrete pumping Work.
7. Entity performing mobile mixer Work.
8. Precast concrete fabricator and installer.
9. Entity performing joint sawing Work.

B. Record detailed meeting minutes. The draft minutes shall be distributed to all attendees of the meeting within 3 days for review and comment. Distribute the final version of the minutes within 5 days of the meeting.

C. Schedule the pre-concrete placement meeting after all of the following submittals applicable to the Work of this section have been reviewed and approved by the Engineer.

1. Mix proportions.
2. Admixture dosage charts showing the effects of concrete temperatures from 50 degrees Fahrenheit to 90 degrees Fahrenheit.
3. Sample panels (12 inches by 12 inches by 2 inches for architectural concrete).
4. Hot and Cold Weather Concrete Construction Plans.
5. Independent testing laboratory AASHTO re:source and ASTM CCRL Accreditation Certification.
6. ACI Grade I certifications for concrete testing personnel.
7. Placement methods and procedures, including surface preparation.
8. Pumping Procedure Plan.
9. Curing Procedure Plan.
10. Joint Location Plan and timing of cuts.
11. Quality Control Plan.
12. Procedure for curing field concrete specimens.

1.07 SUBMITTALS

A. See Appendix "A" for submittal requirements.

B. Do not deliver any concrete to the construction site until all approvals have been obtained.

PART 2. PRODUCTS

2.01 MATERIALS

A. General: Use only cement, fly ash, slag, silica fume, metakaolin, fine aggregates and coarse aggregates that are approved by either the New Jersey or New York State Departments of Transportation.

B. Cement: Conforming to ASTM C 150, Type I and II, and Type III where early strength gain is required, or unless otherwise shown on the Contract Drawings.

C. Very High Early Strength Cement: Defined as cement used to produce concrete with the compressive strength shown on the Contract Drawings within 12 hours and conforming to the following:

1. The compressive strength shall be greater than or equal to the specified strength at the curing time shown on the Contract Drawings, when tested in accordance with ASTM C 39. During cold weather concrete construction, demonstrate that the specified compressive strength can be obtained at a curing temperature of 50 degrees Fahrenheit.

2. Absolute drying shrinkage less than or equal to 0.04 percent at 28 days for the mix proportions containing the Very High Early Strength Cement in accordance with ASTM C 157 modified (Air Drying Method), where the initial comparator reading shall be taken at 3 hours after the addition of the mixing water to the dry materials in the mix.
3. Setting time, determined in accordance with ASTM C 403, shall be sufficient to provide adequate workability, meet the specified strength requirement, and allow enough time at the construction site to finish and begin curing the concrete for its intended use.
4. The Very High Early Strength Cement shall meet the properties specified in 2.01 C.1, 2.01 C.2 and 2.01 C.3 for each Lot of cement not to exceed every 50,000 pounds. Submit certification from an independent testing laboratory, employed by the Contractor and approved by the Engineer, that the cement meets these properties.

D. Silica Fume: Shall conform to ASTM C 1240 and the following:
1. Silicon Dioxide Content: 85 percent minimum.
2. Loss On Ignition: 6 percent maximum.
3. Surface Area (nitrogen absorption): 15 square meters per gram minimum.
4. Crystallinity: Non-crystalline within limits of detection by X-ray defraction.
5. Oversize Foreign Materials (in fume): 5percent maximum on 45-micron sieve (wet).

E. Metakaolin: Conforming to ASTM C 618, Class N.

F. Fly Ash: Conforming to ASTM C 311 and ASTM C 618, Class F except the maximum loss on ignition shall be less than 4 percent.

G. Slag: Conforming to ASTM C 989, Grade 100 or 120.

H. Fine Aggregate
1. Conforming to ASTM C 33, ASTM C 227 and ASTM C 131 with a maximum percentage of wear of 30 percent.
2. Alkali-Silica Reactivity: When requested by the Engineer, provide independent laboratory test results for ASTM C 1293 evaluating the potential alkali reactivity of the aggregate. Use cement as 100 percent of cementitious materials for this evaluation. Expansion at 2 years shall be less than 0.04 percent. If the expansion is 0.04 percent or greater, provide ASTM C 1293 test results showing a minimum percentage of fly ash or slag (Secondary Cementitious Materials - SCM) replacement for cement that is required to mitigate expansion.

I. Coarse Aggregate (Normal Weight Concrete): Conforming to ASTM C 33, ASTM C 227 and ASTM C 535 with a maximum percentage of wear of 40 percent, and ASTM C 88 with a magnesium sulfate loss of not more than 12 percent for a five-cycle test period. Use trap rock or gneiss for all pavement wearing surfaces. The aggregate in any size group shall not contain more than 8 percent by weight of flat or elongated pieces, as tested in accordance with ASTM D 4791. A flat or elongated piece is one having a ratio between the maximum and minimum dimensions of a circumscribing rectangular prism exceeding 5 to 1.

1. In accordance with ACI 318, the nominal maximum size of coarse aggregate shall be not larger than: (1) one-fifth the narrowest dimension between sides of forms or (2) one-third the depth of slabs or (3) three-quarters the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, or prestressing tendons or ducts. The nominal maximum size of coarse aggregate used shall be the largest size aggregate that conforms to ACI 318, Section 26.4.2.1, unless otherwise specified herein or shown on the Contract Drawings.
2. Coarse Aggregate Blending: Mix proportion using aggregate blends shall follow ACI 302.1R Chapter 8.9.2 guidelines incorporating one of the following methods to develop a workable, non-segregating, uniform, and well graded total aggregate gradation:
   a. Percentage of the combined aggregate retained on each of the standard sieves.
   b. Coarseness Factor Chart.
   c. 0.45 power chart.
3. Minimum Volume of Coarse Aggregate: All mixes shall contain a minimum of 39 percent coarse aggregate by volume, with the exception of:
   a. Applications as specifically specified in 2.02 I.4 through 8.
   b. Performance Category VI applications.
   c. Mixes containing only ASTM C 33 Size No. 8 aggregate. Mixes containing only ASTM C 33 Size No. 8 stone not covered in 2.01 I.4 through 7 shall contain a minimum of 36 percent coarse aggregate by volume. These minimum requirements shall apply to all methods of placement, including pump mixes.

4. For Category I full depth pavement concrete the combined aggregate volume shall be a minimum of 70 percent. The combined gradation of the fine and coarse aggregate shall conform to the following table, when tested in accordance with ASTM C 136:

	For Pavement 10 Inches or Greater in Thickness		For Pavement Less Than 10 Inches in Thickness	
Sieve Size % Passing	Min.	Max.	Min.	Max.
2-1/2"	100			
2"	90	98	100	
1-1/2"	76	88	89	98
1"	67	79	74	86
3/4"	65	77	64	76
3/8"	48	60	48	60
No. 4	30	42	30	42
No. 8	27	37	27	37
No. 16	20	30	20	30
No. 30	16	22	16	22
No. 50	4	10	4	10
No. 100	0	4	0	4

5. Pile Jackets: As a minimum, the mix proportion shall contain an ASTM C 33 Size No. 8 coarse aggregate. The ratio of coarse aggregate to fine aggregate by volume shall be not less than 1 to 1.

6. Pipe Piles: Reduce the amount of coarse aggregate to minimize segregation. The volume of coarse aggregate shall not exceed 36 percent. The maximum size coarse aggregate shall be ASTM C 33 Size No. 8.
7. Bridge deck concrete mixes shall contain a minimum of 41 percent coarse aggregate and total minimum aggregate volume of 67 percent. All mix designs shall incorporate a blend of No. 467 and No. 8 aggregates. These minimum requirements shall apply to all methods of placement, including pump mixes.
8. Latex Modified Concrete: The minimum volume of coarse aggregate shall be 7.6 cubic feet per cubic yard (28 percent).
9. Alkali-Silica Reactivity: When requested by the Engineer, provide independent laboratory test results for ASTM C 1293 evaluating the potential alkali reactivity of the aggregate. Use cement as 100 percent of cementitious materials for this evaluation. Expansion at 2 years shall be less than 0.04 percent. If the expansion is 0.04 percent or greater, provide ASTM C 1293 test results showing a minimum percentage of fly ash or slag (SCM) replacement for cement that is required to mitigate expansion. The Engineer may accept results for testing performed in accordance with ASTM C 1567 at 28 days after casting if expansion is found to be less than 0.1 percent for preliminary acceptance when evaluating potential reactivity in accordance with ASTM C 1293. Final acceptance will be based upon results of testing in accordance with ASTM C 1293.

J. Coarse Aggregate (Lightweight Concrete)

1. Expanded clay or shale produced by the rotary kiln process conforming to ASTM C 330 shall be graded in accordance with the requirements for 3/4 inch to No. 4 sieve sizes shown in Table I of that specification.
2. The oven dry unit weight of plant-tested, lightweight aggregate shall vary not more than plus or minus 3.0 pounds from the unit weight (pounds per cubic foot) determined from the sample quantity submitted in accordance with 1.05 A.1.

K. Water: Conforming to ASTM C 1602. Clean and potable for both mixing and curing concrete.

L. Formulated Latex Modifier: Latex modifier shall be modifier "A/NA", as manufactured by Dow Chemical, Midland, Michigan or approved equal. Add latex emulsion at a rate of 3.5 gallons per 94 pounds of cementitious material in the concrete mix.

M. Air Entraining Agent: Conforming to ASTM C 260.

N. Admixtures: All admixtures shall conform to ASTM C 494. Admixtures shall contain less than 0.05 percent chloride ions, and shall be used in accordance with the manufacturer's recommendations. Submit dosage charts, including the effects of concrete temperatures from 50 degrees Fahrenheit to 90 degrees Fahrenheit, to the Engineer.

O. Polycarboxylate High Range Water Reducer: For use when self-consolidating concrete is desired and approved by the Engineer. Conforming to ASTM C 494, Type F or Type G. Dosage rate shall be as recommended by the manufacturer to produce a spread of the concrete mixture measuring between 21 and 27 inches in diameter without segregation when released from a slump cone in accordance with ASTM C 1611.

P. Corrosion Inhibitors

1. Corrosion inhibitor, when shown on the Contract Drawings, shall be one of the following, or approved equal:

a. "DCI-S", as manufactured by W.R. Grace & Company, North Bergan, New Jersey.
b. "Eucon CIA", as manufactured by Euclid Chemical Company, Cleveland, Ohio, with the addition of a retarder.
c. "Sika CNI", as manufactured by with Sika Corporation, Canton, Massachusetts, with the addition of a retarder.

2. The concentration of calcium nitrite shall be 30 percent plus or minus 2 percent by weight of solids per gallon.
3. The Engineer will sample the corrosion inhibitor for testing to verify the calcium nitrite solids content. The amount of calcium nitrite in fresh concrete may also be tested at any time, to verify if the proper quantity of the corrosion inhibitor is being batched in the mix.
4. Corrosion inhibitor admixtures shall not accelerate the setting time of the concrete mixture. Use a retarder and/or other admixtures to ensure that acceleration of setting time does not occur, while maintaining the applicable performance criteria, as stipulated in 2.03. Submit procedures for the placement of concrete mixes containing a corrosion inhibitor when a retarder is required for the range of concrete temperatures from 50 degrees Fahrenheit to 90 degrees Fahrenheit.

Q. Viscosity Modifying and/or Self-Consolidating Admixtures: May be required for tremie concrete applications at the rate recommended by the manufacturer.

R. Curing Materials

1. Liquid membrane forming curing compound conforming to the following:
   a. For horizontal exterior pavement applications, curing compounds shall be ASTM C 309 Type 2, Class B materials. ASTM C 309 Type 1-D, Class B membranes are acceptable for other exterior applications. ASTM C 309 Type 1, Class B membranes are acceptable for interior applications only.
   b. Membranes shall comply with the latest volatile organic compound (VOC) requirements for the states of both New York and New Jersey. Submit certification of compliance to the Engineer upon request.
   c. The membrane shall restrict the loss of water to not more than 0.08 pounds per square foot in 72 hours at a coverage rate of 300 square feet per gallon per coat for Type I curing compounds, and 200 square feet per gallon per coat for Type 2 curing compounds when tested in accordance with ASTM C 156.
2. Burlap: Conforming to AASHTO M 182, Class 3, weighing approximately 9 ounces per square yard dry.
3. Sheet Material: Shall be white burlap polyethylene sheet conforming to ASTM C 171.
4. Cotton Mats: Conforming to ASTM D 5199 with a minimum thickness of 40 mils, ASTM C 156 with a maximum water loss of 0.0065 ounces per inch squared, ASTM D 4833 with a minimum puncture strength of 70 pounds and ASTM E 1347 with a minimum reflectance of 75 percent. The following may be used in lieu of burlap for wet curing operations:
   a. "Transguard 4000", as manufactured by Reef Industries, Inc., Houston, Texas.
   b. An approved equal conforming to the requirements specified in 2.01 R.4.

S. Evaporation Retardant: Shall be used to retain moisture in the concrete during finishing operations. Use one of the following, or approved equal:

1. "Euco-Bar", as manufactured by Euclid Chemical Company, Cleveland, Ohio.
2. "E-Con", as manufactured by L&M Construction Chemicals, Inc., Warren, Michigan.
3. "MasterKure ER 50", as manufactured by BASF Technologies, Cleveland, Ohio.
4. "SikaFilm", as manufactured by Sika Corporation, Canton, Massachusetts.
5. "Aquafilm", as manufactured by Dayton, Inc., Miamisburg, Ohio.

T. Fiber Reinforcement

1. Polypropylene Micro Fibers
   a. Use one of the following products, or approved equal:
      (1) "Fiberstrand", as manufactured by Euclid Chemical Company, Cleveland, Ohio.
      (2) "Fibermesh", as manufactured by Fibermesh, Inc., Chattanooga, Tennessee.
      (3) "Forta", as manufactured by Forta Corporation, Grove City, Pennsylvania.
      (4) "Grace Fibers" or "Grace Microfibers", as manufactured by W.R. Grace & Company, North Bergen, New Jersey.
      (5) "Durafiber", as manufactured by Industrial Systems, Ltd., Lakemoor, Illinois.
   b. Material Requirements
      (1) Collated fibrillated materials: Dosage rate shall be a minimum of 1.5 pounds per cubic yard.
      (2) Multifilament Fibers: Dosage rate shall be a minimum of 1 pounds per cubic yard. The minimum length shall be 0.75 inches.
      (3) Conformance with ASTM C 1116, designation Type III, 4.1.3.
      (4) Use of fibers shall not change the water requirements of the mix.
      (5) Follow manufacturer's recommendations for the quantity of fiber, which shall be not less than the minimum requirements of 2.01 T.1.b.1 and 2.01 T.1.b.2.
      (6) Arrange for the fiber manufacturer to provide the services of a qualified representative at the pre-concrete placement meeting and for the first two days of fibrous concrete placement production, at no additional cost to the Authority.
2. Structural Polypropylene/Polyethylene Macro Fibers
   a. Use one of the following products, or approved equal:
      (1) "Tuf-Strand SF", as manufactured by Euclid Chemical Company, Cleveland, Ohio.
      (2) "Strux 90/40", as manufactured by W.R. Grace & Company, North Bergen, New Jersey.
   b. Material Rrequirements
      (1) Dosage rate shall be a minimum of 4.0 pounds per cubic yard, unless otherwise shown on the Contract Drawings.
      (2) The minimum length shall be 1.50 inches.
      (3) Fiber shall have an Aspect Ratio of 50 to 90.
      (4) Conformance with ASTM C 1116, designation Type III, 4.1.3.

(5) The structural macro fiber concrete shall have an average residual strength of 200 psi when tested in accordance with ASTM C 1399.

(6) Use of fibers shall not change the water requirements of the mix.

(7) Follow manufacturer's recommendations for the quantity of fiber, which shall be not less than the minimum requirements of 2.01 T.2.b.1.

(8) Arrange for the fiber manufacturer to provide the services of a qualified representative at the pre-concrete placement meeting and for the first two days of fibrous concrete placement production, at no additional cost to the Authority.

U. Expansion Joints (except for Bridge Decks) and Contraction Joints (except for Pavements)

1. Vinyl plastic water stops shall be of types and sizes shown on the Contract Drawings and conforming to USACE CRD-C 572-60.

2. Premolded expansion joint filler, when shown on the Contract Drawings:

a. Cork type shall be ASTM D 1752, Type II.

b. Bituminous type shall be ASTM D 1751.

V. Pigments: Conforming to ASTM C 979.

2.02 MIX PROPORTIONS

A. Develop mixes in accordance with the latest editions of ACI 211, ACI 301 and ACI 318 to achieve the proportion performance criteria in accordance with the Contract documents, with a degree of excess as determined by Section 4 of ACI 301, and meet all of the applicable performance criteria as shown on the Contract Drawings and specified herein. All concrete placed underwater shall conform to ACI 304R, Chapter 8. Submit an underwater concrete placement procedure that is in conformance with ACI 304R, Chapter 8. Concrete containing lightweight aggregate shall conform to ACI 213. Prior to concrete construction and after approval of all materials to be used in the concrete, submit a mix proportion showing that all performance criteria have been met. Mix proportions submitted shall be based upon laboratory trial mix test results and/or mixes successfully used within the two years preceding the date of the submittal of the mix for the Work of this Section. The independent testing laboratory used to develop the mix proportions and to perform testing shall have AASHTO resource and ASTM CCRL accreditation for all test methods required to be performed and to develop the required mix. Submit proof of certification to the Engineer prior to the start of development of the mix proportions and testing. The mix proportions shall include copies of test reports including test dates, and a complete list of materials including type, brand and source. The trial mix design performed in the testing laboratory shall use the same materials including cement, supplementary cementitious materials, aggregates and admixtures that will be used at the batch plant. Show fineness modulus, gradations absorptions, and Alkali Silica Reaction testing of aggregates. If any of the approved mix constituents change in source, properties or proportion, submit a new mix for Engineer approval prior to incorporating into the Work. The mix proportions and test results shall conform to the following:

1. Cement Content: Mix designs are limited to a maximum Portland cement content of 400 pounds per cubic yard, unless otherwise approved by the Engineer. For mass concrete and all concrete applications below grade and against earth; or below grade and confined concrete, such as concrete fill within steel pipe piles, mix designs are limited to a maximum Portland cement content of 300 pounds per cubic yard. This does not include sidewalks, slabs on grade, or any application that requires a final finish. The Contractor may also limit the cement content to 300 pounds per cubic yard for other applications that do not require labor for finishing prior to initial set provided that the performance requirements are met.
2. Supplementary Cementitious Materials: Substitute either fly ash, slag, or both. Unless otherwise shown on the Contract Drawings, the minimum total supplemental cementitious material (including fly ash, slag, silica fume and/or metakaolin) shall be 30 percent by total weight of cementitious materials.
3. Concrete Placed Underwater: The minimum cementitious material content shall be 650 pounds per cubic yard of concrete.
4. Water-to-Cementitious Ratio: For Category I through V concrete applications, the mix water-to-cementitious ratio shall not exceed 0.40. Compute water-to-cementitious ratio using the weight of cementitious material, which is equal to the total weight of cement plus fly ash, slag, metakaolin and silica fume. Any admixtures which increase the water-to-cementitious ratio by 0.01 or greater shall be accounted for in the mix proportion to meet the specified water-to-cementititous ratio.
5. Shrinkage: For Category II through V concrete applications, the absolute drying shrinkage shall not exceed 0.04 percent. For Category I and structural slabs, the absolute drying shrinkage shall not exceed 0.03 percent. Concrete shrinkage testing shall be performed in accordance with ASTM C 157, modified to the following procedure.
    a. Trial batch and test specimens shall be made at the water-to-cementitious ratio and slump represented in the approved mix proportion.
    b. Initial curing, removal of specimens from molds, and initial comparator readings.
        (1) For concrete mix designs incorporating silica fume, comply with ASTM C 157 Section 10.1 with respect to initial curing of specimens. Removal of specimens from molds shall be at 9-1/2 hours plus or minus 1/2 hour and initial comparator readings 10 hours plus or minus 1/2 hour.
        (2) For all other concrete mix designs comply with ASTM C157 Sections 10.1 and 10.2 with respect to initial curing of specimens (23-1/2 hours plus or minus 1/2 hour), removal of specimens from molds, and initial comparator readings (24 hours plus or minus 1/2 hour).
    c. Eliminate the wet curing period described in ASTM C 157 Section 10.3 for all specimens. Do not wet cure specimens.
    d. Comply with ASTM C 157 Section 11.1.2 Air Storage (Dry) Method for 28 days for all specimens. Take comparator readings at 4, 7, 14, 21, and 28 days after initial comparator reading.

6. Permeability (ASTM C1202): For Category III and IV concrete, the maximum accelerated Coulomb count (7 days standard curing, 21 days at 100 degrees Fahrenheit) at 28 days shall not exceed 1200 with the exception of concrete placed in a marine environment which will be tested after 28 days of standard curing at 73 degrees Fahrenheit. For concrete mixes with lightweight aggregate, the maximum accelerated Coulomb count at 28 days shall not exceed 1500. Concrete placed in a marine environment shall be 1700 Coulombs for mixes not containing a corrosion inhibitor and 2200 Coulombs for mixes that do contain a corrosion inhibitor. Performance testing shall be performed at 28 days.
7. When high range water reducer is added to the concrete mix at the construction site it shall be delivered in a tank fixed to the truck that discharges directly into the mixing drum, or added to the drum from a calibrated dispensing unit. A calibrated dispensing unit is defined as a manufactured dispenser with clear volume indications marked on the outside of the unit. It shall be available at all times during the concrete placement for re-dosing purposes. Submit a re-dosing chart showing the dosages necessary to increase the slump in inches, per cubic yard of concrete remaining in the drum, over the range of concrete temperatures from 50 degrees Fahrenheit to 90 degrees Fahrenheit. If re-dosing occurs, the re-dosing chart shall be used, but under no circumstances shall the total dosage exceed the maximum dosage recommended by the manufacturer. The truck shall mix for a minimum of an additional 5 minutes after re-dosing prior to discharging concrete.
8. Air Content: The percentage of air in the mix shall fall within the range of the Lower Quality Limit (LQL) and the Upper Quality Limit (UQL) as outlined in the entitled "Air Content Target Range for Freshly Mixed Concrete" in 2.03 A.6. Air content shall be determined by testing in accordance with ASTM C 231 for normal and heavyweight concrete mixes and ASTM C 173 for porous, lightweight aggregate.
9. Lightweight Aggregate: Make adjustments to the weight of coarse lightweight aggregate in accordance with the following:
    a. Design lightweight concrete mix proportions such that the equilibrium unit weight does not exceed 115 lbs. per cubic foot. Equilibrium unit weight is defined as the constant mass after drying at 230 degree Fahrenheit plus or minus 9 degrees Fahrenheit, plus 3 pounds per cubic foot (ASTM C 567). Adjust the proportion of lightweight aggregate to compensate for the difference between the wet unit weight determined in 3.05 B.6 and the dry unit weight of the material submitted in accordance with 1.05 A.1 and the approved mix proportions.
    b. For lightweight aggregate mixes, advise the batch plant 72 hours prior to pouring in order to saturate the aggregate. Presoak lightweight coarse aggregate a minimum of 72 hours prior to mixing of concrete. The lightweight aggregate shall reach an absorbed moisture content not less than the aggregate manufacturer's written recommendations or the concrete will be rejected.

B. Latex Modified Concrete shall conform to ACI 548.4. The mix maximum water to cement ratio shall not exceed 0.40. The minimum volume of coarse aggregate shall be not less than 7.6 cubic feet (absolute volume) per cubic yard.

C. Architectural Concrete

Concrete permanently exposed to view that requires special care in selection of concrete ingredients including color, forming, placing, consolidating and finishing to obtain the desired architectural appearance is designated as "Architectural Concrete".

1. Pigments, in conformance with ASTM C 979, shall be used when matching the color of existing concrete or when a specific color of concrete is required by the Engineer.
2. A minimum of 35 days prior to construction of a mock-up, submit mix proportions and two sample panels (a minimum of 12 inches by 12 inches by 2 inches) for each mix to the Engineer for approval. The materials used for the sample panels shall be from the same sources of material supply for all constituents in the approved mix. When requested by the Engineer, submit samples of all constituents for trial batching to the Authority's Materials Engineering Unit to verify that the physical property requirements are met.
3. Construct mock-up only after the Engineer has approved both the mix proportions for physical properties and the sample panels for color and texture. For cast in place concrete, a mock-up in accordance with ACI 303.1 Section 1.6 Quality Assurance will be required for approval by the Engineer. For walls, a mock-up shall include all details that will be encountered in a typical day's pour. The mock-up may be constructed at the construction site as part of the permanent Work at the sole risk of the Contractor. If the Engineer rejects the mock-up, it shall be removed and recast at no additional cost to the Authority. For precast architectural concrete, the mock-up shall consist of a full member selected in advance by the Engineer. Keep the approved mock-up at the precast concrete production facility for the Engineer to compare with the production units for acceptance or rejection. Acceptance or rejection shall be determined solely by the Engineer.
4. Construct mock-ups only with all of the actual constituents of the approved mix proportions. Do not proceed with production until the mix proportions, sample panels, full-scale mock-up and shop drawings have been approved by the Engineer. Once production begins, do not change suppliers or sources of supply for any of the constituents in the approved mix for the duration of the Contract.
5. In addition to the mix proportions and sample panels, submit catalog cuts for the following for approval: forms, form liners and form oil or release agents.
6. Architectural Concrete shall conform to the Quality Assurance performance criteria specified in 4.01 B, Table 2 for the appropriate placement application and the associated Quality Acceptance Limits specified in 2.03.
7. Noticeable differences in color and/or texture of the finished product, as determined solely by the Engineer, shall be corrected by means and materials approved by the Engineer.

2.03 QUALITY ACCEPTANCE LIMITS

A. Develop mixes to meet the following performance criteria Quality Acceptance Limits in accordance with the relevant application properties specified in 4.01 B, Table 2, unless otherwise shown on the Contract Drawings:

1. Compressive Strength (ASTM C 39): The Lower Quality Limit, LQL, shall be the specified mix compressive strength at 28 days (56 days when mixes contain Type F fly ash), unless otherwise shown on the Contract Drawings.
2. Flexural Strength (ASTM C 78): The Lower Quality Limit, LQL, shall be 700 psi at 28 days, unless otherwise shown on the Contract Drawings.

3. Permeability (AASHTO T 277): The Upper Quality Limit, UQL, shall be 1200 Coulombs at 28 days, accelerated, following the accelerated method specified in 3.05 B.8, except concrete mixes containing lightweight aggregate requiring an UQL of 1500 Coulombs. The Upper Quality Limit, UQL for mix designs containing corrosion inhibitor is determined utilizing the submitted test results in the following equation; UQL = 1200 + [(RCP test result with Corrosion Inhibitor) - (RCP test result without Corrosion Inhibitor)]

   The Upper Quality Limit, UQL, for concrete placed in a marine environment shall be 1700 Coulombs for mixes not containing a corrosion inhibitor and 2200 Coulombs for mixes that do contain a corrosion inhibitor. Performance testing shall be performed at 28 days.

4. Bond Strength (ASTM C 1583): The Lower Quality Limit, LQL, shall be 150 pounds per square inch at 28 days.

5. Water Content (AASHTO T 318): The Upper Quality Limit, UQL, for water content shall be the submitted and approved water to cementitious ratio plus 0.03.

6. Air Content (ASTM C 138, ASTM C 173 or ASTM C 231): Both the Lower Quality Limit, LQL, and the Upper Quality Limit, UQL, shall be as specified in the table below:

   AIR CONTENT TARGET RANGE FOR FRESHLY MIXED CONCRETE

MAXIMUM SIZE AGGREGATE (SIZE #)	AIR CONTENT LQL	AIR CONTENT UQL
2" or above (# 467 and above)	4.0%	7.0%
1-1/2" (# 57)	4.5%	7.50%
1" (# 67)	5.0%	8.0%
1/2" (# 8)	6.0%	9.0%
3/8"	6.5%	9.50%
Latex modified concrete		6.5%

   Note: For a specified compressive strength greater than 5000 pounds per square inch, the LQL and UQL for air content, as indicated above, shall both be reduced by 1.0 percent.

   For all concrete applications not exposed to freeze-thaw cycling or chlorides, air entrainment is not required.

7. Chloride Ion Concentration by Weight of Cementitious Material (ASTM C 1152, ASTM C 1218, ASTM C 114 and ACI 222R): The acid soluble chloride ions by weight of cement in the concrete mix shall be less than or equal to 0.10 percent for reinforced concrete and less than or equal to 0.08 percent for prestressed concrete, in accordance with ACI 222R. The water soluble chloride ions by weight of cement in the concrete mix shall be less than or equal to 0.15 percent for reinforced concrete and 0.06 percent for prestressed concrete, in accordance with ACI 222R.

8. Pavement Thickness: The Lower Quality Limit, LQL, for pavement thickness shall be 97.0 percent.

9. Delaminations: The total surface area tested for any given Lot of concrete shall indicate less than 5.00 percent delaminated area when tested using the chain drag in accordance with ASTM D 4580 Procedure B.

B. For concrete bridge decks where riding surface tolerances are required, when shown on the Contract Drawings, the following requirements shall be met:

1. Surface smoothness deviations shall not exceed 1/4 inch in 16 feet.

2. Vertical deviation from the grade shown on the Contract Drawings shall not exceed plus or minus 0.04 foot at any point.

C. A mass concrete element is defined as any element having its least dimension measuring 24 inches or greater, and also as any element having the potential for locally exceeding the limits defined as follows:

1. The temperature at the core of any mass concrete element shall not exceed 158 degrees Fahrenheit.
2. The maximum temperature difference between the core and the surface of a mass concrete element shall not exceed 35 degrees Fahrenheit at any time.
3. The drop in temperature in the first 24 hours after the end of protection shall not exceed the limits of ACI 306R Table 3.1.
4. Submit for approval a thermal control plan for specific mass concrete element(s) when requested by the Engineer. The plan shall include items detailed in ACI 30 Section 8.1.3.

D. The Quality Acceptance Limits as specified in 2.03 A will be used to calculate Adjustments to Contract Compensation in accordance with Part 4 of this Section.

PART 3. EXECUTION

3.01 PREPARATION FOR CONCRETE PLACEMENT

A. Preparation for New and Existing Structures

1. Straighten bent dowels, whether placed under this Contract or by others, using tools approved by the Engineer. Do not apply heat to dowels.
2. Clean all dowels and all steel that will be embedded in concrete of all loose rust, scale, paint, grease and substances which could reduce the concrete bond.
3. Examine coated reinforcement for integrity of coating. Repair all damaged areas in accordance with the requirements of Specification Section 033110 entitled "CONCRETE REINFORCEMENT". Make the repair crew available at the time of examination.
4. Check all formwork locking devices to ensure that they are in place and properly secured.
5. Do not place concrete for piles, footings, pile caps or slabs supported on pile caps or piles until the pile survey has been completed and additional reinforcing steel, if necessary, has been added as directed by the Engineer.
6. For preparation of surfaces to receive concrete, conform to all procedures, equipment limitations, and Contract requirements prior to placing concrete.
7. Do not place concrete for slabs-on-grade, grade beams or footings until the subgrade has been inspected and approved by the Engineer, and until any base course or fill has been properly compacted in accordance with the Contract requirements.
8. Provide vent holes (1/4 inch diameter, minimum), edge angles or embedded plates at joints where vibrating alone will not ensure elimination of voids. Locate such holes at high points and with uniform spacing along joints for escape of air during concreting operations. Evidence of voids adjacent to embedments will be cause for rejection of Work. Submit all vent holes and procedures for placement of concrete at joints with the shop drawings for review and approval.
9. Make provisions for the concrete to pass through the reinforcing steel without segregating during placement.

B. For preparations for placing concrete pavements, see Specification Section 321314 entitled "PLACEMENT OF PORTLAND CEMENT CONCRETE PAVING".

C. Bonded Overlays on Bridge Decks and Horizontal Patching Applications

1. Bond strength tests shall be performed in accordance with ASTM C 1583, modified using 4-inch by 4-inch steel plates, to determine the adequacy of the surface preparation. A minimum average bond strength of 200 pounds per square inch shall be attained, with no single test value less than 180 pounds per square inch. If time does not permit the above test to be performed, as determined solely by the Engineer, the Engineer will measure the macrotexture depth in accordance with ASTM E 965. A minimum of four tests will be performed and the average macrotexture depth shall be a minimum of 0.06 inches. Quality Control testing by the Contractor shall be performed prior to Quality Assurance testing which may be performed by the Engineer. Prior to the placement of any overlay or patching material, obtain the Engineer's approval of the surface preparation.

2. The Contractor shall sound the concrete surface to identify areas of unsound or deteriorated concrete. The Engineer may verify any or all of the surveyed structures. Areas identified as unsound shall be removed to the limits and depths as ordered by the Engineer. Clean exposed reinforcing steel that is to remain in place by abrasive blasting.

3.02 BATCHING AND MIXING CONCRETE

A. Measurement of Proportions

1. All concrete batching shall be in conformance with ASTM C 94 and ACI 304R.

2. For Very High Early Strength Concrete requiring 2000 pounds per square inch or greater in 6 hours or less time, the method of batching shall be restricted to a calibrated mobile mixer, or to a transit mixer that is loaded at the construction site with bulk bags of the Very High Early Strength Cement. Bulk bags shall contain sufficient Very High Early Strength Cement by weight to batch for a minimum of 3 cubic yards of concrete.

B. Mixing Concrete

1. Transit mix trucks shall be inspected and approved annually by either the New Jersey or New York State Departments of Transportation.

a. Mixers shall be equipped with a metal plate attached by the manufacturer, indicating the volume of mixed concrete the equipment is intended to produce. The quantities of materials transported and the volume of mixed concrete produced shall not exceed the mixer's rated capacity. In locations where the rate of depositing is slow, or it becomes apparent that concrete loads cannot be homogeneously mixed (large dry balls of unmixed cement or concrete), the Engineer may restrict the volume of concrete that may be mixed in a mixer to a volume less than the manufacturer's rated capacity of the mixer.

b. Immediately repair or withdraw from use any mixer which is determined by the Engineer to be mechanically unsatisfactory.

2. If truck mixers are used, keep available a sufficient number to ensure continuous delivery of the concrete at the rate required for the proper handling, placing, finishing and curing of the concrete. If a plant at the construction site is used, it shall be of sufficient capacity to meet such requirements.
   a. Mixers shall be of the revolving-drum type, with drums suitably mounted and fitted with adequate blades capable of discharging the mixture without segregation. All truck mixers shall be equipped with an accurate, operable counter to measure the number of drum revolutions and an accurate, working water site gage or manometer to measure the volume of water introduced into the drum. Truck mixers without an accurately operating counter or water site gage shall be immediately withdrawn from use.
   b. The minimum batch volume when utilizing revolving drum type mixer to deliver concrete shall be 3 cubic yards.
3. The Engineer may permit one re-tempering of concrete admixtures subject to the following:
   a. The re-dosage of high range water reducer shall conform to the Engineer-approved re-dosage chart and shall not exceed the manufacturer's recommended limitation, nor shall it retard the initial set of the concrete by more than 30 minutes.
   b. When air content is below the Lower Quality Limit or above the Upper Quality Limits specified in 2.03 A.6.
   c. When site conditions or situations warrant the addition of a retarder.
4. The Engineer may reject concrete in the following instances:
   a. Concrete has not been placed within 90 minutes from the time the cement had first contact with water. However, the Engineer may allow placement beyond 90 minutes provided that the concrete has acceptable workability, temperature below 9 degrees Fahrenheit, air content, and water content within the limits specified herein.
5. The Engineer will reject concrete subject to the following:
   a. Concrete that has partially hardened or has attained its initial set prior to placement.
   b. Concrete temperature has reached 92 degrees Fahrenheit.
   c. Concrete workability has been lost.
   d. The mix appears to be segregated.
   e. The mixer is not able to produce well mixed, homogeneous concrete as specified in 3.02 B.1.a.
   f. Air content is not in specified range.
   g. Water content is not in the specified range.

6. Construction Site Mixing: Measure mix components in accordance with tolerances specified in ASTM C 94. Weigh all non-liquid components and measure all liquid components immediately prior to batching. Use a calibrated flask with clear indication markings (e.g. ounces, pints, etc.) when measuring liquid components. Flasks without calibrated clear indication markings will not be permitted. Mix concrete materials in an approved drum-type batch machine mixer.
   a. For a mixer capacity of 1 cubic yard or less, continue mixing a minimum of 3 minutes, but not more than 5 minutes after ingredients are in the mixer and before any portion of the batch is released.
   b. For a mixer capacity of greater than 1 cubic yard, increase the mixing time by 1 minute for each additional 1 cubic yard.
   c. Provide a batch ticket to the Engineer for each batch discharged and used in the Work, indicating the Contract number and title, date, time, mix type, mixing time, quantity of each constituent, volume of concrete and amount of water added. Record the location of the deposit of concrete within the structure so that it can be easily identified by the Engineer.

C. Mobile Mixers: When application requires the use of a mobile mixer, it shall meet the following criteria:
1. Proportioning and Mixing Equipment
   a. Mixer shall be a self-contained, self-propelled, continuous mixing type capable of carrying sufficient unmixed dry cement, aggregates, water and admixtures to produce not less than 6 cubic yards of concrete. Maintain a calibrated back-up unit at the construction site ready for use.
   b. Mixer shall be capable of positive measurement of cement being introduced into the mix. A recording meter, visible at all times and equipped with a ticket printout, shall indicate this quantity.
   c. Mixer shall provide positive control of the flow of water and admixtures. Water flow shall be indicated by flow meter and shall be readily adjustable to accommodate minor variations in aggregate moisture.
   d. Mixer shall be capable of being calibrated in accordance with NYSDOT Materials Method NY9.4 to automatically proportion and blend all components of indicated composition on continuous or intermittent basis as required by the finishing operation, and shall discharge mixed material through a chute directly in front of the finishing machine. Notify the Engineer a minimum of 48 hours prior to calibration of the mobile mixers. Before approving the calibration of the mobile mixer, the Engineer will witness the calibration of the mobile mixer. However, the Contractor is responsible for testing the mix produced. Allow the Engineer to test the concrete mix at any time.
   e. Calibrate mixer in accordance with NYSDOT Materials Method NY9.4 to accurately proportion the specified mix. Certification of calibration by an Engineer approved testing agency may be accepted as evidence of this accuracy, provided such certification attests the yield to be true within the following tolerances (by weight):

ALLOWABLE TOLERANCES OF BATCH MATERIALS IN CONCRETE MIXTURES

MATERIAL TYPE	TOLERANCE ALLOWANCE
Coarse Aggregate	+/-2%
Fine Aggregate	+/-2%
Cement	+/-1%
Water	+/-1%
Admixtures	+/-3%
Latex	+/-1%

f. Mix in accordance with the specified requirements for the equipment used. The concrete, as discharged from the mixer, shall be such that finishing operations can proceed at a steady pace with final finishing completed before the formation of the plastic surface film.

g. Repair mixers not functioning in a manner the Engineer considers acceptable. If repair is not practical in the opinion of the Engineer, remove the mobile mixer from the construction site and replace it with one which functions properly.

h. Prior to production, test the moisture content of the fine aggregate and coarse aggregate. Adjust the water gage setting only in the presence of the Engineer, to produce the approved mix water to cement ratio. Test the moisture content of the fine aggregate and coarse aggregate every 3 hours during production, or when the mobile mixer is loaded with aggregates from a stockpile different from the one for which moisture content tests were performed, whichever occurs first. Make adjustments in the presence of the Engineer. For Latex Modified Concrete, the maximum permissible moisture content of fine aggregate and coarse aggregate shall be 6.0 percent and 3.0 percent, respectively, as determined in accordance with ASTM C 566. If these limits are exceeded, stop concreting operations until drier aggregates are obtained. Allow the Engineer to view and copy all records for moisture content testing at any time.

3.03 FIELD PLACEMENT

A. For the duration of all concrete placements at the construction site, the Contractor shall have an individual in a supervisory capacity present with a valid ACI Concrete Construction Special Inspector certification.

B. Prior to any construction site delivery of concrete, furnish, deliver and maintain insulated curing boxes of sufficient size and strength to contain all the specimens (cylinders and beams) made by the Engineer in any two (2) consecutive Work periods. Such boxes shall be equipped to maintain the curing conditions specified in ASTM C 31.

1. Regulate the temperature within the box in the range of 60 degrees Fahrenheit to 80 degrees Fahrenheit, or 68 degrees Fahrenheit to 78 degrees Fahrenheit when the design compressive strength is 6000 pounds per square inch or greater, and provide the moisture to maintain the curing conditions specified in ASTM C 31.

2. When the ambient temperature is greater than 80 degrees Fahrenheit, maintain the temperature of concrete flexural beam specimens in the required range by immersing them in a water bath. Cover the water bath to prevent direct sunlight from raising the water temperature. Completely remove and replace the water in the bath every day.

3. When the ambient temperature is below 60 degrees Fahrenheit, maintain the temperature of concrete flexural beam specimens in the required range by immersing them in a water bath equipped with a heater. Insulate the water bath as required to prevent heat loss.
4. Locate the insulated curing boxes where directed by the Engineer. Protect boxes from vibration and other disturbances during specimen curing.

C. Keep this Specification Section and the following ACI publications available at all times at the construction site:

1. ACI 301.
2. ACI 302.1R.
3. ACI 305R.
4. ACI 306R.
5. ACI 308.
6. ACI 309R.
7. ACI 318.

D. Ensure that the concrete supplier keeps this Specification Section and the following ACI publications available at all times at the batching location:

1. ACI 211.
2. ACI 213.
3. ACI 304R.

E. Bonding New Concrete to Existing Concrete

Where new concrete will be placed against existing concrete surfaces:

1. Surface to receive concrete shall be soaked and kept wet with water for one (1) hour prior to placement of material. Puddles of standing water shall be removed immediately prior to placement.
2. A thin layer of material from the leading edge of the concrete being placed shall be broomed into the wetted surface. Care shall be exercised to ensure that all vertical as well as horizontal surfaces receive a thorough, even coating and that the rate of progress is controlled so that the broomed material does not dry before being covered with additional material as required for final grade.

F. Placing Concrete

1. All concrete shall be placed in the presence of the Engineer, by approved methods.
2. For concrete cast against earth or an approved compacted subgrade, and for concrete overlays, place concrete against surfaces in a saturated surface dry condition.
3. Prior to placing concrete, remove all standing water and puddles.
4. Do not place concrete on or next to frozen surfaces.
5. Transfer concrete from mixer to place of deposit as rapidly as practical to prevent formation of cold joints.
6. Use equipment and methods for placing which permit rapid placement of concrete of the required consistency and which preclude segregation.
7. The method and equipment used to transfer concrete from mixer to forms will be subject to prior approval by the Engineer. Do not use any pipes, chutes or other equipment made of aluminum. If precipitation is heavy during placement, prevent additional water from entering the concrete.

8. Subject to the foregoing requirements, convey concrete by approved conveyors, pipes, chutes or spouts to a point not more than five feet horizontally or vertically from its final position, unless otherwise approved by the Engineer.
9. Concrete for fill in steel reinforced pipe piles, steel shells or caissons shall be deposited using a rigid hopper and an elephant trunk. The hopper and elephant trunk shall be set above the top of pipe piles, steel shells or caissons to permit the escape of air as the concrete is placed. Elephant trunks shall be removed in sections while filling pipe piles, steel shells or caissons from bottom of reinforcing cage to top of pipe piles, steel shells or caissons. Elephant trunks shall extend a minimum distance of 10 feet below top of pipe pile, steel shell or caisson or to bottom of reinforcing cage, whichever is greater. The top 15 feet of the concrete poured from the top shall be vibrated or rodded. No cold joints will be permitted during concreting operations.
10. Except where otherwise approved by the Engineer, consolidate concrete by internal mechanical vibration subject to the following:
    a. Type, number and method of application of vibrators will be subject to prior approval by the Engineer.
    b. Apply vibrators at points not more than 30 inches apart for time intervals of approximately 10 seconds.
    c. Do not use vibrators to move concrete horizontally.
    d. In locations where spading is approved in lieu of mechanical vibration, spade coarse aggregate away from the forms and into the plastic mass; rod concrete around embedded materials and into corners and spaces to be filled and use only approved equipment.
    e. In locations where epoxy coated reinforcement is being used, use rubber tipped or rubber sleeved vibrators.
11. Prevent formation of laitance and accumulation of excessive water on surface of concrete as it is deposited. Remove any accumulated bleed water by approved means before placing other concrete.
12. Place concrete so as to require as little rehandling as possible. Place and spread concrete using an approved mechanical spreading device that prevents segregation of the materials. Place continuously between contraction joints. Perform necessary hand spreading with shovels, not rakes.
13. Deposit concrete as near to joints as possible without disturbing them but do not discharge onto a joint assembly unless placement is centered above the joint assembly.
14. Thoroughly consolidate concrete against and along the faces of all forms and previously placed concrete and along the full length and on both sides of all joint assemblies by means of vibrators inserted in the concrete. Do not permit vibrators to come in contact with a joint assembly, base course or a side form. In no case shall the vibrators be used to move the concrete.
15. Screed and float concrete for riding surfaces as it is placed and use an approved evaporation retardant or fog spray.

G. Concrete Placing and Finishing Equipment for Bridge Decks

1. Slab or Overlays 8 Inches or Greater in Depth

   a. Provide a vibratory, power driven spreading and finishing machine capable of striking off, screeding, consolidating and floating the concrete to the required cross-section and elevation. Ensure that the spreading and finishing machine has sufficient weight to produce the necessary pressure and is capable of being adjusted to produce the cross-section and finish required. Ensure that the spreading and finishing machine is geared to operate consistently and smoothly and is equipped with at least 2 oscillating-type transverse screeds and a scraping device to keep the tops of the forms clean.

   b. Utilize internal vibrators. Internal vibrators shall be gang-mounted to the spreading and finishing machine and supplemented with manual, hand held vibrators adjacent to joint assemblies and similar locations where gang-mounted vibrators are not practical. Except for hand held vibrators, ensure that vibration operation is controlled by the forward movement of the spreading and finishing machine so that vibration automatically ceases when the forward movement of the spreader is stopped.

   c. Ensure that vibrators have a minimum frequency of 5000 impulses per minute.

   d. Check all vibrators prior to the start of concrete placement Work and periodically during construction progress to verify that they are working properly.

2. Slab or Overlays Less Than 8 Inches in Depth

   a. Refer to ACI 309R for consolidation and finishing equipment requirements.

3. Manual tools such as bull floats, trowels, brooms and other similar hand tools are acceptable.

H. For placement and finishing of pavements, see Specification Section 321314 entitled "PLACEMENT OF PORTLAND CEMENT CONCRETE PAVING".

I. Consolidation and Finishing

1. Bridge Decks and Bonded Overlays

   a. Consolidate concrete using vibrators. Ensure that consolidating operations do not segregate the concrete or disturb the transverse joint assemblies, joint ties, the underlying surface or side forms.

   b. Immediately after consolidating the concrete, strike off the surface to ensure that a uniform ridge of concrete, of between 2 and 6 inches, is maintained in front of the screed along the entire width of the pavement.

   c. Immediately after strike off, begin finishing operations to achieve the specified line and grade of the surface. Ensure that the finishing equipment is maintained true without lift, wobble, or other disturbances that could affect the specified line and grade.

   d. At expansion joint assemblies, advance the finishing equipment, avoiding damage to or misalignment of joint assemblies. If advancing the finishing equipment over expansion joints causes concrete segregation or damage to, or misalignment of, the joint assemblies, stop the finishing equipment when the screed is approximately 8 inches from the joint assembly. Remove segregated concrete from the joint; lift the screed and set directly on top of the joint, and resume advancement of the finishing equipment.

e. If screeding operations produce a surface containing voids, bubbles, or other imperfections, then hand finish the surface with a metal float. Do not add water to the surface of the concrete to assist in finishing operations.

f. 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.

   (2) In areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical. Concrete, as soon as placed, shall be struck off and screeded using an approved portable screed. Use a second screed for striking off the bottom layer of concrete when reinforcement is used.

   (3) The screed for the surface shall be at least 2 feet longer than the maximum width of the slab to be struck off. It shall be of approved design, sufficiently rigid to retain its shape, and shall be constructed either of metal (not aluminum) or of other suitable material covered with metal. Consolidation shall be achieved by the use of suitable vibrators.

g. After the concrete has been struck off and consolidated, it shall be further smoothed and trued by means of a longitudinal float using one of the following methods:

   (1) Long-handled floats shall be not less than 12 feet in length and 6 inches in width, stiffened to prevent flexibility and warping. The float shall be operated from foot bridges spanning but not touching the concrete or from the edge of the pavement. Floating shall pass gradually from one side of the bridge deck to the other. Forward movement along the centerline of the pavement shall be in successive advances of not more than one-half the length of the float. Any excess water or laitance in excess of 1/8-inch thick shall be removed and disposed.

   (2) A machine composed of a cutting and smoothing float(s), suspended from and guided by a rigid frame, and constantly in contact with the side forms or underlying surface. If necessary, long-handled floats having blades not less than 5 feet in length and 6 inches in width may be used to smooth and fill in open-textured areas in the pavement. When the crown of the bridge deck will not permit the use of the mechanical float, the surface shall be floated transversely by means of a long-handled float. Care shall be taken not to work the crown out of the pavement during the operation. After floating, any excess water and laitance in excess of 1/8-inch thick shall be removed and disposed. Successive drags shall be lapped one-half the length of the blade.

h. While the concrete is still in a workable condition, test it for trueness with a 16-foot straightedge swung from handles 3 feet longer than one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advance 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 thick shall be removed from the surface of the bridge deck and disposed. Any depressions shall be immediately filled with freshly mixed concrete, struck off, consolidated and refinished. High areas shall be cut down and refinished. Special attention shall be given to ensure that the surface across joints meets the smoothness requirements set forth in 2.03 B. Straightedge testing and surface corrections shall continue until the entire surface is free from observable departures from the straightedge and until the slab conforms to the required grade and cross section. Test the surface across the joints with a 16-foot straightedge as the joints are finished and correct any irregularities in excess of 1/4 inch before the concrete has hardened.

i. The surface of the concrete shall be protected from precipitation during and after finishing until the concrete has achieved final set.

2. Specified concrete finishes, when shown on the Contract Drawings, shall be in accordance with the following requirements:

a. Smooth Finish: A surface of concrete obtained by the use of special forms as specified in Division 03 Section entitled "CONCRETE FORMWORK". Remove all fins and other irregularities in the exposed surfaces of concrete by rubbing the irregularities with a carborundum brick and clean fresh water. Any mortar patches shall be rubbed with a carborundum brick as above specified.

b. Scored Finish: A surface of concrete obtained by roughening in an approved manner or by etching with sharp-pointed steel tools to key or otherwise improve the mechanical bond of the surface. Such scoring shall roughen at least 90 percent of the area so scored.

c. Float Finish: A surface of concrete obtained by the use of a wood float. Apply float finish to horizontal surfaces immediately after screeding and before initial setting has begun.

d. Trowel Finish: A surface of concrete obtained by the use of a steel trowel, after screeding and floating the surface of the concrete to produce a dense, smooth, even surface suitable for painting or the application of floor covering. The troweling shall not take place until the surfaces have set sufficiently to sustain knee boards without damage. Troweling shall eliminate all irregularities and leave the concrete surface with a smooth, hard finish, free from marks and blemishes to the satisfaction of the Engineer. Do not use a steel trowel on air entrained concrete mixes.

e. Traction Finish: A monolithic layer of abrasive concrete having a minimum thickness of 3/4 inch and which shall be "Emericrete SH", as manufactured by the Sika Corporation, or approved equal. Prepare the base and install the monolithic finish in accordance with the recommendations of the manufacturer of the abrasive concrete. The surface shall be given a wood float finish. The sides and edges of pavement slabs shall be rounded with an approved edging tool to the minimum radius obtainable in the sole opinion of the Engineer.

f. Burlap Finish: A surface of concrete obtained by the use of a burlap drag, after screeding and floating the surface of the concrete. Drag the burlap in one direction in a straight line before initial setting has begun and in such a manner that the full width of the slab being finished is dragged in one operation. Prepare the surface prior to dragging by working from a bridge that does not come in contact with the fresh concrete at any point. The use of any burlap that causes irregularities or grooves greater than 1/16 inch in depth in the concrete surface will not be permitted. Rinse or wash burlap as often as is necessary to prevent the presence of hardened particles and consequent scarring of the concrete.

g. Slip Resistant Finish: Stair treads and platforms of steel stairs shall be filled with mortar mixed in the proportions of one part Portland cement to three parts of fine aggregate, mixed with water to a satisfactory consistency. Coat the surface of the mortar with three pounds of aluminum oxide crystals per square yard of surface, uniformly applied, and trowel the surface to a smooth hard finish. Aluminum oxide crystals shall be aluminum (III) oxide crystals ranging from No. 12 to No. 30 in size and shall contain no more than 6 percent of iron or other impurities.

h. "Broom Finish" shall be subject to the following:

(1) Finish the concrete when the water sheen has practically disappeared. Use push broom or floor brush type, not less than 18 inches wide and made of good quality bass or bassine fibers not more than 4-1/2 inches long and with handles longer than half the width of the slab.

(2) Use an adequate number of brooms to keep up with other operations. Achieve proper finish prior to initial set of the concrete.

(3) Wash and thoroughly dry brooms at frequent intervals and remove worn or damaged brooms from the construction site.

(4) Draw broom across previously finished surface from the centerline to each edge of the slab with a slight overlap of strokes.

(5) Corrugations made in surface shall be uniform, approximately 1/16 inch in depth, and not more than 1/8 inch in depth.

(6) Complete brooming before concrete reaches a condition that would result in the surface becoming torn or unduly roughened and before initial set of concrete.

(7) Immediately following brooming, carefully finish the edges of slab along sides and at joints with an approved edging tool to form a smooth rounded surface of required radius and subject to the following:

(a.) Where corners or edges of slabs have crumbled and at any areas which have leaked sufficient mortar to make proper finishing difficult, remove loose fragments and soupy mortar, fill solidly with a mixture of correct proportions and consistency and finish.

(b.) Edges shall be smooth, true to line and free of unnecessary tool marks.

i. "Saw Cut Grooved Surface" for deck slabs as follows:

Saw cut the deck no earlier than 15 days after placing the concrete. Saw cut before opening to traffic. Provide 2 approved gauges to the Engineer to verify groove depth before sawcutting. Include the manufacturer's recommendations for use with the gauges. Cut grooves using multi-bladed sawcutting equipment fitted with diamond-tipped circular saw blades. The Engineer will allow the use of single blade saw equipment where necessary to complete the grooving Work. Cut grooves perpendicular or radial to the centerline of the traveled way. Radially groove in partial-width passes. Limit each pass to 1 lane width. Ensure that grooves are between 0.10 and 0.15 inches wide and 1/4 and 3/8 inches deep. Space the blades to achieve the following distances between the centerlines of each groove to form a random pattern: 3/4 inch, 1-1/4 inch, 5/8 inch, 1 inch, 5/8 inch, 1-1/4 inch, 3/4 inch. Perform consecutive passes within 2 inches of the previous pass. Do not cut grooves over an area that has been already grooved, or introduce a cutting blade into a groove that has been already established. During grooving operations, the Engineer will randomly check the groove dimensions. If the minimum groove depth has not been achieved, stop grooving operations and make the necessary adjustments. Ensure that slurry or debris from the grooving operations does not accumulate in the grooves. Continuously collect slurry and dispose of offsite. Ensure that the slurry does not enter the structure or highway drainage system.

j. Concrete Curbs and Sidewalks

(1) Give sidewalks a "Float Finish", tool edges and joints for a width of 2 inches and round corners to a radius of 1/4 inch with an approved edging tool.

(2) Install expansion joints at not more than 20-foot intervals in sidewalks with matching joints in curbs. Fill expansion joints with 1/4-inch bituminous joint filler.

(3) Score sidewalks in squares as approved by the Engineer.

J. Construction Joints

1. Number, locations and details shall be as shown on the approved shop drawings.
2. Planes of joints shall be normal to direction of pressure and shall include suitable keys and dowels.
3. Locate joints at points of minimum shear, unless otherwise shown on approved shop drawings or directed by the Engineer.
4. Avoid lips and other irregularities between adjoining sections of concrete. Secure forms tightly against previously placed concrete.

K. Control Joints

1. Number, locations and details shall be as shown on the approved shop drawings.
2. Saw cut joints at the earliest timeframe feasible, without marring the surface or chipping and raveling the joint.
3. Accurately time the saw cutting of the joints by utilizing ASTM C 1074 for estimating strength at joint locations.
4. Determination of the maturity required to begin cuts shall be accomplished by creating a mock-up section, recording maturity, and performing test cuts.

L. Expansion and Contraction Joints

1. After curing concrete, clean grooves or saw cuts to receive joint sealant by scrubbing with a mechanical wire brush to loosen dirt and other foreign matter and blowing out loose matter with compressed air.

M. Pump Concrete

1. Grout used to prime the pump line shall not be included in the placement. Discharge the grout into a waste receptacle to be disposed of off Authority property. Do not begin placement until appropriate concrete is visibly being discharged at the end of the pump line.
2. Allow no water to enter the pump hopper at any time during placement operations.
3. Submit written procedures for pumping to the Engineer for approval. The procedures shall contain, but shall not be limited to, pumping scheme, pump description, line diameter, line length and the number of turns and line offsets.

N. Silica Fume Concrete and Fibrous Concrete

1. Arrange for qualified technical representatives from the silica fume and the fiber suppliers, who are experienced in the batching and placement of silica fume and fibrous concrete, to be present for the pre-concrete placement meeting, all test pours and the first two production pours.
2. Fog spray forms, steel reinforcement and subgrade with potable water immediately prior to the placement of fresh concrete. Maintain uniform moisture of the subgrade without standing water, soft spots or dry areas.

3.04 CURING

A. Cure all concrete. Submit a curing procedure plan for approval by the Engineer prior to placing any fresh concrete. Perform curing in accordance with ACI 308 and the requirements herein. Commence curing procedures immediately after fresh concrete has been placed.

1. Provide suitable means, such as insulating blankets or heated enclosures, for maintaining a concrete temperature of at least 50 degrees Fahrenheit after placement. At the end of this period, remove protection in such a manner that the drop in temperature of any portion of concrete is gradual and does not exceed the following within the first 24 hours after removal of protection, in accordance with ACI 306R, Table 5.5: 50 degrees Fahrenheit for applications with a minimum dimension less than 12 inches; 40 degrees Fahrenheit for applications with a minimum dimension between 12 and 36 inches; 30 degrees Fahrenheit for applications with a minimum dimension between 36 and 72 inches; and 20 degrees Fahrenheit for applications with a minimum dimension greater than 72 inches.
2. Allow all concrete to attain a minimum of 3,500 pounds per square inch compressive strength prior to exposure to freeze-thaw cycles.
3. Curing materials and methods shall be submitted to the Engineer for approval.

B. Liquid Membrane Forming Curing Compounds and Sheet Materials for Curing

1. Immediately after screeding and finishing of the concrete and when there is no free water on the concrete surface, apply 2 coats of curing compound. Use one of the curing materials listed in 2.01 R, which may be supplemented by initially using an evaporation retardant listed in 2.01 S, as long as wet curing is not required, subject to the following:

a. Apply white pigmented liquid membrane forming curing compound as soon as surface moisture has evaporated by approved pressure spraying or distributing equipment in two uniform, full applications. Follow curing compound manufacturer's application instructions and application rate. Allow the first application to become tacky before applying the second application perpendicular to the first. At minimum, each application shall be the full quantity recommended by the manufacturer. The entire surface shall be white after the second application.

(1) Recoat areas subjected to heavy rainfall within 3 hours after rain.

(2) Follow manufacturer's recommendations for agitation during application and warming where necessary during cold weather. Do not use liquid membrane forming curing compound where the surface being cured is to receive a finish that will be bonded to the concrete surface or where a floor hardener is to be applied, unless a certification of compatibility and a minimum five-year performance record is submitted in advance to the Engineer for approval.

(3) The Engineer may check for uniformity through random sampling and testing. Testing may include determination of membrane infrared spectrum, pH, specific gravity and solids content.

2. Removal of Forms

a. Remove forms in accordance with the requirements of Specification Section 033100 entitled "CONCRETE FORMWORK" or Specification Section 321314 entitled "PLACEMENT OF PORTLAND CEMENT CONCRETE PAVING".

b. After removal of forms, patch areas of concrete which in the opinion of the Engineer show excessive honeycomb by cutting out defective areas, keying and refilling them with a mortar of cement and fine aggregate in the same proportions as those in the approved concrete mix design and sufficient water to provide a workable mix.

c. Immediately after forms are removed, apply curing compound on the concrete and cure in accordance with 3.04 C.

d. Immediately after removal of forms, holes and voids in the surfaces of concrete, resulting from bolts and ties, shall be wetted and filled with a mortar containing cement and fine aggregate in the same proportions as in the approved concrete mix design, and using cement which shall produce mortar of the same color as the concrete. Exposed mortar surfaces shall then be finished smooth and even with a wood float, except that those surfaces exposed to view in the finished structure shall be finished with a steel trowel to match adjacent surfaces. All fins and other surface irregularities shall be removed promptly by chipping, grinding or other methods approved by the Engineer to give a uniform finish. Where no specific surface finish for formed concrete surfaces is shown on the Contract Drawings, no further finishing will be required.

e. The drop in concrete surface temperature over the first 24 hours shall be controlled in accordance with ACI 306.

C. Wet Curing

1. After application of 2 coats of curing compound and final set has been reached, commence wet curing for all elevated structural decks and any elements utilizing concrete mixes containing silica fume, Very High Early Strength Cement or formulated latex modifier.

2. Cover the surfaces with wet burlap or cotton mats which have been presoaked for a minimum of 24 hours in potable water, so that no marring of the surface occurs. Keep the burlap or cotton mats continuously moist, 24 hours per day, through the use of a fog spraying system or soaker hoses arranged to maintain wet conditions over the entire structure. Burlap, which shall consist of two or more layers, or cotton mats shall overlap a minimum of one foot, and shall be at least one foot longer than necessary to cover the entire width and edges of the pavement lane. The burlap or cotton mats shall be weighted down to prevent displacement.
3. Inspect sheet material before reuse. Repair all holes and tears with cemented patches, subject to approval by the Engineer.
4. Wet curing procedures may be stopped only (1) when the ambient temperature is expected to fall below 35 degrees Fahrenheit within 24 hours, (2) when placing concrete for slabs directly adjacent to the fog spraying system or soaker hoses or (3) when concrete is to receive traffic.
    a. When the ambient temperature at the surface of placement is 35 degrees Fahrenheit and falling, wet curing will not be permitted; instead, apply a liquid membrane forming curing compound in accordance with 2.01 R and 3.04 C.1.
    b. When wet curing is temporarily interrupted for an adjacent placement, remove all standing water in areas to receive fresh concrete prior to placement. Periodically spray a fine mist of water over the wet curing areas to prevent drying of the surface. Do not puddle water on the surface of the fresh concrete. When the fresh concrete is finished and covered with burlap or cotton mats, reassemble the continuous fog spraying system or soaker hoses and continue wet curing immediately.
    c. Areas in which the concrete will be exposed to traffic shall be wet cured for as long as possible.
5. Wet cure for 7 days, or until 75 percent of the design compressive strength is obtained, whichever is longer, when determined by strength tests performed on sample cylinders cast in the field and cured in the same manner as the concrete.
6. Contain water within the area of Work.
7. For latex modified concrete, wet cure for a maximum of 48 hours, unless otherwise directed by the Engineer.

3.05 QUALITY ASSURANCE TESTING, SAMPLING AND INSPECTING

A. The Engineer may perform Quality Assurance testing during mixing and placing of concrete on samples taken from the end of the pump line or at the point of discharge in accordance with ASTM C 172. The Engineer may take samples of concrete from each Lot during a single Work period based on random sampling procedures contained in ASTM D 3665. A Lot of concrete is defined as the production of a single Work period. For each Sublot, the Engineer may cast cylinders in accordance with ASTM C 31 (ASTM C 1758 for self-consolidating concrete) when testing for compressive strength, as well as 4 inch by 8 inch cylinders when permeability is being tested and beams when flexural strength is being tested. The cylinders and beams will be tested in accordance with ASTM C 39 and ASTM C 78, respectively, for each Sublot to determine the compressive strength and flexural strength at the time requirements specified herein.

TABLE 1
LOTS AND SUBLOTS

Daily Placement Quantity (Cubic Yards)	Number of Lots	Number of Sublots
Less than 50	Note 1	Notes 1 and 3
50 – 100	1	3 equally divided
101 – 450	1	4 equally divided
Greater than 450	1	Note 2

Table 1 Notes:

1. If one Work period's placement of a given concrete mix is less than 50 cubic yards, it will not constitute a Lot. It will be added either to the previous or the next Work period's Lot, whichever is closer in time, or until a minimum of 3 Sublots are completed constituting a Lot.

2. For concrete placements of 450 cubic yards or greater, a Sublot will be deemed to be one fourth of a Lot of concrete, or 150 cubic yards of concrete, whichever is less. For larger pours the Engineer may increase the number of cubic yards that constitute a Sublot.

3. If the total concrete quantity under the Contract for any type of mix is less than 50 cubic yards, it will constitute one Lot and will be divided into a minimum of 3 Sublots, regardless of the placement schedule.

B. Quality Assurance Testing Standards and Frequency of Testing

The following procedures may be used by the Engineer to approve the concrete mix proportions and evaluate the in-place concrete for Adjustments to Contract Compensation:

1. Compressive Strength: In accordance with ASTM C 31 and ACI 318 Part 3, Chapter 5, Item 5.6, entitled "Evaluation and Acceptance of Concrete", except that the Engineer will take samples on a random basis. Latex Modified Concrete samples will be wet cured by the Engineer for 1 day and dry cured for 27 days. All cylinders will be tested in accordance with ASTM C 39.
2. Flexural Strength: From each Sublot sample, cast beams in accordance with ASTM C 31. The Engineer will test the beams in accordance with ASTM C 78 and will calculate the average of two test specimens at the flexural strength time requirement. The average of the two test specimen result values for each Sublot will be considered the Sublot flexural strength value.

3. Slump Test: Performed by the Engineer at the point of delivery during the time of placement in accordance with ASTM C 143. For Latex Modified Concrete, the Engineer will perform slump tests 5 minutes after sampling from the mixer.
4. Slump Flow: Performed by the Engineer at the point of delivery during the time of placement in accordance with ASTM C 1611 Procedure B when self-consolidating concrete is approved and used. The Engineer may also use ASTM C 1610 Appendix parameters to determine the flow rate, viscosity, and stability. Self-Consolidating Concrete exhibiting poor stability and segregation will be rejected.
5. Air Content Test: Performed by the Engineer during the placement in accordance with ASTM C 138, ASTM C 173 or ASTM C 231 as appropriate. The Engineer may perform one test for each Sublot, which will be considered the Sublot air content test value.
    a. When results for two consecutive tests or three tests in one Lot or one day's production indicate that the air content is outside the Quality Limits specified in 2.03 A.6, the Engineer will test the next load for acceptance, before placement in the structure. If the air content of the load is outside the Quality Limits specified in 2.03 A.6, it will be rejected. The Engineer will test subsequent loads until the air content is found to be within the specified limits of 2.03 A.6.
6. Unit Weight: The Engineer may determine the plastic unit weight of concrete in accordance with ASTM C 138. For lightweight concrete, if the plastic unit weight deviates from the approved mix proportion wet unit weight by plus or minus 3.0 pounds per cubic foot, the batch plant will be notified and corrective measures taken. If unit weight deviates from the approved mix design wet unit weight by plus or minus 4.0 pounds per cubic foot, terminate concrete placement and determine the root cause.
7. Water Content Test: The Engineer may test for water content during the placement using a Microwave Drying Oven, in accordance with AASHTO T 318 and may adjust drying times depending on the mix constituents to achieve a constant dry weight. Once the water content has been determined, it will be divided by the cementitious content in the mix design to determine the water to cement ratio. When the maximum aggregate size exceeds 1-1/2 inches, the Engineer will obtain a sample of approximately 5000 grams (11 pounds). This sample will be split and the Engineer will perform two separate analyses. The weighted average of the two separate analyses will be considered the Sublot water content value. Likewise, the Engineer will compute the Sublot water cement ratio as given above.
    a. When results for two consecutive tests or three tests in one Lot or one day's production indicate that the water content exceeds the limits given in 2.02 A.4 by 0.03, do not place the next load until it has first been tested and satisfactory test results have been obtained. If the water content for this load is greater than the Upper Limit given in 2.03 A.5, it shall be rejected. The Engineer will test subsequent loads until the water content is found to be within the limit given in 2.03 A.5.

8. Coulomb Test: For each Sublot, the Engineer may cast two 4 inch x 8 inch cylinder specimens. The Engineer will cut 2-inch thick samples from the center of each cylinder for testing. The average of the two test specimen values for each Sublot will be considered the Sublot Coulomb test value.
   a. Testing for all concrete, except marine environment and latex modified, will be performed following ASTM C 1202, modified using the accelerated curing method. Modified, accelerated testing will be by wet curing for seven days at 73 degrees Fahrenheit, and then increasing the curing temperature to 100 degrees Fahrenheit for an additional 21 days. The Upper Quality Limit, UQL, shall be in accordance with 2.03 A.3.
   b. For Latex Modified Concrete applications, samples will be wet cured for 1 day and dry cured for 27 days.
   c. For concrete placed in a marine environment the Upper Quality Limit, UQL, shall be 1700 Coulombs for mixes not containing a corrosion inhibitor and 2200 Coulombs for mixes that do contain a corrosion inhibitor. Performance testing shall be performed at 28 days.
9. Pumped Concrete: Concrete placed by pump will be sampled at the point of placement unless otherwise approved by the Engineer.
10. Bond Strength: The bond strength between overlay concrete and parent concrete may be evaluated in accordance with ASTM C 1583, modified using 4-inch diameter test areas. The Engineer shall perform three tests for each Sublot. Three, 4-inch diameter cores will be cut 1/2 inch into the parent concrete to isolate the overlay concrete. The average value of the three tests shall be considered the Sublot bond strength. The locations for each test shall be randomly determined by the Engineer.
11. Chloride Ion Concentration by Weight of Cement: The Engineer may perform testing for both the acid soluble and water soluble chloride ion concentrations by weight of cementitious material from powder samples from 28-day concrete cylinders, cast from the concrete mix delivered to the construction site. Samples will be obtained using a rotary hammer drill from the mid-height of a minimum of two Sublot specimens from each Lot. The sample will be obtained from the inner three inches of the cylinder specimen and shall be a minimum of 40 grams (0.088 pounds) in weight. The acid soluble and water soluble chloride ion concentrations by weight of cementitious material will be determined by the Engineer in accordance with preparatory standards ASTM C 1152 and ASTM C 1218, respectively.
12. Pavement Thickness: The Engineer may perform non-destructive testing to determine the pavement thickness. Areas indicating pavement thickness below the requirements shown on the Contract Drawings will be cored for verification. The cores will be measured in accordance with ASTM C 174. The average of three test result values for the Sublot will be considered the Sublot test value.
13. Thermal Monitoring: The Engineer may place Temperature Sensing Devices in the in situ concrete to record maximum core temperature and maximum drop of temperature for 24 hours after protection has been removed to verify compliance with ACI 306R.

14. Crosshole Sonic Logging and Test Cores for Tremie Concrete
    a. The Engineer may require drilled test cores for every 100 cubic yards of concrete placed in mass pours or one core for every 1000 square feet of surface of thin pours, such as bulkheads or wall facings. Cores will be obtained in accordance with ASTM C 42 and will be drilled full depth (or thickness) through the pour horizontally or vertically as applicable.
    b. Recovery of less than 95 percent will be considered to indicate defective concrete requiring corrective action by the Contractor.
    c. If the cores reveal voids, honeycombing, seams or other defects, the concrete will be subject to rejection for non-uniformity. Additional cores may be required by the Engineer for further investigation at no additional cost to the Authority. The number and location of cores will be determined by the Engineer.
    d. Fill all test core holes by pressure grouting from the bottom upward, or from the inside out, as the case may be.
    e. Clean out and fill all voids, honeycombing, seams and other defects by pressure grouting with cement or sand-cement to the Engineer's satisfaction. At the Engineer's request drill additional cores at no additional cost to the Authority to verify grouting.
    f. Crosshole Sonic Logging may be used to evaluate integrity of structures

C. In accordance with the Section of the GENERAL PROVISIONS entitled "Inspections and Rejections", provide labor and means for obtaining all samples required for trial batches, field testing, and lab testing performed by the Engineer. At no additional cost to the Authority, furnish and deliver the following when requested by the Engineer:
1. A representative sample, in the quantity requested by the Engineer, of all cement, fly ash, slag, metakaolin, silica fume, fine and coarse aggregate, admixtures, corrosion inhibitor, latex, fibers, pigment, evaporation retardant and liquid membrane forming curing compound during any day of production the Engineer requests a sample. Take such samples in the presence of the Engineer at the point of storage used for the concrete Work. For cement, fly ash, slag, metakaolin and silica fume samples, only use a sampling port on the silo, or drop material in a loader bucket between loads, or take samples from the boot using a "Sample Thief" during loading. Notify the Engineer of aggregates being loaded at their source of supply at least 48 hours in advance of each loading.
2. The cement, fly ash, slag, silica fume or metakaolin manufacturer's Mill Test Certificate and Bill of Lading.
3. Allow the Engineer to sample any mix proportion constituents at any time.

D. The Engineer may direct an inspection of the Contractor's concrete plant or precast concrete fabricator to observe operations and review the Quality Control procedures being implemented. Notify the Engineer, in writing, a minimum of 15 days prior to the commencement of production.

E. Precast Concrete: Fabrication without approved shop drawings will not be permitted. Clearly mark all precast units with identification numbers for each unit. The Engineer will provide a manifest ticket to be attached to the driver's shipping ticket listing the approved unit identification numbers. Any units shipped to the construction site that are not approved or are not listed on the manifest will not be permitted to be unloaded at the construction site. Shipments not accompanied by a manifest upon delivery will not be permitted to be unloaded at the construction site. Arrange for the precast fabricator to provide the following to facilitate the Engineer's Quality Acceptance inspections:

1. An inspection facility meeting NYSDOT Standard Specification 501-2.03.
2. All equipment required to perform testing in accordance with AASHTO T 318.
3. Cylinder molds meeting ASTM C 192.
4. Tyvek tags, blank, for identifying QA sample specimens.
5. Approved fabricator shop drawings.

F. For concrete where riding surface tolerances are required, other than aeronautical pavements, the following requirements shall be met:

1. Test the entire surface of the hardened concrete with a rolling straight edge for conformance to the smoothness requirements. Surface smoothness deviations shall not exceed 1/4 inch in 16 feet. Tests will be made in both the longitudinal and transverse direction of the slab and shall span joints. Correct any deficiencies as specified in 4.01 H and at no additional cost to the Authority.
2. Survey the slab surface for vertical deviation from grade. Vertical deviation from the grade shown on the Contract Drawings shall not exceed plus or minus 0.04 foot at any point. Correct all deficiencies as specified in 4.01 H and at no additional cost to the Authority.
3. Determine finished grade by running levels at intervals of 25 feet longitudinally and transversely. Correct all deficiencies as specified in 4.01 H and at no additional cost to the Authority.
4. The Engineer may elect to verify the requirements of 3.05.F.1-3 above. Correct all deficiencies as specified in 4.01 H and at no additional cost to the Authority.

G. Concrete finishes, when shown on the Contract Drawings, shall conform to the requirements set forth in 3.03 I.2. Correct all deficiencies as specified in 4.01 I and at no additional cost to the Authority.

PART 4. ADJUSTMENTS TO CONTRACT COMPENSATION

4.01 PAYMENT

A. Acceptance of material will be based on the method of estimating Percentage of Lot Within Specification Limits (PWL), where the PWL will be determined in accordance with this Section. All Sublot test result values for a Lot, as defined in 3.05 A, Table 1, will be analyzed statistically to determine the total estimated Percent of the Lot that is within specification limits, as shown in 4.01 B. The PWL is computed using the Lot sample Average value, $\overline{X}$, as defined in 4.01 D.3 and the Lot sample standard deviation, S_N, as defined in 4.01 D.4, for the specified number of Sublots, n, and for the Quality Acceptance Limits, as defined in 2.03 A, where LQL represents the Lower Quality Limit, and UQL represents the Upper Quality Limit, as they apply to each particular acceptance parameter. From these values, the respective Quality Index(ices), Q_L for Lower Quality Index and/or Q_U for Upper Quality Index, is computed in accordance with 4.01 D.5 and 4.01 D.6. Then the PWL for the Lot for the specified number of Sublots, n, is determined from Table 4, "Percent of Lot Within Tolerance Limit (PWL) (Standard Deviation Method)". The Adjustment to Contract Compensation for each Lot will be then calculated using the formulas specified in 4.01 F.

B. Dependent on the application, concrete may be tested for the properties shown below. The PWL of each Lot for each parameter will be determined as specified in 4.01 D. Payments will be based on the concrete application for a Lot and the criteria defined below.

Performance Parameters	Minimum PWL
Flexural Strength	95
Compressive Strength	95
Permeability	94
Bond Strength	80
Water to Cement Ratio	80
Air Content	70*
Pavement Thickness	90
Chloride Content	100**

*denotes that in addition to the minimum PWL, the air content will also be evaluated for the average of test results for a given Lot of concrete as per 3.05 B.5 and 4.01 J.

**denotes that the chloride content (acid soluble and water soluble) will be analyzed only for the average of test results for any given Lot of concrete, as per 3.05 B.11 and 4.01 G.1.b.

Table 2 defines the Quality Acceptance performance criteria to be evaluated for Adjustments to Contract Compensation for a given concrete application. In addition, all concrete shall conform to the requirements of 4.01 G. Any deficiencies found to exist as specified in 4.01 G will govern and the Contractor shall either:

1. Remove and replace the concrete in that particular Lot at no additional cost to the Authority, or

2. Accept a deduction of 50 percent of the Base Price per cubic yard for that particular Lot of concrete.

TABLE 2 PERFORMANCE CRITERIA PARAMETERS							
Category/ Applicatio n	Water to Cement Ratio (W/C)	Percent Air Content	Permeability	Bond Strength	Compressive Strength	Flexural Strength	Pavement Thickness
Category I - Full Depth Pavements and Unbonded Overlays							
	I	I	---	---	---	P	
LQL:	---	*	---	---	---	700 psi	97%
UQL:	****	*	---	---	---	---	---
Category II - Bonded Pavement Overlays							
	I	I	---	P	I	---	---
LQL:	---	*	---	150 psi	***	---	---
UQL:	****	*	---	---	---	---	---
Category III - Elevated Structural Overlays							
	I	I	I	P	I	---	---
LQL:	---	*	---	150 psi	***	---	---
UQL:	****	*	**	---	---	---	---
Category IV - Structural (exposed to freeze-thaw and/or sulfates, in addition to chlorides or a marine environment)							
	I	I	P	---	I	---	---
LQL:	---	*	---	---	***	---	---
UQL:	****	*	**	---	---	---	---
Category V - Structural (exposed to freeze/thaw and/or sulfates only; no exposure to chlorides or a marine environment; curbs and sidewalks)							
	I	I	---	---	P	---	---
LQL:	---	*	---	---	***	---	---
UQL:	****	*	---	---	---	---	---
Category VI -Standard Structural (not exposed to freeze-thaw cycles)-Unless noted on the Contract Drawings incentive adjustments to Contract compensation, as per 4.01 F, will not apply. 4.01 G will apply.							
	---	---	---	---	P	---	---
LQL:	---	---	---	---	***	---	---
UQL:	---	---	---	---	---	---	---

* - Refer to 2.03 A.6.

** - Refer to 2.03 A.3.

*** - The specified compressive strength as shown on the Contract Drawings.

****- The submitted and approved mix proportion water to cement ratio plus 0.03.

P - Used to Calculate Pay Factor per cubic yard. It denotes the concrete property that will be used to calculate payment for a given concrete application. No incentive payments will be made if the performance criteria parameters labeled 'I' for a given application have a PWL less than specified in 4.01 B.

I - Used to Calculate Incentive only when the Pay Factor for the parameter labeled 'P' is greater than 0.00.

C. Full Depth Pavement and Unbonded Overlays (Category I) Final Pay Factor: The Pay Factor for Pavement Thickness will govern only when the Pay Factor for Pavement Thickness is less than the Pay Factor for Flexural Strength, with the exception of when the Pay Factor for Pavement Thickness is 0.00.

D. Method of Estimating Percentage of Material Within Limits (PWL)

1. Locate sampling positions on the Lot by use of random sampling procedures specified in 3.05 A.
2. Take a test sample and make the test specimens on the test sample in accordance with 3.05 A.
3. Determine the Lot sample Average value, $\overline{X}$, by calculating the average of all Sublot test values.
4. Find the Lot sample standard deviation, SN, by using the following formula:

$$S_N = \sqrt{\frac{d_1^2 + d_2^2 + d_3^2 + \ldots + d_n^2}{n - 1}}$$

Where:

S_N = standard deviation of the Sublot test values

$d_1, d_2 \ldots$ = deviation from the individual Sublot test values

$X_1, X_2, \ldots$ from the Average value, $\overline{X}$, that is,

$d_1 = (X_1 - \overline{X})$, $d_2 = (X_2 - \overline{X})$, ..., $d_n = (X_n - \overline{X})$

n = number of Sublots

5. Find the Lower Quality Index, QL, by subtracting the Lower Quality Limit, LQL, from the Average value, $\overline{X}$, and dividing the result by SN.

$$Q_L = \frac{\overline{X} - LQL}{S_N}$$

6. Find the Upper Quality Index, QU, by subtracting the Average value, $\overline{X}$, from the Upper Quality Limit, UQL, and dividing the result by SN.

$$Q_U = \frac{UQL - \overline{X}}{S_N}$$

7. The percentage of material above lower tolerance limit, PL, and the percentage of material below upper tolerance limit, PU, will be found by referring to Table 4, "Percent of Lot Within Tolerance Limit (PWL) (Standard Deviation Method)", locating QL and/or QU in the column appropriate to the total number of Sublots, n, and reading the number under the column heading "PWL".

8. For concrete properties with only an Upper Quality Limit (ratio of water-to-cementitious material, permeability), PWL equals PU. For concrete properties with only a Lower Quality Limit (bond strength, compressive strength, flexural strength, pavement thickness), PWL equals PL. For concrete properties with both Upper and Lower Quality Limits (air content), first calculate of the Upper Quality Index, QU, and the Lower Quality Index, QL, by using the Upper Quality Limit, UQL, and the Lower Quality Limit, LQL, respectively, as stipulated in 2.03 A.6. Determine PWL using the following formula:

$PWL = (P_U + P_L) - 100$

E. Pay Factors for each Lot will be computed in accordance with the formulas contained in 4.01 F, Table 3 entitled "Adjustments to Compensation Per Cubic Yard", by entering the PWL value and performing the calculation indicated for the appropriate PWL range to determine the Pay Factor.

F. Adjustments to Contract Compensation will be calculated as follows:

TABLE 3

ADJUSTMENTS TO CONTRACT COMPENSATION PER CUBIC YARD

Percent Within Limits	Compressive Strength Pay Factor
98-100	(1+(0.02(PWL-100)+0.06))*100
95-97	0.0
55-94	(1+((PWL-95)/100))*100
0-54	(1-0.5)*100
Percent within Limits	Permeability Pay Factor
95-100	(1+(((PWL-95)/100)+0.01))*100
90-94	0.0
55-89	(1+((A8-90)/100))*100
0-54	(1-0.5)*100
Percent Within Limits	Bond Pay Factor
91-100	(1+(0.006*(PWL-90))*100
80-90	0.0
55-79	(1+((2*PWL-159)/100))*100
0-54	(1-0.5)*100
Percent Within Limits	Flexural Strength Pay Factor
98-100	(1+(0.02(PWL-100)+0.06))*100
95-97	0.0
55-94	(1+((PWL-95)/100))*100
0-54	(1-0.5)*100
Percent Within Limits	Pavement Thickness Pay Factor
90-100	0.00
55-89	(1+((PWL-90)/100))*100
0-54	(1-0.5)*100

Pay Factors are multiplied by the Base Price per cubic yard established in the following table in 4.01 G. The result is the amount to be added or deducted from the compensation for that particular Lot of concrete.

G. Correction or Cost Adjustments for Deficiencies

Category	Base Price for Adjustments to Contract Compensation ($ per Cubic Yard)
I	$120
II	$110
III	$155
IV	$155
V	$110
VI	$100

1. Remove and Replace Concrete: Remove and replace concrete in a manner approved by the Engineer and at no additional cost to the Authority if any of the following deficiencies exist, unless the Engineer elects to accept the concrete, at which time the Contractor will be compensated at 50 percent of the Base Price per cubic yard, regardless of the Pay Factors calculated in 4.01 F, Table 3:

   a. Percent Within Limits (PWL) for compressive strength, flexural strength, permeability, bond strength or pavement thickness is below 55.

   b. The average acid soluble chloride ions by weight of cementitious material test results for any given Lot of concrete exceed the limit of 0.10 percent (reinforced concrete) or 0.08 percent (prestressed concrete) weight of chloride ions by weight of cementitious material, in accordance with ASTM C 1152 and ASTM C 114, and the average water soluble chloride ions by weight of cementitious material test results for any given Lot of concrete exceed the limit of 0.15 percent (reinforced concrete) or 0.06 percent (prestressed concrete) weight of chloride ions by weight of cementitious material, in accordance with ASTM C 1218 and ASTM C 114. The Soxhlet test referenced in ACI 222R will not be considered for chloride evaluations.

   c. For all concrete applications, the cylinder compressive strength shall conform to the following:

      (1) The calculated average of any three consecutive compressive strength tests shall be equal to or shall exceed the specified compressive strength.

      (2) No individual compressive strength test result shall be below the specified compressive strength by more than 500 pounds per square inch when the required strength is 5000 psi or less, or by more than 0.10 of the specified strength when the required strength is greater than 5000 pounds per cubic inch.

      (3) If either or both of the requirements specified in 4.01 G.1.c.1 and 4.01 G.1.c.2 are not met, investigate the in-place compressive strength in accordance with ACI 318, Section 5.6.5, at no additional cost to the Authority. If the compressive strength test results of the in-place concrete fail to meet either or both of the requirements specified in 4.01 G.1.c.1 and 4.01 G.1.c.2, the concrete will be considered deficient, and 4.01 G.1 will apply.

   d. Concrete slabs or structures that exhibit any cracks prior to opening to vehicular/aircraft operations or loading will be subject to the actions specified in 4.01 G.1. If the concrete is accepted by the Engineer, seal cracks in a manner approved by the Engineer, and at no additional cost to the Authority.

e. Delamination Testing: The Engineer will check all concrete overlays using the chain drag method in accordance with ASTM D 4580. If more than 5 percent of the total surface area of the Lot is found to be delaminated, remove these areas and replace them at no additional cost to the Authority. The determination by the Engineer as to the existence of delaminations shall be final and binding.

f. Slabs showing high or low spots exceeding 1/2 inch when tested in accordance with 3.05 F.3.

H. Diamond Grinding and Partial Depth Removal

1. Cured riding surfaces, except pavements, that do not meet the smoothness or finished grade requirements set forth in 2.03 B shall be corrected, to obtain the specified smoothness deviation, as follows:

a. High spots between 1/4 inch and 1/2 inch and surfaces that exceed the finished grade requirements shall be identified and ground with diamond grinding equipment.

b. Low spots between 1/4 inch and 1/2 inch and surfaces that are below the finished grade requirements shall be corrected by partial depth removal of the entire slab to 1 inch below rebar by hydro demolition or by hydro milling and constructing an overlay in conformance with this Section.

2. The diamond grinding equipment shall be as approved by the Engineer and shall have a grinding head at least 36-inches wide.

3. Where grinding is required, grind the entire width of the riding surface by the length of defective area. In the sole opinion of the Engineer, if the deficiencies are closely spaced and grinding individual areas will adversely affect ride, grind the entire surface.

4. Dispose of slurry produced from grinding operations off Authority property.

5. Perform diamond grinding, partial depth removal and construction of an overlay, if required to correct deficiencies, at no additional cost to the Authority.

I. If concrete finishes do not meet the requirements set forth for the specified finishes, refinish the hardened concrete as directed by the Engineer, at no additional cost to the Authority.

J. If the average air content for a Lot is either below the LQL or above the UQL range by greater than 1.0 percent air content (with the exception of concrete not exposed to freeze/thaw cycles), 10 percent of the Base Price per cubic yard will be deducted from the compensation for that particular Lot of concrete.

K. If thermal monitoring of a structure indicates that the core temperature of concrete exceeded 158 degrees Fahrenheit, the Engineer will evaluate concrete quality using cores taken by the Contractor, in the presence of the Engineer, from the concrete in question. The cores will be tested in accordance with ASTM C 42 and their compressive strength results will be used to calculate the PWL for payment adjustments.

L. When a Non-Conformance Report is issued by the Engineer pertaining to any individual concrete structure, the disposition of the Non-Conformance Report will be evaluated for assessment of penalty. If the Engineer accepts a structure with physical remediation or repair, 10 percent of the Base Price per cubic yard will be deducted from the compensation for that particular Lot of concrete. This deduction is an addition to any other performance payment adjustments.

M. Precast Concrete Structures: Incentive adjustments as specified in 4.01 F shall not apply. All other sub-sections of 4.01 herein apply.

N. Duct bank, Curb, and Sidewalk Structures: Incentive adjustments as specified in 4.01 F shall not apply. All other sub-sections of 4.01 herein apply.

TABLE 4

PERCENT OF LOT WITHIN TOLERANCE LIMIT (PWL)

(STANDARD DEVIATION METHOD)

Positive Values of Quality Index

(n = Number of Sublots in the Lot)

PWL	n=3	n=4	n=5	n=6	n=7	n=8
99	1.1541	1.4700	1.6714	1.8008	1.8888	1.9520
98	1.1524	1.4400	1.6016	1.6982	1.7612	1.8053
97	1.1496	1.4100	1.5427	1.6181	1.6661	1.6993
96	1.1456	1.3800	1.4897	1.5497	1.5871	1.6127
95	1.1405	1.3500	1.4407	1.4887	1.5181	1.5381
94	1.1342	1.3200	1.3946	1.4329	1.4561	1.4716
93	1.1269	1.2900	1.3508	1.3810	1.3991	1.4112
92	1.1184	1.2600	1.3088	1.3323	1.3461	1.3554
91	1.1089	1.2300	1.2683	1.2860	1.2964	1.3032
90	1.0982	1.2000	1.2290	1.2419	1.2492	1.2541
89	1.0864	1.1700	1.1909	1.1995	1.2043	1.2075
88	1.0736	1.1400	1.1537	1.1587	1.1613	1.1630
87	1.0597	1.1100	1.1173	1.1191	1.1199	1.1204
86	1.0448	1.0800	1.0817	1.0808	1.0800	1.0794
85	1.0288	1.0500	1.0467	1.0435	1.0413	1.0399
84	1.0119	1.0200	1.0124	1.0071	1.0037	1.0015
83	0.9939	0.9900	0.9785	0.9715	0.9672	0.9643
82	0.9749	0.9600	0.9452	0.9367	0.9325	0.9281
81	0.9550	0.9300	0.9123	0.9025	0.8966	0.8928
80	0.9342	0.9000	0.8799	0.8690	0.8625	0.8583
79	0.9124	0.8700	0.8478	0.8360	0.8291	0.8245
78	0.8897	0.8400	0.8160	0.8036	0.7962	0.7915
77	0.8662	0.8100	0.7846	0.7716	0.7640	0.7590
76	0.8417	0.7800	0.7535	0.7401	0.7322	0.7271
75	0.8165	0.7500	0.7226	0.7089	0.7009	0.6958
74	0.7904	0.7200	0.6921	0.6781	0.6701	0.6649
73	0.7636	0.6900	0.6617	0.6477	0.6396	0.6344
72	0.7360	0.6600	0.6316	0.6176	0.6095	0.6044
71	0.7077	0.6300	0.6016	0.5878	0.5798	0.5747
70	0.6787	0.6000	0.5719	0.5583	0.5504	0.5454
69	0.6490	0.5700	0.5423	0.5290	0.5213	0.5164
68	0.6187	0.5400	0.5129	0.4999	0.4924	0.4877
67	0.5878	0.5100	0.4836	0.4710	0.4638	0.4592
66	0.5563	0.4800	0.4545	0.4424	0.4354	0.4310
65	0.5242	0.4500	0.4255	0.4139	0.4073	0.4031
64	0.4916	0.4200	0.3967	0.3856	0.3793	0.3753
63	0.4586	0.3900	0.3679	0.3575	0.3515	0.3477
62	0.4251	0.3600	0.3392	0.3295	0.3239	0.3203
61	0.3911	0.3300	0.3107	0.3016	0.2964	0.2931
60	0.3568	0.3000	0.2822	0.2738	0.2691	0.2660
59	0.3222	0.2700	0.2537	0.2461	0.2418	0.2391
58	0.2872	0.2400	0.2254	0.2186	0.2147	0.2122
57	0.2519	0.2100	0.1971	0.1911	0.1877	0.1855
56	0.2164	0.1800	0.1688	0.1636	0.1613	0.1592
55	0.1806	0.1500	0.1408	0.1363	0.1338	0.1322
54	0.1447	0.1200	0.1125	0.1090	0.1070	0.1057

END OF SECTION

SECTION 033010

PORTLAND CEMENT CONCRETE, LONG FORM

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of the GENERAL PROVISIONS:

Shop Drawings

033010A01 Forms.

033010A02 Test pour details at least 15 calendar days before the test.

033010A03 Number, location and details of contraction, control, expansion and construction joints at least 15 days prior to concrete placement.

Catalog Cuts

033010B01 At least 35 calendar days prior to concrete placement, the following:
Name and address of concrete supplier, type of plant, documentation of State Certification for plant and ready mix trucks, AASHTO re:source accreditation certification for the independent testing laboratory and certification for an on-site individual in a supervisory capacity with a valid ACI Concrete Construction Special Inspector Certification.

033010B02 At least 35 calendar days prior to concrete placement, the following:
Material certifications, source, brand name and test results (where required) of cement, fine and coarse aggregate, fly ash, slag, silica fume, metakaolin and concrete admixtures following guidelines of Appendix "B". In addition, arrange for an independent testing laboratory to verify that Very High Early Strength Cement meets compressive strength, absolute drying shrinkage and setting time requirements specified in 2.01 C at the testing frequency specified therein.

033010B03 At least 35 calendar days prior to concrete placement, the following:
Brand names and chemical compositions of form oil or release agents, evaporation retardant and liquid membrane curing compounds. For Architectural Concrete include this information also for forms, form liners and pigments.

033010B04 At least 35 calendar days prior to concrete placement, the following:
Certification of compatibility and five-year performance record for liquid membrane forming curing compound, when used under conditions specified in 3.04 B, and the requirements of 2.01 R.1.

033010B05 At least 35 calendar days prior to concrete placement, the following:
Test data and field use history for corrosion inhibitor admixtures (when shown on the Contract Drawings) in accordance with 2.01 P.4:
(1) Manufacturer's test method to determine the concentration of the active component of the inhibitor.
(2) Procedures for the production of concrete mixes containing a corrosion inhibitor

for the range of concrete temperatures from 50 degrees Fahrenheit to 90 degrees Fahrenheit and a procedure for the placement of concrete when a retarder is being used.

033010B06 At least 35 calendar days prior to concrete placement, the following:
Certification that admixtures conform to the requirements of 2.01 N submitted with Appendix "B" "Concrete Materials and Mix Proportion Data". Include dosing and re-dosing charts, which shall demonstrate the effects of concrete temperatures from 50 degrees Fahrenheit and 90 degrees Fahrenheit.

033010B07 At least 35 calendar days prior to concrete placement, the following:
A chemical analysis report of the percent by weight of silica fume solids by an approved independent testing laboratory when a wet slurry type of silica fume is being used.

033010B08 At least 35 calendar days prior to concrete placement, the following:
Source of joint sealant for expansion and/or contraction joints.

033010B09 At least 35 calendar days prior to concrete placement, the following:
Type, number and method of application of concrete vibrators.

Samples

033010C01 Concrete ingredients for trial batches including cement, stone, sand, fly ash, slag, silica fume, metakaolin, admixtures, corrosion inhibitor, fibers, latex, pigment and anti-washout agent. Furnish these to the Engineer in whatever quantities he may require at least 35 days prior to concrete placement. This applies to all mixes, including changes to an approved mix.

033010C02 Cement, fly ash, slag, metakaolin and/or silica fume samples to check the Mill Certification at in accordance with 3.05 C.2.

033010C03 For Architectural Concrete, provide two sample panels (12 inches by 12 inches by 2 inches minimum size) for each mix for approval of color and texture. Provide catalog cuts for forms, form liners and form oil or release agents.

Product Data

033010D01 Mix Designs:
Appendix "B" "Concrete Materials and Mix Proportion Data" at least 35 calendar days prior to concrete placement in accordance with 2.02 A. To substantiate the mix proportions, submit all data and field results in accordance with 2.03 A.

033010D02 Proposed changes to any constituents of the approved mix proportions.

033010D03 Mix design submissions must include an intended use(s) (structure, pumping, etc.) for concrete for approval.

Certificates

033010E01 At least 35 calendar days prior to concrete placement, the following:
b. Upon request material certifications, source, brand name and test results (where required) of cement, fine and coarse aggregate, fly ash, slag, silica fume, metakaolin and concrete admixtures following guidelines of Appendix "B". In addition, arrange for an

independent testing laboratory to verify that Very High Early Strength Cement meets compressive strength, absolute drying shrinkage and setting time requirements specified in 2.02 B at the testing frequency specified therein.

033010E02 At least 35 calendar days prior to concrete placement, the following:
Upon request certification of compatibility and five-year performance record for liquid membrane forming curing compound, when used under conditions specified in 3.04 C, and the requirements of 2.02 R.2.

033010E03 At least 35 calendar days prior to concrete placement, the following:
Upon request certification that admixtures conform to the requirements of 2.02 M. submitted with Appendix "B" "Concrete Materials and Mix Proportion Data". Include dosing and re-dosing charts, which shall demonstrate the effects of concrete temperatures from 50 deg F and 90 deg F.

Manufacturer Test Reports

033010F01 At least 35 calendar days prior to concrete placement, the following:
Test data and field use history for corrosion inhibitor admixtures (when specified on the Contract Drawings) as per 2.02.O.4.:
1. Manufacturer's test method to determine the concentration of the active component of the inhibitor.
2. Procedures for the production of concrete mixes containing a corrosion inhibitor for the range of concrete temperatures from 50°F to 90°F and a procedure for the placement of concrete when a retarder is being used.

033010F02 At least 35 calendar days prior to concrete placement, the following:
Upon request a chemical analysis report of the percent by weight of silica fume solids by an approved independent testing laboratory when a wet slurry type of silica fume is being used.

033010F03 Upon request type, number and method of application of concrete vibrators.

Construction and Installation Procedures

033010G01 At least 35 calendar days prior to concrete placement, the following:
Contractor's Quality Control Plan in accordance with 1.04 B.

033010G02 At least 35 calendar days prior to concrete placement, the following:
Precast concrete fabricator's planned schedule for all production and a Quality Control Plan a minimum of 15 days prior to the commencement of production.

033010G03 At least 35 calendar days prior to concrete placement, the following:
Cold and Hot Weather Concrete Construction Plans in accordance with 1.03 materials and methods for protecting concrete from freezing.

033010G04 At least 35 calendar days prior to concrete placement, the following:
Mass Concrete Thermal Control Plan(s) in accordance with 2.03 C. Utilize ACI 207 for guidance in development of documents.

033010G05 At least 35 calendar days prior to concrete placement, the following:
Pumping Procedure Plan, including, at a minimum, the pumping scheme, pump description, line diameter, line length and the number of turns and line offsets.

033010G06 At least 35 calendar days prior to concrete placement, the following: Written placement procedures that are in conformance with ACI 304R, Chapter 8 if concrete is being placed underwater.

033010G07 At least 35 calendar days prior to concrete placement, the following: Methods of adding concrete admixtures, high range water reducers, non-chloride accelerators, corrosion inhibitors, anti-washout agent, latex, fibers, pigment, slag, fly ash and silica fume.

033010G08 At least 35 calendar days prior to concrete placement, the following: Mixing and placement procedures and methods, as well as catalog cuts of equipment for installation. For hand mixes, submit the methods of proportioning, mixing (including minimum time requirements), transferring and placing the concrete.

033010G09 At least 35 calendar days prior to concrete placement, the following: Method of concrete placement in pipe piles (including elephant trunk size, length and material type).

033010G10 At least 35 calendar days prior to concrete placement, the following: Method of concrete placement and consolidation adjacent to joint assemblies and embedded hardware.

033010G11 At least 35 calendar days prior to concrete placement, the following: Curing Procedure Plan in accordance with 3.04, including the method and materials for curing.

033010G12 At least 35 calendar days prior to concrete placement, the following: Control Joint Location Plan.

033010G13 At least 35 calendar days prior to concrete placement, the following: Materials and procedures for filling cracks and patching honeycombs and/or spalls.

033010G14 At least 35 calendar days prior to concrete placement, the following: Proof of certification for all QC personnel as detailed in 1.04 A.2.

Calculations

033010H01 If required by the Engineer or shown on the Contract Drawings, design computations signed and sealed by the Professional Engineer licensed in the state where Work is being performed.

Schedules

033010J01 At least 35 calendar days prior to concrete placement, the following: Precast concrete fabricator's planned schedule for all production and a Quality Control Plan a minimum of 15 days prior to the commencement of production.

Quality Assurance-Quality Control

033010L01 At least 35 calendar days prior to concrete placement, the following: Upon request Contractor's Quality Control Plan in accordance with 1.04 B.

Record Documents

033010M01	Daily copy of batch records in accordance with 1.04 A.1.a.

Information

033010S01	Pre-concrete construction meeting agenda a minimum of 15 days prior to the scheduled date of the meeting.
033010S02	Minutes of the pre-concrete construction meeting within 5 days of the meeting.

Sustainability Submittals

033010V01	Sustainability submittals in accordance with Division 01.

END OF APPENDIX "A"

SECTION 033010

PORTLAND CEMENT CONCRETE, LONG FORM

APPENDIX "B"

CONCRETE MATERIALS AND MIX PROPORTION DATA

A. Materials: (Source / Brand/ Specific Gravity / % Solids):

1. Cement:
   Type…….…Source/Brand……………..……...………………..…....…………....
2. Sand: Fineness Modulus……………..Source………………………………...
3. Stone: Size…………Class…………..Source………………………………..
4. Fly Ash: Type………Source……………………...…………….…………..
5. Slag: Grade…………Source…………………………………………...……
6. Microsilica (Silica Fume): ………Source/Brand……………………………...
7. Metakaolin:…. Source/Brand………………………………………………..
8. Admixtures

   Air Entraining Agent………………………..………………………………

   Non-Chloride Accelerator……………………………………………….....

   Retarder……………………………………………………………..…...

   Water Reducer………………………………………………………………..

   Water Reducer - Retarder……….………………...………………………

   High Range Water Reducer………………………………………………….

   High Range Water Reducer - Retarder……………………...……………..…

   Polycarboxylate High Range Water Reducer……………………………….

   Anti-Washout Admixture……………………………………………………

   Corrosion Inhibitor………………………………………………………..

   Latex……………………………………………………………….………

   Pigment…………………………………………………………….…………

B. Mix Proportions

1. Proposed method of placement:…… Tremie/Mobile…..…...Mixer/Transit Mixer/Portable Mixer/

   Pumping/Tube Diameter..……………………………………………..
2. Proportion of Ingredients:

   Cement……………….……………………….…………………..lbs./cu. yd.

   Fly Ash…………………………………………………………lbs./cu. yd.

   Slag……………………………………………..……………lbs./cu. yd.

   Silica Fume……………………………………………………..lbs./cu. yd.

   Metakaolin……………………………………………………...lbs./cu. yd.

Pigment………………………………………………………………lbs./cu.yd.
Stone…………………………………………………………………lbs./cu. yd.
Sand………………………………………………………………….lbs./cu. yd.
Water……………………………lbs./cu. yd………………………gallons
Air Entraining Agent:………………………………………..ounces/cu. yd.
Admixtures (specify type and amount):
……………………………………at………………………ounces/cu. yd.
……………………………………at………………………ounces/cu. yd.
……………………………………at………………………ounces/cu. yd.
……………………………………at………………………ounces/cu. yd.

C. Mix Properties:

Compressive Strength: f'c =……………..psi at…………..…………..days/hours
Flexural Strength:….………………..……psi at……………………..……days/hours
Permeability at 28 days:…………………………………………...Coulombs
Slump:……………………………………...………………………..inches
Water to Cementitious Ratio:………………………………..……………….
Air Entrainment:…………………………………………………………%
Sand/Stone Ratio:…………………………………………………………….
Combined aggregate gradation chart (% retained on each sieve)…………………
Unit Weight:……………………………………………………….lbs./cu. ft.

D. Conformance with ACI 318

Attach a report on mix proportion and test/statistical data documenting conformance with ACI 318, Chapter 5, or ACI 304R, Chapter 8, as they apply to the Work of the Contract.

E. Concrete Supplier/Batch Plant

1. Name:…………………………………………………………………
2. Address:………………………………………………………………
3. Contact Name:……………………………………………………….
4. Telephone number/Fax number/E-mail address:………………………………
5. Quality Control technician(s):……………………………………………….
   Name(s):………………………………………………………….
   Telephone number(s):……………………………………………...

END OF APPENDIX "B"

DIVISION 03

SECTION 033110

CONCRETE REINFORCEMENT

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for furnishing and installing steel reinforcement for concrete.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Association of State Highway and Transportation Officials (AASHTO)
AASHTO M 31	Specification for Deformed and Plain Carbon and Low-Alloy Steel Bars for Concrete Reinforcement.
AASHTO M 336	Specification for Steel Wire and Welded Wire, Plain and Deformed, for Concrete Reinforcement.
	Standard Specifications for Highway Bridges.
	American Concrete Institute (ACI)
ACI 117	Specification for Tolerances for Concrete Construction and Materials and Commentary.
ACI 315	Guide to Presenting Reinforcing Steel Design Details.
ACI 318	Building Code Requirements for Structural Concrete and Commentary.
	American National Standards Institute (ANSI)/ Concrete Reinforcing Steel Institute (CRSI)
ANSI/CRSI IPG4.1	Stainless Steel Reinforcing Bar Fabrication Facilities.
	ASTM International (ASTM)
ASTM A 184	Specification for Welded-Deformed Steel Bar Mats for Concrete Reinforcement.
ASTM A 276	Specification for Stainless Steel Bars and Shapes.
ASTM A 380	Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
ASTM A 493	Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging.
ASTM A 615	Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
ASTM A 706	Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
ASTM A 767	Specification for Zinc-Coated (Galvanized) Steel-Bars for Concrete Reinforcement.

ASTM A 775	Specification for Epoxy-Coated Steel Reinforcing Bars.
ASTM A 955	Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcement.
ASTM A 970	Specification for Headed Steel Bars for Concrete Reinforcement.
ASTM A 1034	Test Methods for Testing Mechanical Splices for Steel Reinforcing Bars.
ASTM A 1064	Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
	American Welding Society, Inc. (AWS)
AWS D1.4	Structural Welding Code - Steel Reinforcing Bars.
	Concrete Reinforcing Steel Institute (CRSI)
	Manual of Standard Practice.

1.03 BRIDGE WORK

For Work of this Section involving bridges, comply with the applicable provisions of AASHTO's "Standard Specifications for Highway Bridges". Materials shall be in accordance with AASHTO designations where shown in parenthesis after the ASTM designation. Where an AASHTO designation is not shown, comply with the ASTM designation.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver concrete reinforcement in bundles marked with metal tags indicating size, length and mark number.

B. Store and handle materials to prevent corrosion, damage to coating or contamination that could impair bond.

C. Deliver, store and handle stainless steel reinforcing bars to ensure the surface is free of contaminants including deposits of iron and non-stainless steel.

D. Prior to shipping, ensure that all chains and steel bands will not come into direct contact with stainless steel reinforcing bars. Place wood or other soft materials under the tie-downs or use nylon or polypropylene straps to secure stainless steel reinforcing bars.

E. When bundles of carbon steel reinforcing bars and stainless steel reinforcing bars are shipped one on top of the other, the stainless steel reinforcing bars shall be loaded on top. Use wooden spacers to separate the two materials.

F. When storing stainless steel reinforcing bars outdoors, cover the stainless steel reinforcing bars with tarpaulins. Store the bars off the ground or shop floor on wooden supports.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars

1. Carbon steel reinforcing bars: ASTM A 615 (AASHTO M 31), deformed, Grade 60, unless otherwise shown on the Contract Drawings. Use ASTM A 706 where welding of reinforcement is required.

2. Coated carbon steel reinforcing bars, where shown on the Contract Drawings, shall also comply with the following:

a. Galvanized Reinforcing Bars

(1) ASTM A 767, Class I hot-dip galvanized after fabrication and bending. Repair sheared and cut ends and damaged coating with a zinc-rich formulation conforming to ASTM A 767 and in accordance with the material manufacturer's written recommendations. Spray-on coating products will not be permitted. Any reinforcing bars with damaged coating that has not been repaired to the satisfaction of the Engineer shall be removed from the site. The maximum amount of repaired damaged coating shall not exceed 1 percent of the total surface area in any linear foot of the reinforcing bar. This limit does not include sheared or cut ends that are coated with repair material. If the damage to the coating exceeds 1 percent of the total surface area in any linear foot of the reinforcing bar, the reinforcing bar shall be removed from the site.

(2) Reinforcing bars bent before galvanizing shall be in accordance with the minimum finished bend diameters specified in Table 2 of ASTM A 767 except as specified below:

(a.) When bending reinforcing bar sizes No. 7 through No. 11 inclusive, increase the minimum bend radius measured to the inside face of the bend to 4.5 times the bar diameter.

(b.) When bending reinforcing bar sizes No. 14 and No. 18, increase the bend radius to 5.5 times the bar diameter.

b. Epoxy-coated Reinforcing Bars

ASTM A 775. Repair sheared and cut ends and damaged coating with an epoxy patching material conforming to ASTM A 775 and in accordance with the patching material manufacturer's written recommendations. Spray-on coating products will not be permitted. Any reinforcing bars with damaged coating that has not been repaired to the satisfaction of the Engineer shall be removed from the site. The maximum amount of repaired damaged coating shall not exceed 1 percent of the total surface area in any linear foot of the reinforcing bar. This limit does not include sheared or cut ends that are coated with patching material. If the damage to the coating exceeds 1 percent of the total surface area in any linear foot of the reinforcing bar, the reinforcing bar shall be removed from the site.

3. Stainless Steel Reinforcing Bars: ASTM A 955 Grade 60 or Grade 75 as shown on the Contract Drawings. Minimum tensile and yield strength shall be in accordance with ASTM A 955. Other properties including chemical composition and magnetic permeability shall be in compliance with ASTM A 276, Type 2304 (UNS S32304). Clean, descale and passivate all stainless steel reinforcing bars in accordance with ASTM A 380 at the fabrication plant prior to shipment.

B. Welded Wire Fabric

Types shall be as shown on the Contract Drawings and shall comply with the following:

1. Plain: ASTM A 1064 (AASHTO M 336), flat sheets for size W5 and larger and coiled rolls for sizes below W5.
2. Deformed: ASTM A 1064 (AASHTO M 336), flat sheets for sizes D5 and larger and coiled rolls for sizes below D5.
3. Welded wire fabric shall be compatible with other reinforcing steel with which it may come into contact.

C. Welded Steel Bar Mats

Where welded steel bar mats are shown on the Contract Drawings, they shall be in accordance with ASTM A 184 and as specified below:

1. Bar grade, size and spacing shall be as shown on the Contract Drawings.
2. Connections shall be welded as shown on the Contract Drawings.
3. Welded steel bar mats shall be compatible with other reinforcing steel with which it may come into contact.

D. Steel Wire

Steel wire shall comply with ASTM A 1064 (AASHTO M 336), plain finish unless otherwise shown on the Contract Drawings. Steel wire shall be compatible with other reinforcing steel with which it may come into contact.

E. Mechanical Couplers for Reinforcing Bar Splices

1. Where mechanical couplers are shown on the Contract Drawings, use mechanical couplers for reinforcing bar splices.
2. Splices made by mechanical couplers shall be Type I (Service Splice), unless otherwise shown on the Contract Drawings as Type II (Ultimate Butt Splice).
3. Type I splices shall develop a minimum tensile strength of 125 percent of the yield strength of the reinforcing bar.
4. Mechanical couplers shall be tested in accordance with ASTM A 1034, "Monocylic Tensile Test".
5. For Type II splices, submit a test report documenting the performance of the sample splice and the control bar for each bar size.
   a. A sample splice shall be fabricated from a single reinforcing bar from a representative lot. Assemble the sample splice from two reinforcing bar segments cut to length and connected with a Type II mechanical splice. A minimum of one control bar shall be cut and removed from the same reinforcing bar as used in the Type II sample splices. Control bars shall be a minimum length of 3.25 feet for reinforcing bars No. 8 or smaller and 5 feet for reinforcing bars No. 9 or larger. Type II test shall be performed at a rate of 2 tests for each lot of mechanical couplers to be used in the Contract.
   b. The performance of each sample splice shall be compared to the test performance of each corresponding control bar.
   c. Type II sample splices shall rupture in the reinforcing bar either:
      (1) Outside of the affected zone, or

(2) Within the affected zone, provided that the sample has achieved at least 95 percent of the ultimate tensile strength of the control bar associated with the sample.

d. Necking of the bar shall be visibly evident at the rupture, regardless of whether the bar breaks within or outside of the affected zone. The affected zone is defined as the portion of the reinforcing bar where any properties of the bars, including the physical, metallurgical or material characteristics, have been altered by fabrication or installation of the splice.

e. The ultimate tensile strength of each control bar shall be determined by tensile testing the bar to rupture and shall be determined for all control bars, regardless of where each sample splice ruptures.

6. Reinforcing bar couplers and spacers shall be compatible with the material and size of the bars being spliced.

7. Manufacturers: Subject to compliance with requirements, mechanical couplers shall be one of the following manufacturers, or approved equal:

a. Barsplice Products, Inc.; Dayton, OH.

b. Dayton Superior; Miamisburg, OH.

c. Engineered Devices Corporation; Ridgefield Park, NJ.

d. Meadow Burke; Riverview, FL.

e. NVent; Solon, OH.

8. Epoxy Coating

a. Mechanical couplers for use on epoxy-coated reinforcing bars shall be epoxy coated.

b. Mechanical couplers coated prior to installation shall be coated in conformance with ASTM A 775. Couplers coated after installation shall be coated with an epoxy repair material compatible with the reinforcing bar epoxy coating. Any damage to the epoxy coating on the mechanical coupler shall be repaired as specified in 2.01 A.2.b.

9. Galvanized Coating

a. Mechanical couplers for use on galvanized reinforcing bars shall be galvanized as specified in 2.01 A.2.a.(1).

10. Stainless Steel

a. Mechanical couplers for stainless steel reinforcing bars shall be fabricated from materials that comply with 2.01 A.3.

11. Perform Slip Test on the mechanical couplers in accordance with ASTM A 1034. The total slip of the bar within the splice sleeve of the connector after loading in tension to 0.5 multiplied by the yield strength of the reinforcing bar and relaxing to 0.05 multiplied by the yield strength of the reinforcing bar shall not exceed the following measured displacements between gage points clear of the splice sleeve:

a. For bar sizes up to and including No. 14: 0.01 inch.

b. For No.18 bars: 0.03 inch.

12. Type I and Type II splices shall be fabricated in accordance with the coupler manufacturer's written instructions, unless otherwise shown on the Contract Drawings, and using the coupler manufacturer's standard equipment, jigs, clamps and other required accessories.

F. Reinforcing Bar Terminators and T-heads

1. Install terminators and T-heads at locations shown on the Contract Drawings.
2. Terminators and T-heads shall develop a minimum tensile strength of 125 percent of the yield tensile strength of the reinforcing bar and shall comply with ASTM A 970.
3. Subject to compliance with requirements, reinforcing bar terminators and T-heads shall be one of the following, or approved equal:
   a. "Barsplice Doughnut" as manufactured by Barsplice Products, Inc.; Dayton, OH.
   b. "Lenton Terminator Series" as manufactured by nVent; Solon, OH.

2.02 ACCESSORIES

A. Tie Wire

1. For uncoated carbon steel reinforcing bars, use minimum 16-gauge, annealed type.
2. For epoxy-coated and galvanized reinforcing bars, use nylon, plastic or epoxy-coated wire.
3. For stainless steel reinforcing bars, use annealed 16-gauge or 14-gauge wire fabricated from stainless steel alloy in compliance with ASTM A 493, UNS S31600.

B. Supports for Reinforcement

Furnish bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use steel wire bar type supports complying with CRSI's "Manual of Standard Practice" and as specified below:

1. For supporting epoxy-coated reinforcing bars, use plastic coated supports or supports fabricated from or coated with a dielectric material.
2. For slabs-on-grade, use supports with horizontal plate runners.
3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, use supports with plastic capped legs (CRSI, Class 1).
4. Where architectural concrete is shown on the Contract Drawings, use plastic side form spacers.
5. Place all stainless steel reinforcement on bar chairs that are solid plastic, stainless steel or concrete with stainless steel tie wire implanted in the concrete chair. Fabricate stainless steel metal chairs and continuous metal stainless steel supports from stainless steel conforming to ASTM A 493, UNS S31600 or UNS S31603. Stainless steel chairs supported on steel beams shall have plastic coated feet.

2.03 FABRICATION

A. Fabricate concrete reinforcement as shown on the Contract Drawings, on approved shop drawings and in accordance with "Tolerances" of ACI 315.

B. Bend all concrete reinforcement cold. Heating of reinforcing bars or welded wire fabric will not be permitted.

C. Where welding of concrete reinforcement is shown on the Contract Drawings, weld in accordance with AWS D1.4.

D. Stainless steel reinforcing bars shall be fabricated and bent using equipment that has been thoroughly cleaned or otherwise modified to prohibit contamination of the stainless steel from fragments of carbon steel or other contaminants. Do not use carbon steel tools, chains, slings or other equipment when fabricating or handling stainless steel reinforcing bars. Stainless steel reinforcing bars shall be handled to prevent contamination from iron, carbon steel and other ferrous metals. Bend stainless steel reinforcing bars in accordance with ASTM A 955.

PART 3. EXECUTION

3.01 FIELD BENDING

A. General

1. Reinforcing bars shall be bent to the shapes shown on the Contract Drawings and as detailed on the approved shop drawings. Unless otherwise shown on the Contract Drawings or specified herein, field bending shall be in accordance with ACI 318.
2. Reinforcing bars with kinks or improper bends will be rejected and shall not be used. Rejected reinforcing bars shall be removed from the site.
3. Bend reinforcing bars by cold methods only. Direct heating of reinforcing bars will not be permitted.

B. Epoxy-Coated Reinforcing Bars

1. Field bending of epoxy-coated reinforcing bars shall be performed only when ambient and reinforcing bar temperatures are 40 degrees F or higher. When ambient or reinforcing bar temperatures are less than 40 degrees F, the Contractor may construct a fully enclosed space that is heated for field bending operations.
2. Repair any damage to the epoxy coating in accordance with 2.01 A.2.b herein.

C. Galvanized Reinforcing Bars

1. Field bending of galvanized reinforcing bars shall be performed only when ambient and reinforcing bar temperatures are 40 degrees F or higher. When ambient or reinforcing bar temperatures are less than 40 degrees F, the Contractor may construct a fully enclosed space that is heated for field bending operations.
2. Repair any damage to the galvanized coating in accordance with 2.01 A.2.a.(1) herein.

D. Stainless Steel Reinforcing Bars

Stainless steel reinforcing bars shall be field bent as specified in 2.03 D herein.

3.02 INSTALLATION

A. Concrete Construction Special Inspectors (CCSIs) shall be certified and shall be provided with Engineer-approved shop drawings prior to commencing assembly and installation of reinforcing bars.

B. Place concrete reinforcement as shown on approved shop drawings and in accordance with "Placing Reinforcing Bars" in CRSI's "Manual of Standard Practice".

C. Clean concrete reinforcement of loose rust, mill scale, earth, ice and other materials that reduce the bond with concrete.

D. Stainless Steel Reinforcing Bars

1. Ensure stainless steel reinforcing bars show no signs of rusting or surface imperfections and maintain a uniform brightness.
2. Follow procedures approved by the Engineer when cleaning, descaling and passivating stainless steel reinforcing bars at the construction site. Contaminated or rusted bars may be cleaned at the construction site in accordance with ANSI/CRSI IPG4.1, part 6.3.
3. Stainless steel reinforcing bars shall not be used if they exhibit one or more of the following conditions:
   a. Contamination of the stainless steel by iron exceeds 4 inches in length;
   b. Two or more areas of steel contamination greater than 1 inch in length occurring along the length of the stainless steel reinforcing bar;
   c. Three or more occurrences of rust contamination along the full length of the stainless steel reinforcing bar;
   d. Mechanical damage to the stainless steel reinforcing bar during bending or straightening operations.

E. Accurately position, support and secure concrete reinforcement against displacement by formwork, construction or concrete placement operations. Locate and support concrete reinforcement with chairs, runners, bolsters, spacers and hangers in accordance with CRSI's "Manual of Standard Practice". Do not interfere with placement of embedded items.

F. Splices will be permitted only where shown on the Contract Drawings. If the Contractor elects to splice bars at locations other than those shown on the Contract Drawings, the locations shall be clearly notated as such on the shop drawings and approved by the Engineer.

G. Where a vapor barrier is shown on the Contract Drawings, do not cut or puncture the vapor barrier during placement of concrete reinforcement.

H. Place concrete reinforcement to obtain the minimum concrete covers shown on the Contract Drawings for concrete protection. Where the concrete cover is not shown on the Contract Drawings, the cover shall be in accordance with "Concrete Protection for Reinforcement" of ACI 318. Arrange, space and securely tie bars and supports for reinforcement to hold concrete reinforcement in position during concrete placement operations. Set ties so ends are directed into concrete, not toward exposed concrete surfaces.

I. Concrete shall not be placed until the concrete reinforcement is inspected and accepted by a CCSI, placement of the concrete reinforcement meets applicable tolerances in accordance with ACI 117 and permission for placing is approved in writing by the Engineer. Concrete placed in violation of these requirements shall be subject to rejection by the Engineer and shall be removed and replaced by the Contractor at no additional cost to the Authority.

J. Install welded wire fabric in lengths as long as practical. Lap adjoining pieces at least one full mesh and tie splices with tie wire, but in no case shall lap be less than the requirements of "Splices of Welded Deformed Wire Fabric in Tension" or "Splices of Welded Plain Wire Fabric in Tension" of ACI 318. Offset end laps in adjacent widths to prevent continuous laps in either direction.

K. After concrete placement, do not field bend partially embedded concrete reinforcement unless approved by the Engineer and shown on the Contract Drawings and the approved shop drawings.

L. If any crack is observed on any reinforcing bar, that portion of the reinforcing bar shall be removed from the Work and replaced to the satisfaction of the Engineer and at no additional cost to the Authority.

END OF SECTION

SECTION 033110

CONCRETE REINFORCEMENT

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of the GENERAL PROVISIONS:

Shop Drawings

033110A01 Details indicating placement, cover, spacing, splice locations, lap lengths, mechanical coupler hardware, grade, bar size, length, mark number, bending schedule, bending diagram, weld designations, type of coating, material used to repair coating, and types of chairs, spacers, hangers and tie wire for all concrete reinforcement.

033110A02 Changes to the size, spacing or arrangement of the concrete reinforcement shown on the Contract Drawings shall be clearly notated as such on the shop drawings.

Catalog Cuts

033110B01 Catalog cuts for chairs, spacers, hangers and mechanical couplers.

Samples

033110C01 Mechanical coupler hardware.

033110C02 Material used to repair coating.

Certificates

033110E01 Certification from the applicator of epoxy that the epoxy-coated reinforcing bars are in compliance with ASTM A 775.

033110E02 Certified mill test reports for all concrete reinforcement.

Manufacturer Test Reports

033110F01 Test results and certification from the galvanizer that the weight, application and testing of zinc coating conforms with specifications and ASTM A 767.

Qualifications

033110K01 Welder performance qualification test records.

033110K02 Welding procedure specifications and supporting procedure qualification records.

033110K03 Certification of the CCSI.

Inspection Reports

033110O01 Test reports for Type II splices.

END OF APPENDIX "A"

DIVISION 22

SECTION 221312

EXTERIOR SANITARY SEWER GRAVITY SYSTEM

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for exterior sanitary sewer gravity system.

B. Definition of terms relating to reinforced concrete pipe and plastic pipe shall be in accordance with ASTM C 822 and ASTM D 883, respectively.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

<u>ASTM International (ASTM)</u>

ASTM C 76	Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
ASTM C 33	Specification for Concrete Aggregates.
ASTM C 150	Specification for Portland Cement.
ASTM C 443	Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
ASTM C 507	Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
ASTM C 655	Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe.
ASTM C 822	Terminology Relating to Concrete Pipe and Related Products.
ASTM C 969	Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
ASTM C 1840	Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe.
ASTM D 883	Terminology Relating to Plastics.
ASTM D 3034	Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
ASTM D 3212	Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
ASTM E 177	Practice for Use of the Terms Precision and Bias in ASTM Test Methods.
ASTM E 691	Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method.
ASTM F 477	Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
ASTM F 679	Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

American Water Works Association (AWWA)

AWWA C 104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
AWWA C 105	Polyethylene Encasement for Ductile-Iron Pipe Systems.
AWWA C 111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
AWWA C 151	Ductile-Iron Pipe, Centrifugally Cast.

1.03 QUALITY ASSURANCE

A. Any entity performing the Work of this Section shall have at least three years of installation experience with storm water systems of types and sizes similar to that required under this Contract.

B. Pipe will be visually inspected by the Engineer when delivered to the construction site. Damaged material or material not meeting the requirements of this Section shall be removed from the construction site and replaced at no additional cost to the Authority.

C. Pipe may be inspected at the place of manufacture by the Engineer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pipe manufacturer's written instructions for unloading, storing and moving pipe.

B. Care shall be taken when storing pipe and appurtenances so as not to damage Authority or other public or private property. Restore areas which are damaged by the Contractor to their original condition at no additional cost to the Authority.

C. As approved by the Engineer, place products delivered to the construction site along the route where they will be installed, or alternatively, in the Area Available for Contractor's Use, if such area is shown on the Contract Drawings.

1.05 IN-PLACE REQUIREMENTS

A. Acceptance of newly installed reinforced concrete pipe and ductile iron pipe shall be contingent upon the installation meeting criteria for "observations not requiring remediation" as defined in ASTM C 1840. All observations "requiring further engineer evaluation" and "requiring remediation" as defined in ASTM C 1840 shall be noted in the pipe inspection summary report in accordance with 3.03 herein and shall be remediated as approved by the Engineer at no additional cost to the Authority.

B. Acceptance of newly installed polyvinyl chloride pipe shall be contingent upon the installation meeting the following criteria:

1. The maximum allowable vertical or horizontal pipe deflection is 5 percent of the original pipe diameter. Remove and replace any pipe exceeding 5 percent deflection at no additional cost to the Authority.
2. Any pipe joint that is crushed, faulted or separated greater than 3/4 inch, shall be repaired as approved by the Engineer.
3. No cracks in the pipe wall.
4. No indication of wear, abrasion, impact damage or ultraviolet degradation.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

Use any of the pipe systems specified below, unless otherwise shown on the Contract Drawings.

A. Reinforced Concrete Pipe

1. Reinforced concrete pipe shall conform to ASTM C 76, Class V, Wall B or Wall C for circular pipe, ASTM C 507, Class HE-IV for horizontal elliptical Pipe and Class VE-VI for vertical elliptical pipe, unless otherwise shown on the Contract Drawings. Use ASTM C 150, Type II Portland cement. Lifting holes in pipe will not be permitted.
2. Furnish watertight pipe joints conforming to ASTM C 443 of tongue and groove or bell and spigot style sealed with rubber gaskets. Rubber gaskets shall be the following types, as manufactured by Hamilton Kent Manufacturing Co., Winchester, TN, Press-Seal Corp., Fort Wayne, IN, or approved equal:
   a. "Tylox Type C" for tongue and groove pipe joint.
   b. "Tylox SuperSeal", "Type 4G/4F"or "RFS Pipe Gasket" for offset style bell and spigot pipe joint.
   c. "Tylox O-Ring" or "Press-Seal O-Ring" for recessed style bell and spigot pipe joint.

B. Push-On Joint Ductile Iron Pipe

1. Push-on joint ductile iron pipe shall conform to AWWA C 151, Special Thickness Class 52, unless otherwise shown on the Contract Drawings. Push-on joint ductile iron pipe shall be furnished with an exterior asphaltic coating (minimum 1-mil thick) and an interior ceramic epoxy (amine cured novalac) lining (minimum 40-mil thick) containing a minimum of 20 percent by volume of ceramic quartz pigment. Apply the exterior asphaltic coating and the interior ceramic epoxy lining at the manufacturing plant. Application of the interior ceramic epoxy lining shall be performed by an applicator certified by the manufacturer of the interior ceramic epoxy. Submit ceramic epoxy lining applicator's certification to the Engineer.
2. Seal pipe joints with continuous ring rubber gaskets conforming to AWWA C 111.
3. Polyethylene encasement for ductile iron pipe shall conform to AWWA C 105, linear low-density (0.008-inch or 8-mil thickness) or high density, cross-laminated (0.004-inch or 4-mil thickness) polyethylene film. Color of polyethylene encasement shall be its natural color, including white and black, or black (weather resistant) containing not less than 2 percent carbon black with an average particle diameter of 50 millimeters or less. A minimum of 2 percent of a hindered-amine ultraviolet inhibitor is required in any natural or colored film except in black film containing 2 percent or more carbon black.

C. Polyvinyl Chloride Pipe

1. Four-inch through 15-inch diameter polyvinyl chloride pipe shall conform to ASTM D 3034 having an SDR not greater than 35. Eighteen-inch through 48-inch diameter polyvinyl chloride pipe shall conform to ASTM F 679 having a pipe stiffness of 115 psi.

2. Four-inch through 36-inch diameter pipe joints shall be watertight conforming to ASTM D 3212. Gaskets shall be made of polyisoprene conforming to ASTM F 477 and shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the pipe manufacturer shall be used on the gasket and bell during assembly. Solvent cement joints for pipe and fittings are not permitted.

D. Crushed stone for pipe bedding shall be crushed limestone, gneiss or trap rock conforming to ASTM C 33, size No. 67.

PART 3. EXECUTION

3.01 VERIFICATION OF EXISTING UTILITIES

Where the exterior sanitary sewer gravity system alignment crosses an existing utility as shown on the Contract Drawings, a minimum of 30 days prior to start of the Work excavate a test pit or perform other exploratory methods as approved by the Engineer and at no additional cost to the Authority, to verify the elevation and horizontal location.

3.02 INSTALLATION

A. Excavation

1. Excavate trench in accordance with Division 31 Section on excavation, backfilling and filling and as noted herein to the alignment and elevation shown on the Contract Drawings. Prevent accumulation of water in trench. Place pipe in a dry trench.
2. Notify the Engineer if an obstruction that is not shown on the Contract Drawings is encountered and interferes with the installation of the pipe or appurtenances. Do not continue with installation of the pipe or appurtenances until directed by the Engineer.
3. In the course of excavation for reinforced concrete pipe or ductile iron pipe, should the trench or subtrench width exceed the outside diameter of pipe plus two feet for nominal diameters up to 18 inches or outside diameter plus three feet for nominal diameters in excess of 18 inches, the Engineer may require remedial measures to reduce the load on the pipe, such as the use of a concrete cradle or reinforced concrete encasement at no additional cost to the Authority. A subtrench is defined as a trench excavated for pipe placement within a wider trench.
4. For polyvinyl chloride pipe, where trench walls are stable or supported, provide a width sufficient, but not greater than necessary, to ensure working room to properly and safely place and compact haunching and other embedment materials. The space between the pipe and trench wall must be wider than the compaction equipment used in the pipe zone. Minimum width shall be not less than the greater of either the pipe outside diameter plus 16 inches or the pipe outside diameter times 1.25, plus 12 inches.

B. Pipe Support

1. Where shown on the Contract Drawings, use a concrete cradle to support the pipe at proper alignment and elevation and place concrete to dimensions shown on the Contract Drawings. The concrete cradle, when cured, shall support the full length of pipe.

2. Where shown on the Contract Drawings, use crushed stone bedding material to support the pipe at proper alignment and grade. Place and compact crushed stone bedding material in the bottom of the trench to provide a firm, but slightly yielding surface and to an elevation such that pipe laid on same will be at the proper grade and alignment. Make suitable excavations for the pipe bells, where applicable, so that the bottom reaction and support are confined to the pipe barrel. After installation of pipe on the compacted crushed stone bedding material layer, place and compact additional crushed stone bedding material in small lifts to the dimensions shown on the Contract Drawings.

C. Polyethylene Encasement for Ductile Iron Pipe

1. Install polyethylene encasement in accordance with any of the installation methods specified in Section 4.4 of AWWA C 105.
2. Thoroughly clean the surface of the pipe prior to installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or bedding material from becoming trapped between the pipe and the polyethylene encasement.
3. Fit the polyethylene encasement to the contour of the pipe to ensure a snug, but not tight, fit. In the case of bell spigot interfaces or fittings, provide sufficient slack in contouring to prevent stretching or damage to the polyethylene encasement during backfilling of the trench.
4. Secure overlaps and ends with adhesive tape, string or plastic tie straps to hold the polyethylene encasement in place to prevent intrusion of soil between the ductile iron pipe, fittings and appurtenances and the polyethylene encasement.

D. Pipe Installation

1. Immediately prior to placement in the trench, inspect all pipe in the presence of the Engineer to verify that it is internally clean and free of damage. Remove damaged pipe from the construction site and replace to the satisfaction of the Engineer, at no additional cost to the Authority.
2. When lowering pipe into the trench and joining the pipe lengths, take precautions to ensure that the interior of the pipeline remains clean.
3. Lay pipe true to alignment and elevation, with uniform bearing under the full length of its barrel, without break from structure to structure, and with bell or grooved end facing upgrade. Adjustments to alignment and elevation shall be made by scraping away or adding bedding material under the pipe.
4. Prior to start of construction, submit the method for control of alignment and grade for approval. The method shall be a laser system or grade board setup to establish a reference grade and alignment control directly above or within the pipe. Use of other equipment may be substituted if, in the opinion of the Engineer, the alternative system produces equivalent accuracy.
5. Make up pipe joints in accordance with the pipe manufacturer's written instructions and taking extreme care that joints are clean and free of foreign materials. Support pipe free of the bedding during the joining process to avoid disturbing the subgrade.
6. Use a come along and winch or other equipment when necessary to install large diameter pipes. Use inserts to prevent the pipe from being thrust completely home prior to checking gasket location. After the gasket is checked, remove the inserts and complete the joint.
7. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the conclusion of the Work period or if Work is interrupted for any reason.

E. Backfilling

1. Proceed with backfilling only after the Engineer has visually inspected the installed pipes.
2. Backfill and compact the trench from the top of the crushed stone bedding, or concrete cradle, as shown on the Contract Drawings in accordance with Division 31 Section on excavation, backfilling and filling.
3. After backfill material has been placed and compacted to a depth not less than one foot above top of pipe, make a visual inspection by flashing a light between manholes and drainage structures. Correct any displacement or misalignment of the pipe invert.

3.03 POST PIPE INSTALLATION INSPECTION

A. Pipes with a diameter less than 12 inches will not require post pipe installation inspections.

B. Arrange and pay for all post pipe installation inspections to be performed by a National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) certified technician. If the pipe is considered a confined space, submit documentation of training and entry for the technician in accordance with OSHA requirements.

C. At least 30 days prior to performing the post pipe installation inspection (herein after "inspection"), submit to the Engineer a schedule for performing the inspection.

D. Dewater installed pipe and remove all silt, debris and obstructions prior to performing the inspection.

E. In the presence of the Engineer, perform the inspection no sooner than 30 days after completion of the pipe installation and placement of backfill material reaches 3 feet above the pipe crown and before any pavement or other structures is installed. Do not continue with backfill above 3 feet of pipe crown or install any pavement structure until the pipe installation is accepted by the Engineer.

F. Use a crawler mounted camera and measurement technology to perform remote inspection. Use low barrel distortion video equipment with laser profile and measurement equipment and technology, non-contact video micrometer and associated software. Furnish a high-quality DVD in a MPEG2 format video with a standard resolution of 720 x 480. Use a camera with adequate lighting to illuminate the entire periphery of the pipe. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90-degree angle with the axis of the pipe and rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition. The recorded video image shall be clear, focused, and relatively free from roll, static or other image distortion that would prevent the Engineer from evaluating the condition of the pipe. Move the camera through the pipe at a speed not greater than 30 feet per minute. The equipment shall be capable of measuring the distance traveled with an accuracy of one foot per 100 feet.

G. Certify that laser profiling and crack/joint measurement technology is in compliance with ASTM E 691 and ASTM E 177, which includes the following calibration criteria: The equipment and software used must be tested and approved by a recognized independent testing group and include a tested certified accuracy of 0.5 percent or better and a repeatability of 0.12 percent or better. Laser profiling technology may utilize actual pipe diameter as measured with this device to calculate percent deflection and ovality.

H. If mandrels are used to check polyvinyl chloride pipe for deflection, they shall be nine (or greater odd number) arm, non-adjustable, fixed arm mandrels, and shall be sized utilizing the appropriately sized proving rings prior to testing. Clearly label the mandrel size and size the mandrel to provide a diameter of at least 95percent of the allowable minimum inside diameter in accordance with ASTM D 3034 and ASTM F 679. A measurement shall be taken once every 10 feet for the length of the pipe installation, except that a minimum of 4 measurements per pipe installation is required.

I. Pipe Inspection Summary Report Requirements

1. Not later than 5 days after completion of the inspection for each pipe run, submit a pipe inspection summary report and all recorded video/still digital images to the Engineer.

2. The recorded video shall include the following information:

a. The recorded video/still digital images to clearly show the conditions of the interior of the pipe and detect any defects within the pipe as specified in 1.05 herein and the following:

(1) Film the entire circumference at each joint.

(2) Stop the camera and pan when necessary to document and measure defects. Position the camera head perpendicular to all defects requiring measurement by the video micrometer.

b. The project name and number, the location of the inspection access point of the pipe being inspected with respect to the Contract Drawings (e.g., north/south/ east/west end of the pipe, manhole/drop inlet/junction box structure number).

c. The size of pipe, date/time, direction of travel (upstream or downstream), distance in feet from the inspection access point, which pipe is being inspected (if multiple pipes are connected to the inspection access point), and any other identifying factors needed to locate the pipe in the field at a future date.

d. A textual note on the video/still digital images and a verbal description to identify all deficiencies. The location and description of the deficiency shall be added to the recording using an audio microphone.

3. At a minimum, the pipe inspection summary report shall include the following:

a. Actual recorded length and width measurements of all cracks within the pipe.

b. Actual recorded separation measurement of all rigid pipe joints.

c. Detailed written observations of leaks, debris or other damage or defects.

d. For each polyvinyl chloride pipe run include pipe deformation/deflections measurements with the 5 percent deflection limit clearly delineated.

e. A still image with a written description of type, severity and extent of deficiency/deficiencies in an area that exceed acceptance criteria as specified in 1.05 herein.

f. Each still image with description of deficiency shall include reference to allow the Engineer to correlate the still image with the inspection video footage. If a deficiency continuously occurs along the pipe wall, note the extent of the condition and include at least one still image that best represents the condition. If person-entry inspection is utilized, include the actual field measurements taken for all deficiencies in the written description.

g. If no deficiencies are observed, an "OK" entry shall be made in the report for each section of pipe inspected.

h. When deficiencies that require corrective Work are identified, include corrective Work.

i. Documentation that the inspection personnel performing in-field inspections and preparing the pipe inspection summary report are certified technicians in accordance with this Section.

j. Documentation of type of equipment utilized for the inspection and clearly provide data to prove the equipment used meets this Section.

k. A statement of field accuracy achieved for all measurements including plus/minus tolerances. The report shall also include a narrative about required field/measurement calibration and provide proof that all calibration procedures were followed when collecting data within the report.

4. The Engineer will review the pipe inspection summary report including any corrective Work and communicate its determination within 10 days of receiving the pipe inspection summary report. Proceed with the corrective Work only after receiving approval by the Engineer.

5. Upon completion of the corrective measures, re-inspect the pipe installation and resubmit pipe inspection summary report and all recorded video/still digital images to the Engineer. Re-inspection shall be made within 10 days of completing the corrective Work, except where sections of pipe have been replaced re-inspection shall not occur sooner than 30 days after replacement of pipe and final cover (except for pavement structure). Any necessary reinspection of the pipe installation and corrective Work shall be completed in accordance with the requirements of this Section at no additional cost to the Authority.

3.04 INFILTRATION/EXFILTRATION TESTING

A. Perform infiltration/exfiltration testing of all installed pipes.

B. Equipment and procedures used in the performance of the infiltration/exfiltration testing shall be in accordance with ASTM C 969 and subject to the approval of the Engineer.

C. When infiltration testing is used, measure the amount of infiltration with a weir or other suitable measuring device.

D. The allowable infiltration rate including manholes shall be 200 gallons per inch of internal diameter per mile of sanitary sewer pipe tested per 24 hours, when the average groundwater head on the test section is 6 feet or less. When the average groundwater head on the test section is over 6 feet, the allowable infiltration rate shall be that calculated above multiplied by the ratio of the square root of the average groundwater head to the square root of the base head of 6 feet. If the infiltration rate exceeds the allowable limits given above, take the following remedial action:

1. Remove and replace the entire length of pipes at no additional cost to the Authority, or;

2. At the Contractor's discretion, conduct additional infiltration testing at no additional cost to the Authority to determine if the excess infiltration rate is attributed to certain pipe(s). Remove and replace certain pipes at no additional cost to the Authority.
3. Repeat infiltration testing until all installed pipes meet the allowable infiltration rate.

E. When infiltration testing is not practicable because of dry trench conditions, perform exfiltration testing. For exfiltration testing, the allowable leakage limit including manholes shall be 200 gallons per inch of internal diameter per mile of sanitary sewer pipe tested per 24 hours, when the average head on the test section is 3 feet or less. When the average head on the test section is greater than 3 feet, the allowable leakage shall be that calculated above multiplied by the ratio of the square root of the average test head to the square root of the base test head of 3 feet. Perform exfiltration testing, where directed by the Engineer, as follows:
1. Fill the pipes between successive manholes using a manhole standpipe system to provide the required test head.
2. Determine leakage by measuring the amount of water required to maintain the required test head for the required test period.
3. If exfiltration leakage exceeds the rate specified above, proceed with the removing and replacing the defective pipes as specified in 3.04 D.

F. Prior to performing the exfiltration testing, brace all storm sewer pipes in both lateral directions to preclude movement of the pipes.

G. Submit one copy of all test result data to the Engineer daily.

3.05 PROTECTION

A. Do not damage or displace existing or installed products during construction of pipe supports, backfilling, testing and other activities.

B. Where products are damaged or displaced, take remedial measures as approved by the Engineer including, but not limited to, reinstallation of pipe or replacing pipe, and/or testing of joints. Perform all such remedial measures at no additional cost to the Authority.

END OF SECTION

SECTION 221312

EXTERIOR SANITARY SEWER GRAVITY SYSTEM

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of the GENERAL PROVISIONS:

Catalog Cuts

221312B01 Submit catalog cuts of gaskets for pipe joints, including manufacturer's installation instructions.

Certificates

221312E01 Submit certificate from the pipe manufacturer certifying that the pipe, including ceramic epoxy lining, complies with the requirements specified in this Section.

221312E02 Submit ceramic epoxy lining applicator's certification from the pipe manufacturer.

221312E03 Submit certification for the laser profiling and crack/joint measurement technology.

221312E04 Submit the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) certification for the technician.

221312E05 Submit the material supplier, source and certified test data for gradation and composition of the crushed stone. The gradation report shall be current and representative of the material that will be furnished and installed in the Work. Submit this information to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey 07310-1397.

Construction and Installation Procedures

221312G01 Submit the method for control of alignment and grade of pipe during installation.

Inspection Reports

221312O01 Submit inspection summary report(s) for post pipe installation site inspections, including certification for the laser profiling and measurement equipment and technology.

221312O02 Submit test data results for the infiltration/exfiltration testing.

END OF APPENDIX "A"

DIVISION 31

SECTION 312323

EXCAVATION, BACKFILLING AND FILLING

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for excavation, backfilling and filling.

B. Definitions

1. As used herein, excavation shall mean the removal soil and all materials other than bedrock (ledge rock) encountered within the limits of excavation that are not specified to be removed under Division 02 Sections. When excavation of bedrock (ledge rock) is shown on the Contract Drawings, refer to Division 31 Section on rock excavation for removal requirements.
2. As used herein, backfilling shall mean the filling of excavations made for construction purposes and shall extend only to existing grades or design grades, whichever are lower.
3. As used herein, filling shall mean the placement of fill material in conformance with requirements of this Section at or above existing grade or design grade, whichever is lower.
4. As used herein, suitable shall mean material conforming to the gradation, compaction and environmental requirements of this Section.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM) International

ASTM C 88	Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
ASTM C 117	Test Method for Materials Finer than 75 µm (No. 200) Sieve in Mineral Aggregates by Washing.
ASTM C 131	Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
ASTM C 136	Test Method for Sieve Analysis of Fine and Coarse Aggregates.
ASTM D 1556	Test Method for Density of Soil in Place by the Sand-Cone Method.
ASTM D 1557	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 pt 2,700 kN-m/m^3).
ASTM D 2167	Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
ASTM D 3665	Practice for Random Sampling of Construction Materials.
ASTM D 4318	Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
ASTM D 6938	Test Methods for In-Place Density and Water Content of Soil and Soil-

Aggregate by Nuclear Methods (Shallow Depth).

ASTM D 7928 Test Methods for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.

New Jersey Department of Transportation – Standards Specification for Road and Bridge Construction: Division 900 Materials (NJDOT)

Table-901.11-1 - Standard Soil Aggregate Gradations.

New York City Codes, Rules and Regulations (NYCRR)

1.03 SITE CONDITIONS

A. Protect excavations as follows:

1. Prevent water from entering excavated areas and, if it does, remove it immediately to maintain a dry condition at all times.
2. Dispose of water in a manner not to cause injury to the public health or damage to public or private property.
3. If water enters excavated areas and weakens or disturbs underlying soil, remove the weakened or disturbed soil and replace it in conformance with 3.02 A.4.
4. Where shown on the Contract Drawings or where required for protection of adjacent utilities or structures or where required for performance of the Work, secure the sides of excavations against movement as follows:
   a. Furnish and install temporary sheet piling or sheeting held in place by waling and bracing members. Top of sheeting shall extend at least six inches above ground, or as otherwise shown on the Contract Drawings.
   b. Do not excavate below the bottom of sheet piling or sheeting, except as necessary to install sheeting.
   c. Fill voids behind sheeting immediately with material conforming to I-12 designation as defined in 2.01 A, or with other material as otherwise approved by the Engineer.
   d. Comply with all other requirements of the Specifications that may impose additional or stricter requirements.
5. For excavations extending to a depth of 5 feet or more, and where sheeting is not required, excavate slopes to a safe angle of repose. Trenches 5 feet deep or greater require a protective system. Provide safe access and egress to all excavations including ladders, steps, ramps, or other safe means of exit for employees working in trench excavations 4 feet or deeper. These devices must be located within 25 feet of all workers.
6. Restore all areas impacted by excavation to their original condition, matching pavement types and sections to meet original pavement grades.

B. Do not traverse paved areas with tracked vehicles or equipment, such as carry-all scrapers, which may damage such pavement unless protected to the satisfaction of the Engineer.

C. Do not place fill or backfill on frozen subgrade.

D. Do not perform rolling or other compaction at any time when the ground water level is above a plane two feet below the surface to be compacted. When the ground water level is above such plane, lower it by approved methods and maintain it below such level prior to and during the compaction operations.

E. Protect from damage trees and other vegetation that are to remain in place.

1.04 QUALITY ASSURANCE AND QUALITY CONTROL

A. General

1. Establish and maintain a Quality Control Plan (hereinafter called the "Plan") along with all the personnel, equipment, supplies and facilities necessary to obtain samples, perform and document tests and meet Specification Section requirements. For contracts requiring 500 cubic yards of fill or greater, the Plan is required. For contracts requiring less than 500 cubic yards of fill, the Plan is at the Contractor's option.
2. Describe the Plan in a written document. Submit the written Plan to the Authority's Chief of Materials Engineering, Materials Engineering Unit for review at least 28 calendar days prior to the start of backfilling or fill Work.
3. In the absence of an approved Quality Control Plan, the Authority will make no payments for backfilling or fill which is subject to specific quality control.
4. The Plan may be implemented wholly, or in part by the Contractor, or by an independent organization engaged by the Contractor, but it shall in all cases remain the responsibility of the Contractor.
5. Organize the Plan to address at a minimum the following items:
   a. Quality control organization chart.
   b. Quality control organization names and qualifications of personnel.
   c. Area of responsibility and authority of each individual.
   d. Names and qualifications of personnel as required by 1.04 A.7.d.
   e. A listing of any outside organizations, such as testing laboratories that will be used by the Contractor, and a description of the services they will provide.
   f. A testing plan which lists the tests required to be performed by the Contractor or organization engaged by the Contractor, the frequencies of testing, sampling locations and the location of the testing facilities.
   g. Procedures for ensuring that tests are taken in accordance with the testing plan, that tests are documented, and that proper corrective actions are taken when necessary.
   h. Procedures for ensuring that testing equipment is available, that it complies with specified standards, and that it has been calibrated against certified standards.
   i. Procedures for verifying that tests are taken in accordance with the appropriate ASTM standards.
   j. Procedures for daily submittal of test results to the Engineer.
   k. An action plan detailing procedures to be used to correct unsatisfactory production processes and construction practices when tests indicate that the backfill or fill is failing to meet the following:
      (1) Aggregate gradation.
      (2) In-place density.
      (3) Surface smoothness.
      (4) Grades.

6. The Plan shall address all elements which affect the quality of the backfill or fill, including at a minimum:
   a. Aggregate gradation.
   b. Quality of materials.
   c. Stockpile management.
   d. Placement and compaction.
   e. Surface smoothness and grades.
7. Quality Control Organization
   a. Implement the Plan by the establishment of a separate Quality Control Organization. Develop and submit an organization chart to show all quality control personnel integrated with other management, production and construction functions and personnel.
   b. The organization chart shall identify all quality control staff required to implement all elements of the quality control program, including inspection and testing functions for different items of Work.
   c. If an outside organization or independent testing laboratory is used for implementation of all or part of the Plan, the personnel assigned will be subject to the qualification requirements specified herein. The organization chart shall indicate which personnel are employees of the Contractor and which are employees of an outside organization.
   d. The Quality Control Organization shall consist of at least the following personnel:
      (1) A Plan administrator which shall be an employee of the Contractor. The Plan administrator shall have prior quality control experience on a project of comparable size and scope and shall meet one of the following requirements:
         (a.) Licensed Professional Engineer with one year of earthwork experience as approved by the Engineer.
         (b.) Licensed Professional Geologist with one year of earthwork experience as approved by the Engineer.
         (c.) Engineer-in-Training with two years of earthwork experience as approved by the Engineer.
         (d.) An individual with three years of earthwork experience as approved by the Engineer and with a Bachelor Degree in Civil Engineering, Civil Engineering Technology or Construction.
         (e.) Construction Materials Testing Engineering Technology certified at Level III or IV by the National Institute for Certification in Engineering Technologies (NICET).
         (f.) Geotechnical Engineering Technology certified at Level III or IV by the National Institute for Certification in Engineering Technologies (NICET).
         (g.) Highway Materials Engineering Technology certified at Level III or IV by NICET.
         (h.) Highway Construction Engineering Technology certified at Level III or IV by NICET.
         (i.) A NICET certified Engineering Technician in Civil Engineering Technology with 5 years of earthwork experience as approved by the Engineer.

(2) Certification at an equivalent level by a State or nationally recognized organization will be acceptable in lieu of NICET certification. The Plan administrator shall have full authority to institute any and all actions necessary for the successful operation of the Plan to ensure compliance with this Section. The Plan administrator shall report directly to a responsible officer in the Contractor's organization. The administrator may supervise the Plan on more than one project provided that he can upon request be at the construction site within one hour.

(3) A sufficient number of quality control technicians to adequately implement the Plan. The quality control technicians shall be engineers or engineering technicians holding a current certificate issued by NICET or the American Concrete Institute (ACI). The quality control technicians shall report directly to the Plan administrator and shall perform the following functions:

(a.) Inspection of all equipment used in placing and compacting material to ensure proper operating conditions.

(b.) Inspection during construction to ensure that placement and compaction is in conformance with this Section and will produce a finished product that meets requirements of this Section.

B. Noncompliance

1. In cases where quality control activities do not comply with either the Plan or this Section, or where the Contractor fails to properly operate and maintain an effective Plan, the Engineer may order the Contractor to replace ineffective or unqualified quality control personnel.

C. For Recycled Concrete Aggregate (RCA), if applicable, perform the following additional quality control tests on dedicated stockpiles being produced for use under this Contract:

1. At least once per day, gradation tests as determined in accordance with ASTM C 117 and ASTM C 136.

2. Continuous visual inspection, including removal of any objectionable material, to ensure compliance with 2.01 D. herein.

3. At least once every two weeks, soundness of aggregates as determined in accordance with ASTM C 88 and resistance to degradation as determined in accordance with ASTM C 131.

D. Control Strip

1. For contracts requiring 500 cubic yards of fill or greater, and where otherwise directed by the Engineer, select an area from the first day's production to be called a control strip. The control strip shall be a minimum of 2,500 square feet and shall be constructed to meet the requirements of this Section and in the same manner as the remainder of the fill it represents. The purpose of the control strip is to have the Contractor establish the compaction pattern, methods and effort required to achieve the quality requirements and to calibrate the Contractor's nuclear gage. Construct additional control strips whenever a significant change occurs in the type or source of the material and whenever a significant change occurs in the composition of the material from the same source.

E. Where temporary sheet piling or sheeting is required or is shown on the Contract Drawings, shop drawings and calculations shall be prepared, signed and sealed by a Professional Engineer licensed in the State in which the Work will be performed, who has a minimum of five years' experience in the design of soil retaining structures.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Fill

1. Unless otherwise shown on the Contract Drawings, fill shall consist of clean sand and gravel containing no organic matter, conforming to the following NJDOT "Standard Soil Aggregate Gradations", except that in lieu of the standard NJDOT gradation, for I-12 a minimum of 5 percent must pass the No. 50 sieve and a maximum of 10 percent can pass the No. 200 sieve:

	Total Percent Passing by Weight		
	NJDOT Designation		
	I-7	I-10	I-12 - Modified
Sieve Sizes			
4 inch		100	100
2 inch		80-100	
1 inch	100		
3/4 inch		60-100	70-100
1/2 inch	80-100		
No. 4		40-100	
No. 8	35-100		
No. 16	25-90	20-70	
No. 50	5-50	5-40	5-75
No. 100	0-8	0-30	
No. 200	0-2	0-20	0-10

2. The clean sand and gravel may consist up to a total of 10 percent of the following materials:
   a. Wood: 0.1 percent, maximum.
   b. Brick, Mica Schist, or other friable material: 4 percent, maximum.
   c. Asphalt Concrete: 10 percent, maximum.
3. If the fill is made from quarry processed, virgin aggregate, it shall be crushed dolomite, limestone, gneiss, granite, or trap rock free from coatings of clay, clay clods, silt, plant matter, poor durability particles, and other objectionable materials such as debris, refuse, cinders and slag.
4. Comply with fill designations shown on the Contract Drawings and place designated fill in the locations shown.

B. Backfill

1. Unless otherwise shown on the Contract Drawings, material shall conform to the requirements for I-12 designation, as defined herein.

C. Sources

1. Do not deliver any material until the Engineer has reviewed and approved material supplier and source submittal. Delivered material must receive on-site approval prior to use.

2. When fill and backfill material are furnished by the Authority, refer to the Contract Drawings for the location of the existing stockpile, the NJDOT Designation (if applicable), and the estimated quantity of available material. Samples of Authority-furnished material will not be required for testing.
3. Unless otherwise approved by the Engineer, material excavated at the construction site shall be used only for backfill and shall be used to the extent that it conforms to the requirements specified in 2.01 A and 6 NYCRR Part 360.13(c), unless otherwise noted on Contract Drawings. Submit samples for testing by the Engineer for verification of conformance with the requirements of this Section.
4. If sufficient quantities of suitable material are unavailable from sources described in 2.01 C.2 and C.3 above, furnish material from sources off site, as directed by the Engineer. The Contractor will be compensated for the cost of furnishing only (excluding cost of placing and compacting the fill and backfill) such fill or backfill material from sources off site at the "Net Cost" thereof.

D. Recycled Concrete Aggregate

Recycled Concrete Aggregate (RCA) conforming to the requirements specified below and to the gradations specified in 2.01 A.1 and to the Environmental Compliance criteria specified in 2.01.G may be used as above-grade fill or aggregate base course for pavements and foundations. RCA may not be used as sub-grade fill.

1. The RCA shall consist of at least 90 percent, by weight, Portland cement concrete, with the following materials making up the remaining 10 percent:
   a. Wood: 0.1 percent, maximum.
   b. Brick, Mica schist, or other friable material: 4 percent, maximum.
   c. Asphalt Concrete: 10 percent, maximum.
   d. Virgin Aggregate: 10 percent, maximum.
2. The percentage of asphalt concrete and other deleterious material shall be determined by weighing that material retained on the No. 4 sieve, and dividing by the total weight of RCA material retained on the No. 4 sieve.

E. Soundness of Aggregates

1. Loss limitation shall not be more than 10 percent loss by weight using sodium sulfate for a 5-cycle test period, or not more than 15 percent loss by weight using magnesium sulfate for a 5-cycle test period as determined in accordance with ASTM C 88.

F. Resistance to Degradation

1. Percentage loss between the original weight and the final weight of the test sample shall not exceed 45 percent as determined in accordance with ASTM C 131.
2. RCA, if used, shall be supplied from permitted or State Registered Construction and Demolition Debris Processing Facilities (C&DDPF). Obtain and submit a copy of the permit or registration to the Engineer.
   a. In New York, the source of the RCA shall be C&DDPF conforming to 6 NYCRR Part 361-5: Construction and Demolition Debris Processing Facilities.
   b. In New Jersey, the source of the RCA shall be a Class B C&DDPF conforming to NJAC - Title 7: Environmental Protection; Chapter 26A: Recycling Rules.

G. Environmental Compliance

All fill material brought on the construction site must be sampled and analyzed to demonstrate environmental quality as follows:

1. New Jersey: For material imported to sites in New Jersey, sample and analyze fill material in accordance with the New Jersey Department of Environmental Protection (NJDEP) April 2015 "Fill Material Guidance for SRP Sites" (SRP Fill Guidance). Submit to the Engineer the following:
   a. Written documentation demonstrating the material brought on site meets the qualifications as clean fill specified in the SRP Fill Guidance and a written statement signed by a NJ Professional Engineer or NJDEP Licensed Site Remediation Professional (LSRP) that the material does not contain contaminants above the NJDEP 7:26D, Remediation Standards, Residential Direct Contact Soil Remediation Standard and Impact to Groundwater Soil Screening Levels.
   b. A copy of the current permit/recycling facility approval for each facility supplying fill material.
   c. Analytical results in accordance with the SRP Fill Guidance. Provide documentation that the laboratory performing the analysis is certified in the New Jersey Environmental Laboratory Certification Program (ELCP). The following shall be provided:
      (1) The analytical data shall be in an Excel spreadsheet format that compares the data to the New Jersey Residential Direct Contact Soil Remediation Standard and Impact to Groundwater Soil Screening Levels, and shall be accompanied by a completed chain of custody for the samples, a sampling plan for the samples collected, and the certifications of the entity completing the sampling.
      (2) The number of samples shall be in accordance with the SRP Fill Guidance.
2. New York: For material imported to sites in New York State, sample and analyze fill material in accordance with 6 NYCRR Part 360.13(e). Submit to the Engineer the following:
   a. Written documentation demonstrating the material brought on site meets the physical criteria and does not exceed maximum concentration levels for General Fill specified in 6 NYCRR Part 360.13(f) and a written statement signed by a NY Professional Engineer or NY Professional Geologist that the material does not contain contaminants above the lower of the Protection of Public Health – Residential Land Use and Protection of Groundwater Soil Cleanup Objectives in Table 375-6.8(b) of 6 NYCRR.
   b. A copy of the current permit/approval for each facility supplying fill material.
   c. Analytical results in accordance with the 6 NYCRR Part 360.13(e). The laboratory performing the analysis shall be certified by the New York State Department of Health's Environmental Laboratory Approval Program. The following shall be provided:
      (1) The analytical data shall be in an Excel spreadsheet format that compares the data to the Protection of Public Health – Residential Land Use and Protection of Groundwater Soil Cleanup Objectives, and accompanied by a completed chain of custody for the samples, a sampling plan for the samples collected, and the certifications of the entity completing the sampling.

(2) The number of samples shall be in accordance with Table 1 of 6 NYCRR Part 360.13.

3. Crushed stone from a native source (quarry/mine) may be imported without analytical results. Submit to the Engineer the following:
   a. A copy of the State quarry or mine facility permit.
   b. A notarized certification that the material excavated from undisturbed geologic formations, obtained from the licenses quarry/mine, is not known or suspected of being contaminated, and is not affected by conditions or processes that would result in the introduction of or increase in concentration of contaminants already present in the quarry/mine.
4. At the Engineer's discretion, the Engineer will perform quality assurance testing of fill material brought to the site to confirm compliance with the specified requirements. Remove and replace, at no additional cost to the Authority, fill material determined by the Engineer to be not in compliance.

PART 3. EXECUTION

3.01 PREPARATION

A. Clearing and Grubbing

Remove trees, clear and grub areas to be excavated or in which construction is to be performed, as follows:

1. Remove trees, stumps, all roots larger than 2 inches in diameter, and all matted root systems.
2. Remove all topsoil, debris, organic matter and any other objectionable material not suitable for use as backfill or fill or for support of structures or pavements.
3. Backfill all holes and other low spots resulting from clearing and grubbing with material conforming to 2.01 B or 2.01 D before proceeding with compaction of fill as specified in 3.03.

3.02 EXCAVATION

A. General

1. Excavation shall consist of the removal of materials as defined in 1.01 B.1, and the removed materials shall be segregated by material type (e.g., sand fill, miscellaneous fill, sand, gravel, clay) and stockpiled at the location shown on the Contract Drawings.
2. Excavate to elevations required for installation of permanent construction in such manner as not to disturb the subgrade below such elevations.
3. Where existing foundations or other existing construction are encountered which may cause hard spots, remove them to a minimum of two feet below subgrade for pavement or structures and backfill with material conforming to 2.01 B or 2.01 D.
4. If the bottom of excavation is weakened or disturbed or carried below required depth compact as follows:
   a. Under Footings: Compact bottom as specified in 3.03 below and replace over-excavation with the same concrete as that specified for the footing or foundation.
   b. Locations other than Under Footings: Compact bottom as approved by the Engineer and refill with material conforming to 2.01 B or 2.01 D.

5. Perform excavation around and adjacent to existing structures, pipes and conduits which are to remain in place, without damage to or movement of existing construction. Use hand excavation to locate and expose near-surface structures, pipes and conduits. When excavation is to be performed under such structures, pipes and conduits, support them in a manner as approved by the Engineer to ensure uninterrupted operation of the supported items.

B. Dewatering

1. Where excavations are to extend below the water table, prior to placement of any permanent construction or filling or backfilling any excavated area, lower the water table in such an area to two feet below the elevation of the required subgrade and maintain this condition until the construction or pavement is placed thereon.
2. Dewater in a manner to prevent the loss of ground due to the migration of soil fines into the dewatering system.

C. Trenching for Utilities

1. Shape bottom of trench to uniform invert section.
2. When excavating in soft soils which may be subject to lateral movement or bottom heave, conform to requirements shown on the Contract Drawings.

D. Disposal of Excavated Material

1. All debris and all material either unsuitable for or in excess of that required for backfill or fill, shall be reused, recycled or disposed of away from the construction site in accordance with Division 01 Section entitled "Recycling of Construction Debris Material".

E. Restrictions

1. Do not place backfill until the Engineer has inspected and approved the Work and has indicated where backfill may be placed.
2. Leave all pipe joints exposed until all tests, required by other Sections of the Specifications on such pipe, have been performed.
3. Remove all temporary structures, sheet piles, sheeting, bracing and forms and all organic materials and debris of every nature, taking care, upon the removal of sheet piling, sheeting and temporary supports, not to cause movement of adjacent ground or structures or create the danger of a slide.

3.03 PLACEMENT AND COMPACTION

A. Equipment

1. Steel vibratory rollers shall have provision for regulation of vibration frequency. Submit and obtain Engineer approval of the type and size of compaction, placing and spreading equipment to be used before the start of any compaction efforts.
2. Unless otherwise shown on the Contract Drawings, pneumatic-tired rollers shall have minimum weight of 20 tons and a tire pressure of between 60 and 150 psi. For aircraft pavements, the minimum roller weight shall be 50 tons.
3. When mechanical tampers are used, submit and obtain Engineer approval of the type and size of tamper before compaction efforts begin.

B. Subgrade, Excavated and Existing Surfaces

Compaction of subgrade, excavated and existing surfaces shall consist of a proof rolling operation performed as follows, unless otherwise shown on the Contract Drawings that proof rolling is not required:

1. Compact surface with a minimum of six passes of an approved vibratory steel roller operated at a speed not to exceed three miles per hour and at the optimum operating frequency recommended by the manufacturer, unless a higher minimum number of passes is shown on the Contract Drawings. Overlap passes of roller a minimum of six inches.
2. In areas where surface consists of a fine grained soil, compact with a minimum of six passes of an approved pneumatic-tired roller, unless a higher minimum number of passes is shown on the Contract Drawings. Overlap passes of roller a minimum of six inches.
3. In areas where use of a roller is impractical, compact surface while at or near optimum moisture content with mechanical tampers.
4. If, in the sole determination of the Engineer, the proof rolling produces noticeable weaving of the surface, excavation of unsuitable material and replacement with backfill may be required below subgrade, within the limits and to the depth as directed by the Engineer. The Contractor will be compensated for any such excavation of unsuitable material below the elevation of subgrade or under footing and subsequent backfilling at the "Net Cost" thereof.

C. Backfill and Fill

1. Moisture content of backfill and fill material shall be within a range of plus or minus two percent of optimum, as determined by Procedure C of ASTM D 1557.
2. Backfill and fill shall be compacted to achieve a density of 95 percent of the maximum density as determined by Procedure C of ASTM D 1557, except where alternate density requirements are approved by the Engineer or shown on the Contract Drawings.
3. Backfill conforming with I-12 gradation as defined herein, and fill conforming with I-7 and I-12 gradation as defined herein, shall be placed in 14-inch, loose layers. In areas where a 14-inch layer over existing material is not adequate to support the construction equipment, increase thickness of first lift as approved by the Engineer.
4. When shown on the Contract Drawings, backfill and fill, conforming to I-10 gradation, shall be placed in 12-inch, loose layers.
5. In areas adjacent to structures and utilities as shown on the Contract Drawings, compaction equipment shall be restricted as shown on the Contract Drawings.
6. In areas where use of a roller is impractical, place fill in maximum 8-inch, loose layers and compact with approved mechanical tampers to the specified density. In pipe trenches, each layer of backfill shall be not more than 8 inches in thickness before compaction. Place backfill on both sides of the pipe, simultaneously.
7. The surface of filled or backfilled areas, which are to receive pavement or on which a structure is to be placed, shall be within plus or minus 1/2 inch of the elevations shown on the Contract Drawings and shall be free of depressions or projections greater than 1/2 inch when tested with a 16-foot straight edge.

8. The surface of filled areas at other locations shall be within plus or minus one inch of elevations shown on the Contract Drawings unless a closer tolerance is necessary to meet requirements of other Sections of the Specifications or meet requirements shown on the Contract Drawings.

3.04 QUALITY CONTROL AND QUALITY ACCEPTANCE INSPECTION AND TESTING

Testing will include pre-placement laboratory tests by the Engineer, quality control testing by the Contractor, and Quality Acceptance Inspection and Testing by the Engineer. The Quality Acceptance Inspection and Testing frequencies are determined by the Engineer and are dependent on the type of fill or backfill, the nature and size of the installation, and the structural significance of the installation.

A. Pre-Placement Laboratory Tests

1. Gradation will be determined in accordance with ASTM C 117, ASTM C 136, and ASTM D 7928. Maximum density will be determined in accordance with Procedure C of ASTM D 1557. If deemed appropriate by the Engineer, Atterberg Limits will be determined on fine-grained soils in accordance with ASTM D 4318.
2. The Engineer may test fill samples obtained by the Engineer at the site. If a site prohibits stockpiling of fill due to space limitations, the Engineer may sample at the source, prior to delivery. The delivered fill may then also be retested to verify the initial test results. Notify the Engineer at least five days prior to delivery of fill to the construction site.
3. The Engineer will test field samples of material submitted from each source for compliance with 2.01. Notify the Engineer when backfill and fill material are on the site at least seven days prior to placement to allow sufficient time for testing. A copy of the test analyses will be on file with the Engineer. The samples will be taken from stockpiles on site, prior to material placement. Typical testing frequencies may be as follows:

   A Lot shall be defined as one day's production but no more than 400 cubic yards.

   Material Produced Using Virgin Aggregate

Gradation	1 test per Lot
Moisture-Density (Proctor) Test	1 test per Lot

   Material Produced Using Recycled Concrete Aggregate

Gradation	4 tests per Lot (one test from each sublot)
Moisture-Density (Proctor) Test	4 tests per Lot
Composition	4 tests per Lot

4. The Engineer may check fill thickness at least once every 2,500 square feet.
5. The Engineer may check conformance to elevations required by the Contract Drawings and required tolerance for surface straightness.
6. The Engineer may determine in-place density of compacted fill from in-place density test. Frequency of testing may be at least one test every 2,500 square feet per lift or at least every 50 feet of trench per lift. Locations of random sampling will be determined in accordance with ASTM D 3665. The in-place density will be determined in accordance with ASTM D 6938, or ASTM D 2167, or ASTM D 1556.
7. If the Engineer's maximum density will be used for Contractor's quality control testing, the Contractor must first obtain this laboratory value from the Engineer prior to placement.

8. If the sample from a source is approved, upon the Engineer's request, direct the Engineer to that source. At the Engineers discretion, additional samples may be selected and tested by the Engineer.
9. The Engineer will notify the Contractor of approval of material source within seven days after selecting and taking samples. Approval of a source of backfill or fill material will be subject to material continuing to meet the requirements of 2.01.
10. The Contractor shall provide labor and equipment to take samples as directed by the Engineer to assist in required testing, at no additional cost to the Authority.

B. Quality Control Testing by the Contractor

1. The Contractor's Quality Control Plan shall be implemented in accordance with the approved Plan submitted in compliance with Appendix "A" herein.
2. Implement and maintain the Quality Control Plan and procedures to ensure all fill and backfill materials and completed construction conform to this Section. The Engineer shall be permitted access to the Contractor's plant, equipment and field operations at all times for checking compliance with the approved quality control procedures. Provide labor and equipment to take samples as directed and assist the Engineer in other tests. Repair all areas from which samples are taken to meet all requirements of this Section.
3. Perform in-place quality control density testing to determine densities achieved after compaction efforts. The frequency of testing shall be as follows, unless otherwise shown on the Contract Drawings:

In-Situ Field Testing - Per Lift:	
In-place Density	1 test / 2,500 sq. ft.
In-Place Density - Trenches	1 test / 50 ft. of trench

C. Quality Acceptance Inspection and Testing by the Engineer

1. At the discretion of the Engineer, Quality Acceptance Inspection and Testing to verify field densities will be performed after compaction operations. The Engineer will determine the density of compacted fill or backfill by in-place density tests or from undisturbed samples cut from the compacted fill or backfill as required. Notify the Engineer 72 hours prior to start of filling or backfilling to allow the Engineer time to make provisions for such testing.
2. Test methods may be either sand-cone (ASTM D 1556), rubber balloon (ASTM D 2167), or nuclear device with moisture content determined by ASTM D 6938. Tests will measure the density of the layer immediately below each compacted layer and the density of the uppermost or final layer.
3. Quality Acceptance Inspection and Testing will also include periodic sampling and testing of backfill and fill materials to verify continued conformance with the requirements of 2.01 and to verify the value of maximum density used as the control value.
4. To evaluate whether material has been compacted to specified density, the Engineer will compare results of in-place density tests with results of control tests on material of the same designation using Procedure C of ASTM D 1557.
5. If fill or backfill have not been sufficiently compacted as determined by in-place density tests, the Contractor shall continue compaction effort and shall adjust the moisture content as necessary until the specified compaction is obtained, at no additional cost to the Authority.

END OF SECTION

SECTION 312323

EXCAVATION, BACKFILLING AND FILLING

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of the GENERAL PROVISIONS:

Shop Drawings

312323A01 Where sheet piling or sheeting is required or is shown on the Contract Drawings, submit detailed shop drawings and design calculations of the sheeting and bracing system to the Engineer for review. Submit such drawings and calculations three weeks prior to commencement of such excavation.

Product Data

312323D01 Submit to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Room 234, Jersey City, NJ 07310-1397, material suppliers and sources for each designation of fill or backfill used under this Contract. Include, at a minimum, the Contract location, title and number; designation of intended material use; and source and supplier of material. Submit such information at least three weeks prior to delivery of material to the site. If indicated on the subsequent submittal response for material suppliers and sources, samples of approved backfill or fill shall be submitted to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Room 234, Jersey City, NJ 07310-1397.

312323D02 Submit a description and complete specification of the compaction equipment in accordance with 3.03 A.

312323D03 Submit all environmental compliance documents for fill material specified in 2.01 H. Provide such documents at least three weeks prior to delivery of material to the site.

Certificates

312323E01 Submit three copies of a "Clean Fill Certification Report" and a "Certificate of Clean Fill" for all imported fill materials.

312323E02 If RCA is used, submit a copy of the facility's permit or registration for State Registered Construction and Demolition Debris Processing Facilities (C&DDPF).

Quality Assurance-Quality Control

312323L01 Submit a Quality Control Plan for review and approval by the Engineer in accordance with 1.04 A.

END OF APPENDIX "A"

DIVISION 31

SECTION 313218

GEOTEXTILES

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies the requirements for geotextiles made of long-chain synthetic polymers for the following applications:

1. Subsurface drainage.
2. Permanent erosion control.
3. Stabilization.
4. Separation of dissimilar materials.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

<u>American Association of State Highway and Transportation Officials (AASHTO)</u>

AASHTO M 288	Specification for Geotextile Specification for Highway Applications.

<u>ASTM International (ASTM)</u>

ASTM D 4354	Practice of Sampling of Geosynthetics for Testing.
ASTM D 4759	Practice for Determining the Specification Conformance of Geosynthetics.
ASTM D 4873	Guide for Identification, Storage, and Handling of Geotextiles Rolls and Samples.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

Unless otherwise shown on the Contract Drawings, the geotextile shall conform to the requirements of AASHTO M 288.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Label, ship and store the geotextile in accordance with ASTM D 4873.

B. The product label shall clearly show the manufacturer's name, product number and name, and unique roll number.

C. Include with each roll delivered to the construction site, the manufacturer's written certification stating that the geotextile complies with the requirements of this Section.

D. Wrap each geotextile roll with a material that will protect the geotextile from damage due to shipment, water, sunlight and contaminants.

1.05 QUALITY ASSURANCE

A. The manufacturer shall have an on-site company laboratory that is accredited by the Geosynthetic Accreditation Institute (GAI) - Laboratory Accreditation Program at the actual production location or provide GAI accredited independent third-party test results which may be substituted for the on-site company laboratory. The manufacturer shall be ISO 9001:2000 certified.

B. The Engineer will visually inspect the geotextile when delivered to the construction site. Remove and replace geotextile that is damaged or geotextile that does not meet the requirements of this Section at no additional cost to the Authority.

C. Engineer's Sampling and Testing

1. Using random samples obtained from the geotextile delivered to the construction site, the Engineer may elect to perform testing to verify that the geotextile conforms to the physical requirements specified in this Section. Testing will be performed in accordance with ASTM D 4759.
2. The Engineer will determine the lot sizes and number for testing in accordance with Procedure C of ASTM D 4354 with a minimum of three tests per lot.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Manufacturers: Subject to compliance with requirements of this Section, furnish and install geotextile of one of the following manufacturers, or approved equal:

1. Hanes Geo Components; Winston-Salem, NC.
2. Propex Operating Company; Chattanooga, TN.
3. Tencate Geosynthetics; Pendergrass, GA.

B. Fibers used for the manufacture of geotextiles, and the threads used in joining geotextiles by sewing (if necessary), shall comply with the physical requirements of AASHTO M 288.

C. The geosynthetic property values in AASHTO M 288 are Minimum Average Roll Values (MARV) as determined in accordance with ASTM D 4759. Use of multiple layers of a geotextile to achieve MARV will not be accepted.

D. For the following geotextile applications comply with the physical requirements of Table 1 in AASHTO M 288, unless otherwise shown on the Contract Drawings. The elongation, permittivity and apparent opening size requirements shall be as shown on the Contract Drawings.

1. Subsurface Drainage Geotextile: Class 2.
2. Permanent Erosion Control Geotextile: Class 1 or 2.
3. Stabilization Geotextile: Class 1, with a permittivity greater than 0.1 per second.
4. Separation of Dissimilar Materials Geotextile: Class 1.

PART 3. EXECUTION

3.01 PREPARATION

A. Ensure that the surface on which the geotextile will be installed is smooth and level and does not have depressions or projections greater than 3 inches, including ruts that may result from construction equipment. In areas requiring a pavement, perform proof rolling in accordance with Division 31 Section on excavation, backfilling and filling.

3.02 INSTALLATION

A. General

1. Install the geotextile as shown on the Contract Drawings and as specified in this Section.
2. As approved by the Engineer, remove and replace geotextile that becomes damaged during installation at no additional cost to the Authority. The Engineer may elect to accept repairs to any damaged geotextile.

B. Subsurface Drainage Installations

1. Loosely place the geotextile in the excavated trench avoiding wrinkles or folds. Ensure that the geotextile is placed against the bottom and sides of the excavated trench. Overlap successive sheets of the geotextile a minimum of 12 inches, with the upstream sheet overlapping the downstream sheet.
2. Immediately following placement of the geotextile, place the drainage aggregate and subdrain pipe as shown on the Contract Drawings.
3. After placing the drainage aggregate and subdrain pipe, overlap the geotextile a minimum of 12 inches and place additional drainage aggregate or suitable backfill material over the geotextile.
4. After completing the installation of the geotextile, drainage aggregate and subdrain pipe, continue to backfill and compact the trench in accordance with Division 31 Section on excavation, backfilling and filling.

C. Permanent Erosion Control, Separation of Dissimilar Materials and Stabilization Installations

1. Unroll and place the geotextile on the prepared surface such that it is flat and tight with no folds. Do not overstretch the geotextile such that placement of overlying materials will tear the geotextile. Ensure that the geotextile is unrolled and placed in the proper orientation.
2. In the case of a sloped surface, and unless otherwise shown on the Contract Drawings, anchor the terminal ends of the geotextile at the top and toe or bottom of slopes with a sufficient number of 10- or 12-inch long nails or alternatively, staples.
3. Unless otherwise shown on the Contract Drawings, overlap successive sheets of the geotextile a minimum of 18 inches in both the transverse and parallel directions. In the case of a sloped surface, the overlap shall be upslope over downslope. Secure all overlaps with a sufficient number of 10- or 12-inch long nails or alternatively, staples, as required to maintain the overlap.
4. In the case of a sloped surface, place the armor stone, riprap or aggregate base course onto the geotextile beginning at the bottom or toe of slope and proceed upslope. Limit the height from which the armor stone, riprap or aggregate base course is dropped onto the geotextile to one foot.

5. For underwater applications, place the first layer of armor stone, riprap or aggregate base course immediately after the geotextile is installed.

6. On curves and angles, fold or cut the geotextile to conform to the curve or angle. The fold or overlap shall be shingled in the direction of construction and secured in place by 10- or 12-inch long nails or alternatively, staples.

3.03 PROTECTION

A. Once installed, do not expose the geotextile to the atmosphere for more than 14 days.

B. Equipment having rubber tires may operate on the surface of the geotextile provided that the underlying material or subgrade is of adequate strength. Do not operate equipment having tracks on the surface of the geotextile.

C. Use lightweight construction vehicles for placement of the first lift of the aggregate base course or other material as shown on the Contract Drawings.

D. Avoid turning construction equipment on the geotextile and subsequently on first lift of the aggregate base course or other material as shown on the Contract Drawings. As necessary, construct turnouts to facilitate construction and allow construction vehicles to exit.

END OF SECTION

SECTION 313218

GEOTEXTILES

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of the GENERAL PROVISIONS:

A. Samples

1. If requested, submit to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, 3-foot length sample of the geotextile(s).

B. Certificates

1. Manufacturer's written certification that the geotextile complies with the requirements of this Section.
2. Manufacturer's ISO 9001:2000 certification.

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of the GENERAL PROVISIONS:

Samples

313218C01 If requested, submit to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, NJ 07310-1397, 3-foot length sample of the geotextile(s).

Certificates

313218E01 Manufacturer's written certification that the geotextile complies with the requirements of this Section.

313218E02 Manufacturer's ISO 9001:2000 certification.

DIVISION 33

SECTION 331110

EXTERIOR WATER SUPPLY SYSTEM

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for exterior water supply systems.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American National Standards Institute (ANSI)
ANSI B16.18	Cast Copper Alloy Solder Joint Pressure Fittings.
ANSI/NSF-61	Drinking Water Systems Components - Health Effects.
	ASTM International (ASTM)
ASTM A 240	Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
ASTM A 536	Specification for Ductile Iron Castings.
ASTM B 88	Specification for Seamless Copper Water Tube.
ASTM C 33	Specification for Concrete Aggregates.
	American Water Works Association (AWWA)
AWWA C 104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
AWWA C 105	Polyethylene Encasement for Ductile-Iron Pipe Systems.
AWWA C 110	Ductile-Iron and Gray-Iron Fittings.
AWWA C 111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
AWWA C 116	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
AWWA C 151	Ductile-Iron Pipe, Centrifugally Cast.
AWWA C 153	Ductile-Iron Compact Fittings.
AWWA C 223	Fabricated Steel and Stainless-Steel Tapping Sleeves.
AWWA C 502	Dry-Barrel Fire Hydrants.
AWWA C 509	Resilient-Seated Gate Valves for Water Supply Service.
AWWA C 512	Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
AWWA C 515	Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
AWWA C 550	Protective Interior Coatings for Valves and Hydrants.
AWWA C 600	Installation of Ductile-Iron Mains and Their Appurtenances.
AWWA C 651	Disinfecting Water Mains.
AWWA C 800	Underground Service Line Valves and Fittings.
	Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc.
MSS SP-60	Connecting Flange Joints between Tapping Sleeves and Tapping Valves.
	National Fire Protection Association (NFPA)
NFPA 24	Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.03 QUALITY ASSURANCE

A. Any entity performing the Work of this Section shall have at least three years of installation experience with exterior water supply systems of types and sizes similar to those required under this Contract.

B. Pipe will be visually inspected by the Engineer when delivered to the construction site. Damaged material or material not meeting the requirements of this Section shall be removed from the construction site and replaced undamaged, conforming, at no additional cost to the Authority.

C. Pipe may be inspected at the place of manufacture by the Engineer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for unloading, storing and moving of products.

B. Care shall be taken when storing pipe and appurtenances so as not to damage Authority or other public or private property. Restore areas which are damaged by the Contractor to their original condition, at no additional cost to the Authority.

C. As approved by the Engineer, place products delivered to the construction site along the route where they will be installed, or alternatively, in the Area Available for Contractor's Use, if such area is shown on the Contract Drawings. Stack ductile iron pipe in accordance with requirements of AWWA C 600.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. All products with wetted surfaces shall comply with ANSI/NSF-61.

B. Ductile Iron Pipe: 4 Inches and Larger

1. Manufacturers: Subject to compliance with requirements of this Section, furnish and install ductile iron pipe of one of the following manufacturers, no substitutions will be permitted:

a. American Cast Iron Pipe Company, Birmingham, AL.

b. McWane International, Birmingham, AL.

c. United States Pipe and Foundry Co., LLC., Birmingham, AL.

2. Ductile iron pipe shall conform to AWWA C 151, Special Thickness Class 52. Ductile iron pipe shall be furnished with interior cement-mortar lining which is twice the standard thickness specified in AWWA C 104, and an exterior asphaltic coating that is approximately 1-mil thick. Rubber gaskets shall conform to AWWA C 111.

C. Joint Restraint Systems

1. Where joint restraint is required for push on joint ductile iron pipe, use one of the following compatible systems, as approved by the ductile iron pipe manufacturer, to restrain push-on joints:

a. "Amarillo Fast-Grip Gaskets" as manufactured by American Cast Iron Pipe Company, Birmingham, AL.

a. "BOLT-LOK Restrained Joint Pipe" as manufactured by United States Pipe and Foundry Co., LLC., Birmingham, AL.

c. "FIELD LOK 350 Gaskets" as manufactured by United States Pipe and Foundry Co., LLC., Birmingham, AL.

d. "Flex-Ring Joint Pipe" including "Field Flex-Ring Joint Pipe" as manufactured by American Cast Iron Pipe Company, Birmingham, AL.

e. "SURE STOP 350 Gaskets" as manufactured by McWane International, Birmingham, AL.

b. "TR FLEX" as manufactured by United States Pipe and Foundry Company Co., LLC., Birmingham, AL, or McWane International, Birmingham, AL.

2. Where joint restraint is required for mechanical joint ductile iron pipe, use one of the following systems, as approved by the ductile iron pipe manufacturer, to restrain mechanical joints:

a. "BOLT-LOK Restrained Joint Pipe" for ductile iron pipe 4 inches through 24 inches, as manufactured by United States Pipe and Foundry Co., LLC., Birmingham, AL.

b. "MEGALUG Mechanical Joint Restraint" for ductile iron pipe 4 inches through 48 inches, as manufactured by EBAA Iron Sales, Inc. of Eastland, TX.

c. "MJ FIELD LOK Gaskets" as manufactured by United States Pipe and Foundry Co., LLC., Birmingham, AL, or McWane International, Birmingham, AL.

d. "ONE-LOK Series SLD" as manufactured by Sigma Corporation, Cream Ridge, NJ.

e. "ROMAGRIP Pipe Restraint" as manufactured by Romac Industries Inc., Bothell, WA.

f. "Uni-Flange Series 1400" as manufactured by The Ford Meter Box Company Inc., Wabash, IN.

D. Fittings for ductile iron pipe shall be ductile iron conforming to AWWA C 110 and AWWA C 153. Ductile iron fittings shall be furnished with interior cement-mortar lining that is twice the standard thickness specified in AWWA C 104 and an exterior asphaltic coating that is approximately 1-mil thick or, alternatively, coated with a minimum 6-mil thick fusion-bonded epoxy coating on the interior and exterior conforming to AWWA C 116.

1. Manufacturers: Subject to compliance with requirements of this Section, furnish and install ductile iron fittings of one of the following manufacturers, no substitutions will be permitted:

a. American Cast Iron Pipe Company, Birmingham, AL.

b. McWane International, Birmingham, AL.

c. Sigma Corporation, Cream Ridge, NJ.

d. Star Pipe Products, Houston, TX.

e. United States Pipe and Foundry Co., LLC., Birmingham, AL.

E. Copper Tubing: 2 Inches and Smaller

Shall meet the requirements of ASTM B 88, Type K, O50.

F. Fittings for copper tubing shall meet the requirements of ANSI B16.18 solder joint pressure fitting, flared joint fitting or compression fitting. Fittings and valves shall conform to AWWA C 800.

G. Fire Hydrants

1. Fire hydrants shall meet or exceed the requirements of AWWA C 502 and shall be furnished with a 5-1/4-inch main valve opening and a mechanical joint inlet connection. The size and thread configuration for the pumper nozzle (1 required) and hose nozzle (2 required) as well as the size and configuration of the operating and nozzle cap nuts shall comply with the requirements of the local fire department. See Appendix "B" for model and manufacturer of fire hydrants. No substitutions will be permitted.

H. Gate Valves, Tapping Gate Valves and Indicator Post Gate Valves

1. Manufacturers: Subject to compliance with requirements of this Section, furnish and install gate valve, tapping gate valve an indicator post gate valve of one of the following manufacturers, no substitutions will be permitted:

    a. Model No. A-USP2 for gate valve up to 12 inches and Model No. T-USP2 for tapping gate valve up to 12 inches as manufactured by United States Pipe Valve and Hydrant LLC., Chattanooga, TN.

    b. Model No. 4067-01 for gate valve up to 12 inches and Model No. 4751-01 for tapping gate valve up to 12 inches as manufactured by M&H Valve Company, Anniston, AL.

    c. Model No. A-2362 for gate valve up to 12 inches and Model No. T-2362 for tapping gate valve up to 12 inches as manufactured by Mueller Water Products Inc., Atlanta, GA.

    d. Model No. 8571(DB) for gate valve up to 12 inches and Model No. 8590 (DB) for tapping gate valve up to 12 inches as manufactured by Kennedy Valve, Elmira, NY.

    e. Model No. USP1 for gate valve 16 inches and larger as manufactured by United States Pipe Valve and Hydrant LLC., Decatur, IL.

    f. Model No. 4067-01 for gate valve 16 inches and larger as manufactured by M&H Valve Company, Anniston, AL.

    g. Model No. A-2361 for gate valve 16 inches and larger as manufactured by Mueller Company Water Products, Decatur, IL.

    h. Model No. W/2638:7571SS for gate valve 16 inches and larger as manufactured by Kennedy Valve Company, Elmira, NY.

    i. Model No. P2362 indicator post gate valve up to 12 inches as manufactured by Mueller Company Water Products, Decatur, IL.

    j. Model No. USP2 indicator post gate valve up to 12 inches as manufactured by United States Pipe Valve and Hydrant LLC., Decatur, IL.

    k. Model No. 4067-01P indicator post gate valve up to 12 inches as manufactured by M&H Valve Company, Anniston, AL.

    l. Model No. 8071-P(DB) indicator post gate valve up to 12 inches as manufactured by Kennedy Valve Company, Elmira, NY.

2. Gate valves and tapping gate valves shall be the same size as the pipe on which they are installed and shall be installed in a vertical orientation.

3. Gate valves and tapping gate valves for sizes 4 inch through 12 inch pipe shall be ductile iron full wall body thickness resilient-seated meeting or exceeding the requirements of AWWA C 509. The bonnet shall also be ductile iron. Gate valves and tapping gate valve shall be coated both inside and outside with resistant fusion-bonded epoxy conforming to the requirements of AWWA C 550. Unless otherwise shown on the Contract Drawings, gate valves shall have mechanical joint connections and O-ring seals and tapping gate valves shall have mechanical joint by flange joint connection and O-ring seals. Flanged joints shall meet the requirements of MSS SP-60. Gate valve and tapping gate valve shall be nut operated and non-rising stem. Clockwise torque shall be required to open the valves. Valves shall be rated for 250 psi working pressure, 500 psi hydrostatic test pressure.
4. Gate valves for 16 inch pipe and larger shall be ductile iron reduced wall body resilient-seated meeting or exceeding the requirements of AWWA C 515. Gate valves shall be coated both inside and outside with resilient fusion-bonded epoxy conforming to the requirements of AWWA C 550. Gate valves shall be furnished with nut operated, non-rising stem. Unless otherwise shown on the Contract Drawings, gate valves shall have mechanical joint connections, and O-ring seals. Where shown on the Contract Drawings, flanged joints shall meet the requirements of MSS SP-60. A clockwise torque shall be required to open the gate valve. Gate valves shall be rated for 200 psi working pressure, 400 psi hydrostatic test pressure.
5. Indicator post gate valves for sizes 4 inch through 12 inch pipe shall be ductile iron full wall body thickness resilient seated meeting or exceeding the requirements of AWWA C 509. The bonnet and stuffing box shall also be ductile iron. Indicator post gate valves shall be coated both inside and outside with resistant fusion-bonded epoxy conforming to the requirements of AWWA C 550. Unless otherwise shown on the Contract Drawings, the indicator post gate valve shall have mechanical joint connections and O-ring seals. Indicator post gate valves shall be nut operated and non-rising stem. Clockwise torque shall be required to open the valve. Indicator post gate valves shall be rated for 250 psi working pressure, 500 psi hydrostatic test pressure.

I. Corporation stop shall conform to AWWA C 800.

J. Indicator post shall be Model No. A 20806 as manufactured by Mueller Company Water Products, Decatur, IL; Model No. 2945A as manufactured by Kennedy Valve Company, Elmira, NY; or approved equal. Plainly mark the direction of operation with an arrow cast on the head of the post. Furnish lock with breakable hasp. Color of indicator post shall be red.

K. Tapping Sleeves

1. Manufacturers: Subject to compliance with requirements of this Section, furnish and install ductile iron pipe of one of the following manufacturers, no substitutions will be permitted:
   a. Cascade Waterworks Manufacturing Company, Yorkville, IL.
   b. Mueller Company Water Products, Decatur, IL.
   c. Romac Industries, Inc., Bothell, WA.
   d. United States Pipe Valve and Hydrant Division of Decatur, IL.

2. For wet tap to an existing ductile iron pipe, the tapping sleeve shall be stainless steel conforming to ASTM A 240, Type 304L and meeting or exceeding the requirements of AWWA C 223. Tapping sleeve shall be furnished with stainless steel flanged joint for the tapping gate valve.
3. For wet tap to an existing cast iron pipe, the tapping sleeve shall be full wall body thickness ductile iron meeting or exceeding ASTM A 536, Grade 65-45-12 with mechanical joint for the tapping gate valve.

L. Air release/vacuum relief valve shall be ductile iron and conform to AWWA C 512.

M. Crushed stone for bedding shall be crushed limestone, gneiss, trap rock aggregate conforming to ASTM C 33, Size No. 67.

N. Paint for rods, bands, nuts, bolts, washers, and other appurtenances shall be "Bitumastic 50" as manufactured by Carboline Company of St. Louis, MO, or approved equal.

O. Polyethylene Encasement

AWWA C 105, linear low-density (0.008-inch or 8-mil thickness) or high density, cross-laminated (0.004-inch or 4-mil thickness) polyethylene film. Color of polyethylene encasement shall be its natural color, including white and black, or black (weather resistant) containing not less than 2 percent carbon black with an average particle diameter of 50 millimeters or less. A minimum of 2 percent of a hindered-amine ultraviolet inhibitor is required in any natural or colored film except black film containing 2 percent or more carbon black.

PART 3. EXECUTION

3.01 VERIFICATION OF EXISTING UTILITIES

Where the exterior water supply system alignment crosses an existing utility as shown on the Contract Drawings, a minimum of 30 days prior to the start of the Work, excavate a test pit or perform other exploratory methods as approved by the Engineer and at no additional cost to the Authority, to verify the elevation and horizontal location.

3.02 INSTALLATION

A. Do not operate existing valves.

B. Excavation

1. The top of ductile iron pipe, fittings, valves and appurtenances shall have a minimum cover of four feet, unless otherwise shown on the Contract Drawings.
2. Excavate trench in accordance with Division 31 Section on excavation, backfilling and filling, to the alignment and elevation shown on the Contract Drawings. Prevent accumulation of water in trench. Place pipe and appurtenances in a dry trench.
3. Notify the Engineer if an obstruction that is not shown on the Contract Drawings is encountered and interferes with the installation of ductile iron pipe or appurtenances. Do not continue with installation of ductile iron pipe or appurtenances until directed by the Engineer.

C. Installation of Crushed Stone Bedding, Ductile Iron Pipe, Fittings, Gate Valves, Fire Hydrants and Appurtenances

1. Immediately prior to placing in trench, inspect all products in the presence of the Engineer to verify that they are internally clean and free of damage to the materials, linings and coatings. Remove and replace damaged products at no additional cost to the Authority.
2. Crushed stone bedding shall support the pipe such that the bottom reaction and support is confined completely to the pipe barrel.
3. If using the Tablet Method as specified in Section 4.4 of AWWA C 651 to disinfect the installation, secure calcium hypochlorite granules or tablets (5-gram calcium hypochlorite) to the top of joint in the ductile iron pipe with a food grade adhesive at upstream end of the ductile iron pipe prior to placing ductile iron pipe in the trench. Additionally, secure one calcium hypochlorite tablet in the fire hydrant and the lateral pipe connecting to each fire hydrant. Ensure that installation is kept dry and clean.
4. Install products in accordance with AWWA C 600 and Section 4 of AWWA C 651. Restrain products in accordance with the manufacturer's written instructions.
5. Backfill in accordance with the requirements of Division 31 Section on excavation, backfilling and filling. Backfill around pipe barrels only and perform field tests specified in 3.05. Backfill to elevations shown on the Contract Drawings after field tests are completed and approved by the Engineer.

D. Polyethylene Encasement

1. Install polyethylene encasement in accordance with any of the installation methods in Section 4.4 of AWWA C 105.
2. Thoroughly clean the surface of the ductile iron pipe, fittings and appurtenances prior to installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or bedding material from becoming trapped between the pipe and the polyethylene encasement.
3. Fit the polyethylene encasement to the contour of the ductile iron pipe to ensure a snug, but not tight, fit. In the case of fittings and appurtenances, provide sufficient slack in contouring to prevent stretching or damage to the polyethylene encasement during backfilling of the trench.
4. Secure overlaps and ends with adhesive tape, string or plastic tie straps to hold the polyethylene encasement in place so that soil does not get in between the ductile iron pipe, fittings and appurtenances and the polyethylene encasement.

E. Connection to Existing Water Supply System

1. Connect to existing water supply system after hydrostatic testing is completed and approved in writing by the Engineer.

F. Fire Hydrants

1. Hydrant nozzles shall be oriented so that they do not point directly at hydrant fenders or pipe guards, walls or other obstructions.

G. Remove, retain and relocate existing fire hydrants if shown on the Contract Drawings. Repair or replace any existing hydrant that is damaged during the performance of the Work, as approved by the Engineer, at no additional cost to the Authority.

H. Wet Tap

1. Prior to installing tapping sleeve, thoroughly clean the exterior surface of the existing pipe and lightly dust the interior surface of the tapping sleeve with calcium hypochlorite powder.
2. Where wet tapping existing pipes encased in polyethylene, apply a minimum of two wraps of polyethylene adhesive tape completely around the pipe prior to mounting the tapping machine and chain. After the wet tap is completed, inspect the polyethylene for damage. Repair any damage to the polyethylene, as approved by the Engineer, at no additional cost to the Authority.

I. Painting

1. Using a brush, apply two heavy coats of paint to all rods, bands, nuts, bolts, washers and other appurtenances prior to installing the polyethylene encasement, and to any rods, bands, nuts, bolts, washers and other appurtenances installed in a valve chamber structure.

3.03 PROTECTION

A. The interior of all products shall remain clean and ventilated at all times.

B. Do not damage or displace existing or newly installed products during construction of pipe supports, backfilling, and during field tests and other activities.

C. If products are contaminated, damaged or displaced, take remedial measures as approved by the Engineer including, at minimum, additional field tests, reinstallation of pipe or replacing pipe. Perform all such remedial measures at no additional cost to the Authority.

3.04 DISINFECTION, FLUSHING AND SAMPLING

A. Disinfect and flush the installation in accordance with AWWA C 651 and as follows:

1. Upon completion of the retention period required for disinfection, thoroughly flush the installation before it is connected to the existing system or placed in service. Ensure that the following minimum flow rate, which conforms to NFPA 24; paragraph 10.10.2.1, is achieved in the pipe during flushing operation:

Pipe Size (Inches)	Flow Rate (Gallons per Minute)
4	390
6	880
8	1560
10	2440
12	3520

2. Dispose of the chlorinated water in conformance with all federal, state and municipal laws, ordinances, rules and regulations. If there is any possibility that the chlorinated water being discharged will cause damage to the environment, apply a neutralizing chemical to the chlorinated water to reduce the residual chlorine remaining in the water.
3. After final flushing, have an independent testing laboratory sample, test and certify the water for conformance with the purity standards of the United States Environmental Protection Agency and the Federal Clean Water Act Health Standards. No installation will be approved without such certification.

3.05 FIELD TESTING

A. Furnish all equipment necessary to perform field tests.

B. Hydrostatic Testing

1. Air pressure testing will not be permitted.
2. Hydrostatic testing shall be performed in the presence of the Engineer for all products after installation and backfill as specified in 3.02 C.5. Do not perform hydrostatic testing on connections to existing water supply systems. Hydrostatic testing shall be in accordance with AWWA C 600 and as follows:
    a. The test pressure for the hydrostatic testing shall be 200 psi. No installation will be approved if the pressure is above 205 psi or below 195 psi at any time during the hydrostatic testing.
    b. The hydrostatic testing shall be of at least a 2 hour duration.
    c. Completely expel air from the section of the installation that will be subjected to the hydrostatic testing. At the conclusion of the hydrostatic testing, remove and plug any corporation cocks.
    d. Test pressure shall be achieved by gradual increase of pressure. Do not open or close gate valves under test pressure.
    e. The Engineer will inspect all exposed products during the hydrostatic testing. As approved by the Engineer, repair or replace any damaged or defective products and any visible leaks that are discovered during the hydrostatic testing at no additional cost to the Authority and repeat the hydrostatic testing to the satisfaction of the Engineer.
    f. No installation will be approved if during the hydrostatic testing, the quantity of water that must be added exceeds the quantity as determined by the following formula:

$$L = \frac{SD\sqrt{p}}{133{,}200}$$

Where:

L = the allowable quantity of water, in gallons per hour;

S = the length of pipe tested, in feet;

D = the nominal diameter of the pipe, in inches;

p = the average test pressure during the hydrostatic testing, in pounds per square inch (gauge).

If the quantity of water exceeds the rate as determined in above, locate the problem and repair, as approved by the Engineer, at no additional cost to the Authority. After the repair is completed, repeat the hydrostatic testing to the satisfaction of the Engineer.

C. Fire Hydrant Testing

1. Fire hydrant testing shall be performed after hydrostatic testing is complete and approved in writing by the Engineer.

   a. Connect a pressure pump to one of the fire hydrant's hose nozzles. Open the fire hydrant's main valve a few turns and allow the barrel to fill until the water is level with the bottom of the other outlet (hose or pumper) nozzle. After all air is expelled, replace and tighten the outlet (hose or pumper) nozzle cap. Completely open the fire hydrant's main valve. Close the gate valve located in the lateral pipe connecting to fire hydrant. Subject the fire hydrant to a pressure of 200 psi and visually inspect for leakage. If necessary, repair or replace the fire hydrant as approved by the Engineer and repeat this test, at no additional cost to the Authority.

   b. Assist the Engineer in determining that the residual water in the barrel of the fire hydrants properly drains. Close the fire hydrant main valve and remove one outlet nozzle cap. The Engineer will place the palm of one hand over the outlet nozzle opening to ensure that the residual water in the barrel of the fire hydrant properly drains such that a noticeable suction is felt. If in the opinion of the Engineer, the residual water does not properly drain, correct the drainage, as approved by the Engineer, at no additional cost to the Authority.

D. Connection to Existing Water Supply System

1. Connection to the existing water supply system shall be tested after connection is made prior to backfill.

2. The Engineer will inspect all exposed products. As approved by the Engineer, repair or replace any damaged or defective products at no additional cost to the Authority.

END OF SECTION

SECTION 331110

EXTERIOR WATER SUPPLY SYSTEM

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of the GENERAL PROVISIONS:

Catalog Cuts

331110B01 Catalog cuts for any product used in this Section. Ensure that fire hydrant size and thread configuration for the pumper nozzle and hose nozzle, as well as the size and configuration of the operating and nozzle cap nuts is clearly stated.

Certificates

331110E01 The material supplier, source and certified test data for gradation and composition of the crushed stone for bedding. The gradation report shall be current and representative of the material that will be supplied for the Work. Submit this information to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey 07310-1397.

Qualifications

331110K01 Resume indicating name, address and previous work experience of the entity performing the Work of this Section, prior to performing the Work of this Section.

331110K02 The name, address and qualifications of the independent testing laboratory to be employed to sample, test and certify the water for conformance to purity standards.

Inspection Reports

331110O01 Submit results of field tests specified in 3.05.

END OF APPENDIX "A"

SECTION 331110

EXTERIOR WATER SUPPLY SYSTEM

APPENDIX "B" - FIRE HYDRANTS

Facility	Model	Direction of Opening	Fire Hydrant Colors		
			Barrel	Bonnet	Outlet Caps
Port Newark	Metropolitan/M-94 (1)	Left	Yellow	Green	Yellow
Elizabeth Port Authority Marine Terminal	Metropolitan/M-94 (1)	Left	Red	Silver	Red
Auto Marine Terminal	Metropolitan/M-94 (1)	Left	Yellow	Green	Yellow
Howland Hook Marine Terminal	Metropolitan/M-94 (1)	Right	Black	Silver	Black
Brooklyn Marine Terminal	Metropolitan/M-94 (1)	Right	Black	Silver	Black
Newark Liberty International Airport (Standard Pressure)	Metropolitan/M-94 (1)	Left	Yellow	Green	Yellow
Newark Liberty International Airport (High Pressure)	Metropolitan/M-94 (1)	Left	Red	Red	Red
John F. Kennedy International Airport (Standard Pressure)	Metropolitan/M-94 (1)	Right	Black	Silver	Black
John F. Kennedy International Airport (Intermediate Pressure)	Metropolitan/M-94 (1)	Right	Black	Yellow	Yellow
John F. Kennedy International Airport (High Pressure)	Metropolitan/M-94 (1)	Right	Yellow	Yellow	Yellow
LaGuardia Airport (Standard Pressure)	Metropolitan/M-94 (1)	Right	Black	Silver	Black
LaGuardia Airport (High Pressure)	Metropolitan/M-94 (1)	Right	Yellow	Yellow	Yellow
Teterboro Airport	Metropolitan/M-94 (1)	Right	Red	Red	Red
Goethals and Bayonne Bridges and Outerbridge Crossing for NY Side Only	Metropolitan/M-94 (1)	Left	Red	Red	Yellow

(1) As manufactured by United States Pipe Valve and Hydrant Division of Decatur, Illinois. No substitutions permitted.

EXTERIOR WATER SUPPLY SYSTEM

APPENDIX "B" - FIRE HYDRANTS

(CONTINUED)

Facility	Model	Direction of Opening	Colors		
			Barrel	Bonnet	Outlet Caps
George Washington Bridge	American-Darling B-84-B-5 (2)	Left	Red	Red	Red
Lincoln Tunnel (NY and NJ)	American-Darling B-84-B-5 (2)	Left	Red	Red	Red

(2) As manufactured by American Flow Control; a division of American Cast Iron Pipe Company of Birmingham, Alabama.

END OF APPENDIX "B"

DIVISION 33

SECTION 334160

EXTERIOR STORM DRAINAGE SYSTEM

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for exterior storm drainage systems, including subdrains.

B. Definition of terms relating to reinforced concrete pipe and plastic pipe shall be in accordance with ASTM C 822 and ASTM D 883, respectively.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Association of State Highway and Transportation Officials (AASHTO)
AASHTO M 252	Specification for Corrugated Polyethylene Pipe, 75- to 250-mm (3- to 10-in.) Diameter.
AASHTO M 294	Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
AASHTO M 330	Specification for Polypropylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter.
	ASTM International (ASTM)
ASTM C 76	Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
ASTM C 33	Specification for Concrete Aggregates.
ASTM C 150	Specification for Portland Cement.
ASTM C 443	Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
ASTM C 507	Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe.
ASTM C 655	Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe.
ASTM C 822	Terminology Relating to Concrete Pipe and Related Products.
ASTM C 969	Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
ASTM C 1840	Practice for Inspection and Acceptance of Installed Reinforced Concrete Culvert, Storm Drain, and Storm Sewer Pipe.
ASTM D 883	Terminology Relating to Plastics.
ASTM D 3212	Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
ASTM D 3350	Specification for Polyethylene Plastics Pipe and Fittings Materials.

ASTM E 177	Practice for Use of the Terms Precision and Bias in ASTM Test Methods.
ASTM E 691	Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method.
ASTM F 477	Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
ASTM F 2487	Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High-Density Polyethylene and Polypropylene Pipelines.
	American Water Works Association (AWWA)
AWWA C 104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
AWWA C 105	Polyethylene Encasement for Ductile-Iron Pipe Systems.
AWWA C 111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
AWWA C 151	Ductile-Iron Pipe, Centrifugally Cast.

1.03 QUALITY ASSURANCE

A. Any entity performing the Work of this Section shall have at least three years of installation experience with storm water systems of types and sizes similar to that required under this Contract.

B. Pipe will be visually inspected by the Engineer when delivered to the construction site. Damaged material or material not meeting the requirements of this Section shall be removed from the construction site and replaced at no additional cost to the Authority.

C. Pipe may be inspected at the place of manufacture by the Engineer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with pipe manufacturer's written instructions for unloading, storing and moving pipe.

B. Care shall be taken when storing pipe and appurtenances so as not to damage Authority or other public or private property. Restore areas which are damaged by the Contractor to their original condition at no additional cost to the Authority.

C. As approved by the Engineer, place products delivered to the construction site along the route where they will be installed, or alternatively, in the Area Available for Contractor's Use, if such area is shown on the Contract Drawings.

1.05 IN-PLACE REQUIREMENTS

A. Acceptance of newly installed reinforced concrete pipe and ductile iron pipe shall be contingent upon the installation meeting criteria for "observations not requiring remediation" as defined in ASTM C 1840. All observations "requiring further engineer evaluation" and "requiring remediation" as defined in ASTM C 1840 shall be noted in the pipe inspection summary report in accordance with 3.03 herein and shall be remediated as approved by the Engineer at no additional cost to the Authority.

B. Acceptance of newly installed corrugated polyethylene and corrugated polypropylene pipe shall be contingent upon the installation meeting the following criteria:

   1. The maximum allowable vertical or horizontal pipe deflection is 5 percent of the original pipe diameter. Remove and replace any pipe exceeding 5 percent deflection at no additional cost to the Authority.

2. Any pipe joint that is crushed, faulted or separated greater than 3/4 inch, shall be repaired as approved by the Engineer.
3. No splits in the welded seams or cracks in the pipe wall.
4. No indication of wear, abrasion, impact damage or ultraviolet degradation.

1.06 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

Use any of the pipe systems specified below, unless otherwise shown on the Contract Drawings.

A. Reinforced Concrete Pipe
   1. Reinforced concrete pipe shall conform to ASTM C 76, Class V, Wall B or Wall C for circular pipe, ASTM C 507, Class HE-IV for horizontal elliptical Pipe and Class VE-VI for vertical elliptical pipe, unless otherwise shown on the Contract Drawings. Use ASTM C 150, Type II Portland cement. Lifting holes in pipe will not be permitted.
   2. Furnish watertight pipe joints conforming to ASTM C 443 of tongue and groove or bell and spigot style sealed with rubber gaskets. Rubber gaskets shall be the following types, as manufactured by Hamilton Kent Manufacturing Co., Winchester, TN, Press-Seal Corp., Fort Wayne, IN or approved equal:
      a. "Tylox Type C" for tongue and groove pipe joint.
      b. "Tylox SuperSeal", "Type 4G/4F"or "RFS Pipe Gasket" for offset style bell and spigot pipe joint.
      c. "Tylox O-Ring" or "Press-Seal O-Ring" for recessed style bell and spigot pipe joint.

B. Push-On Joint Ductile Iron Pipe
   1. Push-on joint ductile iron pipe shall conform to AWWA C 151, Special Thickness Class 52, unless otherwise shown on the Contract Drawings. Push-on joint ductile iron pipe shall be furnished with interior cement-mortar lining which is twice the standard thickness specified in AWWA C 104, and an exterior asphaltic coating approximately 1-mil thick.
   2. Seal pipe joints with continuous ring rubber gaskets conforming to AWWA C 111.
   3. Polyethylene encasement for ductile iron pipe shall conform to AWWA C 105, linear low-density (0.008-inch or 8-mil thickness) or high density, cross-laminated (0.004-inch or 4-mil thickness) polyethylene film. Color of polyethylene encasement shall be its natural color, including white and black, or black (weather resistant) containing not less than 2 percent carbon black with an average particle diameter of 50 millimeters or less. A minimum of 2 percent of a hindered-amine ultraviolet inhibitor is required in any natural or colored film except in black film containing 2 percent or more carbon black.

C. Corrugated Polyethylene Pipe

1. Three-inch through 10-inch diameter corrugated polyethylene pipe, including fittings, shall have a full circular cross section, with an outer corrugated pipe wall and a corrugated interior or smooth inner liner conforming to AASHTO M 294 with plant certification from the National Transportation Product Evaluation Program (NTPEP). Corrugations shall be annular. Pipe resin shall conform to ASTM D 3350 with a minimum cell classification 424420C and between 2 percent to 4 percent carbon black. Virgin and post-consumer and post-industrial recycled resins will be permitted. Mitered end sections shall not be constructed of polyethylene. Where shown on the Contract Drawings, use perforated corrugated polyethylene pipe with a manufacturer's installed geotextile wrap (sock) to prevent entry of aggregate through the perforations.
2. Twelve-inch through 60-inch diameter corrugated polyethylene pipe shall have a full circular cross section, with an outer corrugated pipe wall and a smooth inner liner conforming to AASHTO M 294 with plant certification from the National Transportation Product Evaluation Program (NTPEP). Corrugations shall be annular. Pipe resin shall conform to ASTM D 3350 with a minimum cell classification 435400C and between 2 percent to 4 percent carbon black. Virgin and post-consumer and post-industrial recycled resins will be permitted. Mitered end sections shall not be constructed of polyethylene.
3. Three-inch through 10-inch diameter pipe joints shall be soil-tight conforming to AASHTO M 252. Twelve-inch through 60-inch diameter pipe joints shall be watertight conforming to ASTM D 3212. Gaskets shall be made of polyisoprene conforming to ASTM F 477 and shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the pipe manufacturer shall be used on the gasket and bell during assembly.

D. Corrugated Polypropylene Pipe

1. Twelve-inch through 60-inch diameter polypropylene pipe shall have a full circular cross section, with an outer corrugated pipe wall and a smooth inner liner conforming to AASHTO M 330 with plant certification from the NTPEP. Corrugations shall be annular. Polypropylene compound shall be made of virgin polypropylene compound meeting the properties of AASHTO M 330, Section 6. Post-consumer and post-industrial recycled resins will not be permitted. Mitered end sections shall not be constructed of polypropylene.
2. Twelve-inch through 60-inch diameter pipe joints shall be watertight conforming to ASTM D 3212. Gaskets shall be made of polyisoprene conforming to ASTM F 477 and shall be installed by the pipe manufacturer and covered with a removable wrap to ensure the gasket is free from debris. A joint lubricant supplied by the pipe manufacturer shall be used on the gasket and bell during assembly.

E. Crushed stone for pipe bedding shall be crushed limestone, gneiss or trap rock conforming to ASTM C 33, size No. 67.

F. Crushed stone for subdrains shall be washed crushed limestone, gneiss or trap rock conforming to ASTM C33 size No. 67.

PART 3. EXECUTION

3.01 VERIFICATION OF EXISTING UTILITIES

Where the exterior storm drainage system alignment crosses an existing utility as shown on the Contract Drawings, a minimum of 30 days prior to start of the Work excavate a test pit or perform other exploratory methods as approved by the Engineer and at no additional cost to the Authority, to verify the elevation and horizontal location.

3.02 INSTALLATION

A. Excavation

1. Excavate trench in accordance with Division 31 Section on excavation, backfilling and filling and as noted herein to the alignment and elevation shown on the Contract Drawings. Prevent accumulation of water in trench. Place pipe in a dry trench.
2. Notify the Engineer if an obstruction that is not shown on the Contract Drawings is encountered and interferes with the installation of the pipe or appurtenances. Do not continue with installation of the pipe or appurtenances until directed by the Engineer.
3. In the course of excavation for reinforced concrete pipe or ductile iron pipe, should the trench or subtrench width exceed the outside diameter of pipe plus two feet for nominal diameters up to 18 inches or outside diameter plus three feet for nominal diameters in excess of 18 inches, the Engineer may require remedial measures to reduce the load on the pipe, such as the use of a concrete cradle or reinforced concrete encasement at no additional cost to the Authority. A subtrench is defined as a trench excavated for pipe placement within a wider trench.
4. For corrugated polyethylene pipe and corrugated polypropylene pipe, where trench walls are stable or supported, provide a width sufficient, but not greater than necessary, to ensure working room to properly and safely place and compact haunching and other embedment materials. The space between the pipe and trench wall must be wider than the compaction equipment used in the pipe zone. Minimum width shall be not less than the greater of either the pipe outside diameter plus 16 inches or the pipe outside diameter times 1.25, plus 12 inches.

B. Pipe Support

1. Where shown on the Contract Drawings, use a concrete cradle to support the pipe at proper alignment and elevation and place concrete to dimensions shown on the Contract Drawings. The concrete cradle, when cured, shall support the full length of pipe.
2. Where shown on the Contract Drawings, use crushed stone bedding material to support the pipe at proper alignment and grade. Place and compact crushed stone bedding material in the bottom of the trench to provide a firm, but slightly yielding surface and to an elevation such that pipe laid on same will be at the proper grade and alignment. Make suitable excavations for the pipe bells, where applicable, so that the bottom reaction and support are confined to the pipe barrel. After installation of pipe on the compacted crushed stone bedding material layer, place and compact additional crushed stone bedding material in small lifts to the dimensions shown on the Contract Drawings.

C. Polyethylene Encasement for Ductile Iron Pipe

1. Install polyethylene encasement in accordance with any of the installation methods specified in Section 4.4 of AWWA C 105.

2. Thoroughly clean the surface of the pipe prior to installation of the polyethylene encasement. During installation, care shall be exercised to prevent soil or bedding material from becoming trapped between the pipe and the polyethylene encasement.
3. Fit the polyethylene encasement to the contour of the pipe to ensure a snug, but not tight, fit. In the case of bell spigot interfaces or fittings, provide sufficient slack in contouring to prevent stretching or damage to the polyethylene encasement during backfilling of the trench.
4. Secure overlaps and ends with adhesive tape, string or plastic tie straps to hold the polyethylene encasement in place to prevent intrusion of soil between the ductile iron pipe, fittings and appurtenances and the polyethylene encasement.

D. Pipe Installation

1. Immediately prior to placement in the trench, inspect all pipe in the presence of the Engineer to verify that it is internally clean and free of damage. Remove damaged pipe from the construction site and replace to the satisfaction of the Engineer, at no additional cost to the Authority.
2. When lowering pipe into the trench and joining the pipe lengths, take precautions to ensure that the interior of the pipeline remains clean.
3. For subdrains, place geotextile (fabric) in trench and then place washed crushed stone in maximum 6-inch lifts to ensure proper alignment and elevation. Compact each lift of washed aggregate with two passes of a vibrating pad compactor.
4. Lay pipe true to alignment and elevation, with uniform bearing under the full length of its barrel, without break from structure to structure, and with bell or grooved end facing upgrade. Adjustments to alignment and elevation shall be made by scraping away or adding bedding material under the pipe.
5. Prior to start of construction, submit the method for control of alignment and grade for approval. The method shall be a laser system or grade board setup to establish a reference grade and alignment control directly above or within the pipe. Use of other equipment may be substituted if, in the opinion of the Engineer, the alternative system produces equivalent accuracy.
6. Make up pipe joints in accordance with the pipe manufacturer's written instructions and taking extreme care that joints are clean and free of foreign materials. Support pipe free of the bedding during the joining process to avoid disturbing the subgrade.
7. Use a come along and winch or other equipment when necessary to install large diameter pipes. Use inserts to prevent the pipe from being thrust completely home prior to checking gasket location. After the gasket is checked, remove the inserts and complete the joint.
8. Close all openings in the pipeline with watertight plugs when pipe laying is stopped at the conclusion of the Work period or if Work is interrupted for any reason.

E. Backfilling

1. Proceed with backfilling only after the Engineer has visually inspected the installed pipes.
2. Backfill and compact the trench from the top of the crushed stone bedding, or concrete cradle, as shown on the Contract Drawings in accordance with Division 31 Section on excavation, backfilling and filling.

3. After backfill material has been placed and compacted to a depth not less than one foot above top of pipe, make a visual inspection by flashing a light between manholes and drainage structures. Correct any displacement or misalignment of the pipe invert.

3.03 POST PIPE INSTALLATION INSPECTION

A. Pipes with a diameter less than 12-inches will not require post pipe installation inspections.

B. Arrange and pay for all post pipe installation inspections to be performed by a National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) certified technician. If the pipe is considered a confined space, submit documentation of training and entry for the technician in accordance with OSHA requirements.

C. At least 30 days prior to performing the post pipe installation inspection (herein after "inspection"), submit to the Engineer a schedule for performing the inspection.

D. Dewater installed pipe and remove all silt, debris and obstructions prior to performing the inspection.

E. In the presence of the Engineer, perform the inspection no sooner than 30 days after completion of the pipe installation and placement of backfill material reaches 3 feet above the pipe crown and before any pavement or other structures is installed. Do not continue with backfill above 3 feet of pipe crown or install any pavement structure until the pipe installation is accepted by the Engineer.

F. Use a crawler mounted camera and measurement technology to perform remote inspection. Use low barrel distortion video equipment with laser profile and measurement equipment and technology, non-contact video micrometer and associated software. Furnish a high-quality DVD in a MPEG2 format video with a standard resolution of 720 x 480. Use a camera with adequate lighting to illuminate the entire periphery of the pipe. Center the camera in the pipe both vertically and horizontally and be able to pan and tilt to a 90-degree angle with the axis of the pipe and rotating 360 degrees. Use equipment to move the camera through the pipe that will not obstruct the camera's view or interfere with proper documentation of the pipe's condition. The recorded video image shall be clear, focused, and relatively free from roll, static or other image distortion that would prevent the Engineer from evaluating the condition of the pipe. Move the camera through the pipe at a speed not greater than 30 feet per minute. The equipment shall be capable of measuring the distance traveled with an accuracy of one foot per 100 feet.

G. Certify that laser profiling and crack/joint measurement technology is in compliance with ASTM E 691 and ASTM E 177, which includes the following calibration criteria: The equipment and software used must be tested and approved by a recognized independent testing group and include a tested certified accuracy of 0.5 percent or better and a repeatability of 0.12 percent or better. Laser profiling technology may utilize actual pipe diameter as measured with this device to calculate percent deflection and ovality.

H. If mandrels are used to check corrugated polyethylene pipe and/or corrugated polypropylene pipe for deflection, they shall be nine (or greater odd number) arm, non-adjustable, fixed arm mandrels, and shall be sized utilizing the appropriately sized proving rings prior to testing. Clearly label the mandrel size and size the mandrel to provide a diameter of at least 95percent of the allowable minimum inside diameter in accordance with AASHTO M 294 and AASHTO M 330. A measurement shall be taken once every 10 feet for the length of the pipe installation, except that a minimum of 4 measurements per pipe installation is required.

I. Pipe Inspection Summary Report Requirements

1. Not later than 5 days after completion of the inspection for each pipe run, submit a pipe inspection summary report and all recorded video/still digital images to the Engineer.
2. The recorded video shall include the following information:
    a. The recorded video/still digital images to clearly show the conditions of the interior of the pipe and detect any defects within the pipe as specified in 1.05 herein and the following:
        (1) Film the entire circumference at each joint.
        (2) Stop the camera and pan when necessary to document and measure defects. Position the camera head perpendicular to all defects requiring measurement by the video micrometer.
    b. The project name and number, the location of the inspection access point of the pipe being inspected with respect to the Contract Drawings (e.g., north/south/ east/west end of the pipe, manhole/drop inlet/junction box structure number).
    c. The size of pipe, date/time, direction of travel (upstream or downstream), distance in feet from the inspection access point, which pipe is being inspected (if multiple pipes are connected to the inspection access point), and any other identifying factors needed to locate the pipe in the field at a future date.
    d. A textual note on the video/still digital images and a verbal description to identify all deficiencies. The location and description of the deficiency shall be added to the recording using an audio microphone.
3. At a minimum, the pipe inspection summary report shall include the following:
    a. Actual recorded length and width measurements of all cracks within the pipe.
    b. Actual recorded separation measurement of all rigid pipe joints.
    c. Detailed written observations of leaks, debris or other damage or defects.
    d. For each corrugated polyethylene and corrugated polypropylene pipe run include pipe deformation/deflections measurements with the 5percent deflection limit clearly delineated.
    e. A still image with a written description of type, severity and extent of deficiency/deficiencies in an area that exceed acceptance criteria as specified in 1.05 herein.
    f. Each still image with description of deficiency shall include reference to allow the Engineer to correlate the still image with the inspection video footage. If a deficiency continuously occurs along the pipe wall, note the extent of the condition and include at least one still image that best represents the condition. If person-entry inspection is utilized, include the actual field measurements taken for all deficiencies in the written description.

g. If no deficiencies are observed, an "OK" entry shall be made in the report for each section of pipe inspected.

h. When deficiencies that require corrective Work are identified, include corrective Work.

i. Documentation that the inspection personnel performing in-field inspections and preparing the pipe inspection summary report are certified technicians in accordance with this Section.

j. Documentation of type of equipment utilized for the inspection and clearly provide data to prove the equipment used meets this Section.

k. A statement of field accuracy achieved for all measurements including plus/minus tolerances. The report shall also include a narrative about required field/measurement calibration and provide proof that all calibration procedures were followed when collecting data within the report.

4. The Engineer will review the pipe inspection summary report including any corrective Work and communicate its determination within 10 days of receiving the pipe inspection summary report. Proceed with the corrective Work only after receiving approval by the Engineer.

5. Upon completion of the corrective measures, re-inspect the pipe installation and resubmit pipe inspection summary report and all recorded video/still digital images to the Engineer. Re-inspection shall be made within 10 days of completing the corrective Work, except where sections of pipe have been replaced re-inspection shall not occur sooner than 30 days after replacement of pipe and final cover (except for pavement structure). Any necessary reinspection of the pipe installation and corrective Work shall be completed in accordance with the requirements of this Section at no additional cost to the Authority.

3.04 INFILTRATION/EXFILTRATION TESTING

A. If shown on the Contract Drawings, perform infiltration/exfiltration testing of all installed pipes. Pipes with a diameter less than 12-inches will not require infiltration/exfiltration testing.

B. Equipment and procedures used in the performance of the infiltration/exfiltration testing shall be in accordance with ASTM C 969 for reinforced concrete pipe and ASTM F 2487 for corrugate polyethylene or polypropylene pipe and subject to the approval of the Engineer.

C. When infiltration testing is used, measure the amount of infiltration with a weir or other suitable measuring device.

D. The allowable infiltration rate including manholes shall be 200 gallons per inch of internal diameter per mile of storm sewer pipe tested per 24 hours, when the average groundwater head on the test section is 6 feet or less. When the average groundwater head on the test section is over 6 feet, the allowable infiltration rate shall be that calculated above multiplied by the ratio of the square root of the average groundwater head to the square root of the base head of 6 feet. If the infiltration rate exceeds the allowable limits given above, take the following remedial action:

1. Remove and replace the entire length of pipes at no additional cost to the Authority, or;

2. At the Contractor's discretion, conduct additional infiltration testing at no additional cost to the Authority to determine if the excess infiltration rate is attributed to certain pipe(s). Remove and replace certain pipes at no additional cost to the Authority.
3. Repeat infiltration testing until all installed pipes meet the allowable infiltration rate.

E. When infiltration testing is not practicable because of dry trench conditions, perform exfiltration testing. For exfiltration testing, the allowable leakage limit including manholes shall be 200 gallons per inch of internal diameter per mile of storm sewer pipe tested per 24 hours, when the average head on the test section is 3 feet or less. When the average head on the test section is greater than 3 feet, the allowable leakage shall be that calculated above multiplied by the ratio of the square root of the average test head to the square root of the base test head of 3 feet. Perform exfiltration testing, where directed by the Engineer, as follows:
1. Fill the pipes between successive manholes using a manhole standpipe system to provide the required test head.
2. Determine leakage by measuring the amount of water required to maintain the required test head for the required test period.
3. If exfiltration leakage exceeds the rate specified above, proceed with the removing and replacing the defective pipes as specified in 3.04 D.

F. Prior to performing the exfiltration testing, brace all storm sewer pipes in both lateral directions to preclude movement of the pipes.

G. Submit one copy of all test result data to the Engineer daily.

3.05 PROTECTION

A. Do not damage or displace existing or installed products during construction of pipe supports, backfilling, testing and other activities.

B. Where products are damaged or displaced, take remedial measures as approved by the Engineer including, but not limited to, reinstallation of pipe or replacing pipe, and/or testing of joints. Perform all such remedial measures at no additional cost to the Authority.

END OF SECTION

SECTION 334160

EXTERIOR STORM DRAINGE SYSTEM

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of the GENERAL PROVISIONS:

Catalog Cuts

334160B01 Submit catalog cuts of gaskets for pipe joints, including manufacturer's installation instructions.

Certificates

334160E01 Submit certificate from the pipe manufacturer certifying that the pipe complies with the requirements specified in this Section.

334160E02 Submit certification for the laser profiling and crack/joint measurement technology.

334160E03 Submit the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) certification for the technician.

334160E04 Submit the material supplier, source and certified test data for gradation and composition of the crushed stone. The gradation report shall be current and representative of the material that will be furnished and installed in the Work. Submit this information to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey 07310-1397.

Construction and Installation Procedures

334160G01 Submit the method for control of alignment and grade of pipe during installation.

Inspection Reports

334160O01 Submit inspection summary report(s) for post pipe installation site inspections, including certification for the laser profiling and measurement equipment and technology.

END OF APPENDIX "A"

DIVISION 33

SECTION 334914

MANHOLE AND DRAINAGE STRUCTURES

PART 1. GENERAL

1.01 SUMMARY

A. This Section specifies requirements for precast and cast-in-place concrete manhole and drainage structures.

B. Definition of terms shall be in accordance with ASTM C 822.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

	American Concrete Institute (ACI)
ACI 318	Building Code Requirements for Structural Concrete and Commentary.
	ASTM International (ASTM)
ASTM A 48	Specification for Gray Iron Castings.
ASTM A 536	Specification for Ductile Iron Castings.
ASTM C 33	Specification for Concrete Aggregates.
ASTM C 39	Test Method for Compressive Strength of Cylindrical Concrete Specimens.
ASTM C 55	Specification for Concrete Building Brick.
ASTM C 443	Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
ASTM C 497	Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile.
ASTM C 822	Terminology Relating to Concrete Pipe and Related Products.
ASTM C 913	Specification for Precast Concrete Water and Wastewater Structures.
ASTM C 923	Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
ASTM C 990	Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
ASTM C 1107	Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
ASTM C 1329	Specification for Mortar Cement.

1.03 SITE CONDITIONS

Environmental Conditions: Cold and hot weather requirements shall conform to the applicable requirements of Division 03 Section on Portland cement concrete except that in a precast plant the ambient temperature may be below 40 degrees F providing that the forms and product are preheated and heat cured and protected. Temperature recording devices shall be used.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. Where a precast concrete manhole and drainage structure is shown on the Contract Drawings, as approved by the Engineer the Contractor may submit a substitution for the cast-in-place concrete structure which conforms in size and strength to the precast concrete structure shown on the Contract Drawings and as specified in this Section. Where a cast-in-place concrete manhole and drainage structure is shown on the Contract Drawings, as approved by the Engineer the Contractor may submit a substitution for the precast concrete structure which conforms in size and strength to the cast-in-place concrete structure shown on the Contract Drawings and as specified in this Section. Equivalent strength of substituted structure shall be based on structural design of reinforced concrete in accordance with ACI 318.

B. Design of lifting devices for precast concrete manhole and drainage structures shall conform to ASTM C 913.

C. Design of joints for precast concrete manhole and drainage structures shall conform to ASTM C 913. Unless otherwise shown on the Contract Drawings, joints shall be designed for leakage not to exceed 0.025 gallons per hour per foot of joint at 3 feet of head.

1.05 QUALITY ASSURANCE

A. Design Calculations: Where the Contractor elects to submit a substitute precast or cast-in-place drainage structure, design calculations shall be prepared by a Professional Engineer licensed in the state where the manhole and drainage structure will be installed. The design calculations shall demonstrate that the substituted concrete manhole and drainage structure is equivalent in size and strength to the concrete manhole and drainage structure shown on the Contract Drawings, based on structural design of reinforced concrete in accordance with ACI 318.

B. Precast concrete manhole and drainage structures, including casting quality, will be visually inspected by the Engineer when delivered to the construction site. Damaged material or material not meeting the requirements of this Section shall be removed from the construction site and replaced by the Contractor at no additional cost to the Authority.

C. Precast concrete manhole and drainage structures may be inspected by the Engineer at the place of manufacture.

D. For cast-in-place concrete manhole and drainage structures, do not place concrete until the Engineer has inspected the formwork and verified that the dimensions and concrete reinforcing are in accordance with details shown on the Contract Drawings, on approved shop drawings and as specified in this Section.

E. Conform to the applicable requirements for quality assurance as specified in Division 03 Section on Portland cement concrete except that, if the concrete is precast, the producer shall maintain a fully equipped testing lab and employ a Quality Control Technician to perform Quality Control Tests. Unless otherwise shown on the Contract Drawings, Quality Control Tests for precast concrete shall consist of compression tests on a minimum of two cylinders for each day's production tested in accordance with ASTM C 39 for cylinders or ASTM C 497 for drilled cores. Acceptance shall be based on the requirements of ACI 318.

F. Tolerances of dimensions, squareness, joint surfaces, location of reinforcement and thickness of slabs and walls for precast concrete manhole and drainage structures shall conform to ASTM C 913.

G. Castings shall be of uniform quality, free from sand holes, shrinkage cracks and other defects. Surface of the castings shall be free from burnt-on sand and shall be smooth. Bearing surfaces between grates or covers and frames shall be cast or machined with such precision that continuous, full and uniform bearing is provided throughout the perimeter area of contact. The bearing contact with the frame shall be non-rocking when in place and under the influence of traffic or other loads. Pairs of machined castings shall be match marked to facilitate subsequent identification at installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with precast concrete fabricator's written instructions for unloading, storing and moving precast concrete manhole and drainage structures.

B. Care shall be taken when storing precast concrete manhole and drainage structures to prevent damage to Authority or other property, and any property so damaged shall be repaired by the Contractor at no additional cost to the Authority.

C. Each precast concrete manhole and drainage structure shall be clearly marked by indentation or waterproof paint to indicate the date of fabrication, fabricator, and structure type and name as shown on the Contract Drawings.

1.07 SUBMITTALS

See Appendix "A" for submittal requirements.

PART 2. PRODUCTS

2.01 MATERIALS

A. Portland Cement Concrete

1. Portland cement concrete shall be Performance Category VI and attain a minimum 28-day compressive strength of 5000 psi for precast and 4000 psi for cast-in-place concrete manholes and drainage structures in accordance with Division 03 Section on Portland cement concrete.

B. Preformed Flexible Joint Sealant

1. Seal joints between precast sections which occur 4 feet or more below finished grade.
2. When necessary, seal joints between precast sections with a preformed flexible joint sealant conforming to ASTM C 990, except that sealant size, length, quantity of primer and packing material shall be in accordance with the sealant manufacturer's written recommendations.

3. Manufacturers: Subject to compliance with requirements of this Section, preformed flexible joint sealant shall be of one of the following manufacturers, or approved equal:
   a. "ConSeal CS-102" as manufactured by Concrete Sealants, Inc.; Tipp City, OH.
   b. "RAM-NEK" as manufactured by Henry Co.; El Segundo, CA.
   c. "Pro-Stik" as manufactured by Press-Seal Corp.; Fort Wayne, IN.

C. Resilient Connectors
1. Resilient connectors shall conform to ASTM C 923.
2. Manufacturers: Subject to compliance with requirements of this Section, resilient connectors shall be of one of the following manufacturers, or approved equal:
   a. A-LOK Products, Inc.; Tullytown, PA.
   b. Press-Seal Corp.; Fort Wayne, IN.
   c. Trelleborg Pipe Seals Milford, Inc.; Milford, NH.

D. Steel Reinforcement
1. Steel reinforcement shall conform to Division 03 Section on concrete reinforcement.
2. There shall be a continuity of reinforcement at all corners of the precast and cast-in-place concrete manhole and drainage structure.

E. Frames, Drainage Grates and Manhole Covers
1. Unless otherwise shown on the Contract Drawings, fabricate frames of the type(s) shown on the Contract Drawings of Class 35B cast iron conforming to ASTM A 48.
2. Fabricate manhole cover and drainage grate of the type and material shown on the Contract Drawings. Where cast iron is shown, fabricate manhole cover and drainage grate of Class 35B cast iron conforming to ASTM A 48. Where ductile iron is shown, fabricate manhole cover and drainage grate of Grade 65-45-12 or Grade 80-55-06 ductile iron conforming to ASTM A 536. Ductile iron manhole cover and drainage grate shall bear the letters "D.I." in a clearly visible manner on the upper surface.
3. Identify each frame and drainage grate or manhole cover by the name of the fabricating foundry, origin and date of fabrication, ASTM designation number and class of cast iron or grade of ductile iron or other material.

F. Concrete Brick, Mortar Cement and Hydraulic-Cement Grout (Non-Shrink)
1. Concrete brick shall conform to ASTM C 55.
2. Hydraulic-cement grout (non-shrink) shall conform to ASTM C 1107.
3. Mortar cement shall conform to ASTM C 1329, Type M.

G. Crushed Stone Bedding

Crushed stone for pipe bedding shall be crushed limestone, gneiss or trap rock aggregate conforming to ASTM C 33, size number 67.

PART 3. EXECUTION

3.01 PREPARATION

A. Ensure proper orientation of the manhole and drainage structure to accommodate pipes.

B. Immediately prior to placement in the excavation, precast concrete manhole and drainage structures shall be inspected in the presence of the Engineer to verify that they are internally clean and free of damage. Remove any damaged structure from the construction site and replace, at no additional cost to the Authority. Subject to the approval of the Engineer, a damaged precast concrete manhole and drainage structure may be repaired in a manner that ensures that the structure will conform to the requirements of this Section and its intended use. Acceptance of a repaired manhole and drainage structure is at the sole discretion of the Engineer.

3.02 INSTALLATION

A. Excavation and Backfill

1. Excavate for manhole and drainage structure in accordance with Division 31 Section on excavation, backfilling and filling in the location and to depth shown on the Contract Drawings. Provide clearance around the sidewalls of the manhole and drainage structure as required for construction.
2. Prevent accumulation of water in excavations. Place manhole and drainage structure in a dry trench.

B. Support and Backfilling

1. Support manhole and drainage structure to proper grade and alignment on crushed stone bedding or other support system as shown on the Contract Drawings.
2. Backfill excavation for manhole or drainage structure in accordance with Division 31 Section on excavation, backfilling and filling.

C. Precast Concrete Manhole and Drainage Structures

1. Lift and handle precast concrete manhole and drainage structure only at the lifting points so designated by the fabricator.
2. When lowering precast concrete manhole and drainage structure into the excavation and joining pipe to the structure, take precautions to ensure that the interior of the pipes and the manhole and drainage structure remains clean.
3. Set precast concrete manhole and drainage structure so that it is fully bearing on crushed stone bedding, compacted in accordance with Division 31 Section on excavation, backfilling and filling or set on other support system as shown on the Contract Drawings.
4. For a precast concrete manhole and drainage structure consisting of multiple sections, lower and set the base section before placing additional sections. Avoid misalignment by using guide devices affixed to the lower section, or as otherwise approved by the Engineer. Prior to setting subsequent sections, ensure that the joint surface is clean. Place the preformed flexible joint sealant in accordance with the manufacturer’s written instructions. Preformed flexible joint sealant may be installed at the fabricator's plant prior to delivering to construction site.
5. Verify that the installed manhole and drainage structure meets the required alignment and grade.
6. If the precast concrete manhole and drainage structure is not fabricated with the necessary pipe openings, then core drill the precast concrete manhole and drainage structure for the pipes so as not to create an opening larger than that required to install the pipes. Fill resultant annular space between the pipes and wall of the manhole and drainage structure with mortar cement. Cut pipes flush with the interior of the structure.

7. Shape inverts through manhole as shown on the Contract Drawings.
8. Remove all lifting devices and plug the recesses with mortar cement.

D. Cast-In-Place Concrete Manhole and Drainage Structures

1. Prepare crushed stone bedding or other support system as shown on the Contract Drawings to receive the base slab as specified for precast structures in 3.02 C.3.
2. Erect forms in accordance with Division 03 Section on concrete formwork and ensure that forms are braced against all movement.
3. Furnish and install reinforcing steel in accordance with the details shown on the Contract Drawings and in accordance with Division 03 Section on concrete reinforcement.
4. After formwork and reinforcing steel are inspected and approved by the Engineer, place and cure concrete in accordance with Division 03 Section on Portland cement concrete.
5. Complete installation as specified in 3.02 C.5. through 3.02 C.7.

E. Frames and Manhole Covers or Drainage Grates

1. Set frame using mortar cement and masonry as shown on the Contract Drawings. Radially laid concrete brick shall have 1/4-inch thick vertical joints at inside perimeter. Lay all concrete brick in a full bed of mortar cement and completely fill all joints. Where more than one course of concrete brick is required, stagger vertical joints.
2. In grass areas, set frame and manhole cover two inches above finished grade.
3. Set frame and drainage grate flush with finished grade.
4. Fit and match-mark frame and manhole cover or drainage grate to avoid rocking of manhole cover and drainage grate. Set all castings firm and snug to avoid rattle.

END OF SECTION

SECTION 334914

MANHOLE AND DRAINAGE STRUCTURES

APPENDIX "A"

SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples" of the GENERAL PROVISIONS:

Shop Drawings
334914A01 Precast concrete and cast-in-place concrete manhole and drainage structures.

Catalog Cuts
334914B01 Frame, drainage grate and manhole cover.

334914B02 Preformed flexible joint sealant for joints in precast concrete manhole and drainage structures, including manufacturer's installation requirements.

334914B03 Resilient connectors, including manufacturer's installation requirements.

Certificates
334914E01 The material supplier, source, and certified test data for gradation and composition of the crushed stone for bedding. The gradation report shall be current and representative of the material that will be furnished and installed in the Work. Submit this information to the Chief of Materials Engineering, Materials Engineering Unit, Port Authority Technical Center, 241 Erie Street, Jersey City, New Jersey 07310-1397.

Calculations
334914H01 For design of a substitute concrete manhole and drainage structure, at Contractor's option.

END OF APPENDIX "A"

Construction Project Daily Inspection Checklist

ATTACHMENT A

Construction Project Daily Safety Inspection Checklist

The situations identified below are potentially hazardous conditions that may occur during airport construction projects. Safety area encroachments, unauthorized and improper ground vehicle operations, and unmarked or uncovered holes and trenches near aircraft operating surfaces pose the most prevalent threats to airport operational safety during airport construction projects.

Date: _ ______________________________	Prepared By: ______________________________

Potentially Hazardous Conditions

Item	Action Required	Or	None
Excavation adjacent to runways, taxiways, and aprons improperly backfilled.			☐
Mounds of earth, construction materials, temporary structures, and other obstacles near any open runway, taxiway, or taxi lane; in the related Object Free area and aircraft approach or departure areas/zones; or obstructing any sign or marking.			☐
Runway resurfacing projects resulting in lips exceeding 3 in (7.6 cm) from pavement edges and ends.			☐
Heavy equipment (stationary or mobile) operating or idle near AOA, in runway approaches and departures areas, or in OFZ.			☐
Equipment or material near NAVAIDs that may degrade or impair radiated signals and/or the monitoring of navigation and visual aids. Unauthorized or improper vehicle operations in localizer or glide slope critical areas, resulting in electronic interference and/or facility shutdown.			☐
Tall and especially relatively low visibility units (that is, equipment with slim profiles) — cranes, drills, and similar objects — located in critical areas, such as OFZ and approach zones.			☐
Improperly positioned or malfunctioning lights or unlighted airport hazards, such as holes or excavations, on any apron, open taxiway, or open taxi lane or in a related safety, approach, or departure area.			☐
Obstacles, loose pavement, trash, and other debris on or near AOA. Construction debris (gravel, sand, mud, paving materials) on airport pavements may result in aircraft propeller, turbine engine, or tire damage. Also, loose materials may blow about, potentially causing personal injury or equipment damage.			☐
Inappropriate or poorly maintained fencing during construction intended to deter human and animal intrusions into the AOA. Fencing and other markings that are inadequate to separate construction areas from open AOA create aviation hazards.			☐
Improper or inadequate marking or lighting of runways (especially thresholds that have been displaced or runways that have been closed) and taxiways that could cause pilot confusion and provide a potential for a runway incursion. Inadequate or improper methods of marking, barricading, and			☐

Item	Action Required	Or	None
lighting of temporarily closed portions of AOA create aviation hazards.			
Obliterated or faded temporary markings on active operational areas.			☐
Misleading or malfunctioning obstruction lights. Unlighted or unmarked obstructions in the approach to any open runway pose aviation hazards.			☐
Failure to issue, update, or cancel NOTAMs about airport or runway closures or other construction related airport conditions.			☐
Failure to mark and identify utilities or power cables. Damage to utilities and power cables during construction activity can result in the loss of runway / taxiway lighting; loss of navigation, visual, or approach aids; disruption of weather reporting services; and/or loss of communications.			☐
Restrictions on ARFF access from fire stations to the runway / taxiway system or airport buildings			☐
Lack of radio communications with construction vehicles in airport movement areas.			☐
Objects, regardless of whether they are marked or flagged, or activities anywhere on or near an airport that could be distracting, confusing, or alarming to pilots during aircraft operations.			☐
Water, snow, dirt, debris, or other contaminants that temporarily obscure or derogate the visibility of runway/taxiway marking, lighting, and pavement edges. Any condition or factor that obscures or diminishes the visibility of areas under construction.			☐
Spillage from vehicles (gasoline, diesel fuel, oil) on active pavement areas, such as runways, taxiways, aprons, and airport roadways.			☐
Failure to maintain drainage system integrity during construction (for example, no temporary drainage provided when working on a drainage system).			☐
Failure to provide for proper electrical lockout and tagging procedures. At larger airports with multiple maintenance shifts/workers, construction contractors should make provisions for coordinating work on circuits.			☐
Failure to control dust. Consider limiting the amount of area from which the contractor is allowed to strip turf.			☐
Exposed wiring that creates an electrocution or fire ignition hazard. Identify and secure wiring, and place it in conduit or bury it.			☐
Construction work taking place outside of designated work areas and out of phase.			☐

Construction Safety and Phasing Plan (CSPP)

Terminal and Hangar Development

CONSTRUCTION SAFETY AND PHASING PLAN (CSPP), 100%

New York Stewart International Airport (SWF)
Orange County, New York

Prepared by:

MDG MOHSEN DESIGN GROUP

Prepared For

Signature Flight Support, LLC

SIGNATURE AVIATION

June 2024

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APPENDICES

Appendix A Project Layout Plan (Sheet C020)
Appendix B Safety and Security Notes & Details (Sheets C050, C052 & C053)
Appendix C Maintenance of Traffic Plan (MOT), (Sheets C021-C029, C030-C032)

1.0 INTRODUCTION

Aviation safety is the primary consideration at airports, especially during construction. The Airport Operator's Construction Safety and Phasing Plan (CSPP) and the Contractor's Safety Plan Compliance Document (SPCD) are the tools to ensure safety compliance when coordinating construction activities with Airport Management. These documents identify aspects of the construction project that pose a potential safety hazard to Airport Management and outline mitigation procedures for each hazard.

The CSPP sets forth benchmarks and requirements for the Project to help ensure the highest safety, security, and efficiency levels at the Airport during construction. Guideline requirements for the CSPP are developed from FAA Advisory Circular 150/5370-2G, Operational Safety on Airports During Construction. The CSPP is to be used by all personnel involved in the Project. The CSPP covers the actions of the construction personnel and equipment and the actions of inspection personnel and Airport staff.

This document has been developed to minimize interruptions to Airport operations, reduce construction costs, and maximize the performance and safety of construction activity. Strict adherence to the provisions of the CSPP by all personnel assigned to or visiting the construction site is mandatory for construction projects at the Airport. The Contractor must submit a Safety Plan Compliance Document (SPCD) to the Airport describing how the Contractor will comply with the requirements outlined in this CSPP and the requirements outlined in AC 150/5370-2G. The SPCD must be submitted to the Airport for approval prior to issuance of the Notice-to-Proceed (NTP). If the Contractor's activities are found to be in non-compliance with the provisions of the CSPP or the SPCD, the Owner's Representative will direct the Contractor to cease those operations that are in violation immediately. In addition, a safety meeting will be conducted to review provisions in the CSPP/SPCD that were violated. The Contractor will not be allowed to resume any construction operations until after the conclusion of the safety meeting and after the Contractor has implemented all corrective actions required.

2.0 PROJECT SCOPE

This CSPP was developed for the construction of the terminal, hangar and apron at New York Stewart International Airport (SWF) in Orange County, New York. During this phase of development, the work at SWF will consist of the following main elements:

- Demolition of existing slab remains from the former Building 136.
- Construction of new hangar and associated facilities within the footprint of Building 136.
- Rehabilitation of approximately 19,500 SF of concrete apron adjacent to the north side of the new hangar.
- Mill and overlay approximately 2,225 SF of asphalt pavement located northwest of the new hangar.
- Construct new asphalt pavement between the new hangar and Building 138.
- Construct new visitors/employees asphalt paved parking on the south side of the new hangar.
- Construct concrete sidewalks.
- Construct landscape areas and place sod.
- Connect utilities to the new hangar.

The Project and its limits are provided in the Project Layout Plan, included in **Appendix A**. Work areas affected by the proposed construction are shown on the attached Work Zone Traffic Control General

Notes and Maintenance of Traffic Plan (MOT) are contained in **Appendix C**. Safety and Security Notes and Details are also included in **Appendix B**.

3.0 CSPP REQUIREMENTS

Necessary construction locations and activities have been identified, and their impact on Airport operations has been assessed. The effect of work on Airport Operations Areas (AOA) is discussed in this document and graphically depicted in the MOT provided in **Appendix C**. These sheets are from the drawing set issued to the Contractor for bidding and construction.

4.0 COORDINATION

4.1 Contractor Progress Meetings

Construction Progress Meetings will be held weekly or as required, with minutes recorded and issued to all stakeholders. Attendees shall include but not be limited to the Resident Project Representative, Contractor Project Manager, Contractor Safety and Security Officer (CSSO), and Airport Manager. Items for discussion related to construction safety will include the following:

- The schedule of activities extended out for a 2 to 3-week period.
- Impacts on Airport operations.
- NOTAM's to be issued.
- Review of safety measures required and parties responsible for compliance.
- Review of any changes in scope.

4.2 Scope or Schedule Changes

If changes in scope or schedule are required at the request of the Airport or by unforeseen conditions, they shall be addressed accordingly, per contract requirements, and the CSPP will be updated to reflect the changes.

5.0 PHASING

The sequence of construction and phasing for this Project was developed to maintain the maximum efficiency of aircraft operations while maintaining safety and allowing for the construction activities to progress. For each project phase, the CSPP identifies the requirements outlined in Chapter 2 of FAA AC 150/5370-2G, Operational Safety on Airports during Construction.

- Areas Closed to Airport Management – Reference Section 5.1 Phasing Elements and the MOT included in **Appendix C**.
- Duration of Closures – Reference Section 5.1 Phasing Elements and MOT included in **Appendix C**. Runways and Taxiways will not be affected by the construction activities.
- Taxi Routes – See taxiway impacts in Section 5.1 Phasing Elements and MOT in **Appendix C**. Taxiways will not be affected by the construction activities.
- Emergency and Fire Access Routes – Emergency access in and around the site will be maintained by the Contractor, as required, for the duration of this Project. The Contractor must prominently mark open trenches and excavations within the construction site, with approval from Airport Management and light them with low-profile barricades with red steady burn lights during hours of restricted visibility or darkness.

- Construction Staging Areas – See the Project Layout Plan contained in **Appendix A**. The construction documents depict the staging area and general safety and security notes concerning the use of the staging area.
- Construction Access and Haul Routes – Reference MOT Plans included in **Appendix C** for routing layouts to the various phases of the Project. Haul routes will be confirmed by Airport Management prior to the start of each phase. Applicable control along the Contractor haul routes for safety and security must always be maintained. This is especially important at those locations that require the Contractor to cross or move through active airfield surfaces. Reference Section 8.2, Vehicle and Pedestrian Operations, Section 18, Marking and Signs for Access Routes, and Section 20, Protection of Safety Areas, Object-Free Areas, Obstacle-Free Zones, and Approach/Departure Surfaces.

  The Contractor shall establish and maintain a list of Contractor and Subcontractor vehicles authorized to operate on the site. Individually owned vehicles shall be restricted to parking lots outside the AOA. To be authorized to operate on the Airport, each Contractor or Subcontractor's vehicle shall:
  - Be marked/flagged for high daytime visibility and lighted for nighttime operations. Vehicles that are not marked and/or lighted shall be escorted by a vehicle appropriately marked and/or lighted. Vehicles requiring an escort shall be identified on the list.
  - Be identified with the name and/or logo of the Contractor and be of sufficient size to be identified at a distance. Vehicles needing intermittent identification may be marked with tape or with commercially available magnetically attached markers. Vehicles that are not appropriately identified shall be escorted by a vehicle that conforms to this requirement. Vehicles requiring escort shall be identified on the list.
  - Be operated in a manner that does not compromise the safety of Airport operations. If, in the opinion of the Owner or Owner's Authorized Representative (OAR), any vehicle is operated in a manner not fully consistent with this requirement, the Owner and OAR have the right to restrict the vehicle's operation or prohibit its use on the Airport.
- Impacts to NAVAIDS – No NAVAIDS will be impacted.
- Lighting Changes – No change to runway or taxiway lighting is anticipated.
- Temporary marking – No temporary markings on active surfaces are required.
- Required Hazard Marking and Lighting - Low profile barricades with steady burn red lights, signs, lighting and/or safety flag details are shown in **Appendix B**. For additional details and descriptions, reference Section 18, Marking and Signs for Access Routes, Section 16, Hazard Marking, Lighting and Signing, and Section 20, Protection of Safety Areas, Object Free Areas, Obstacle Free Zones, and Approach/Departure Surfaces.

  Proper marking and lighting of areas on the airfield associated with the construction are the responsibility of the Contractor and shall be described in the Contractor's SPCD. This will include properly marking and lighting closed runways, taxiways, and taxilanes, the limits of construction, material storage areas, equipment storage areas, haul routes, parking areas, and other areas defined as required for the Contractor's exclusive use. The Contractor shall erect and maintain suitable marking and warning devices visible for day and night use around the perimeter of these areas. Temporary barricades, flagging, and flashing warning lights will be required at critical access points. The type and location of marking and warning devices will be approved by the Resident Project Representative.
  Special emphasis shall be given to open trenches, excavations, heavy equipment marshaling areas, and stockpiled material located in the AOA, which shall be predominantly marked by the

Contractor with flags and lighted by approved light units during hours of restricted visibility and darkness.

- Lead times for required notifications – The Contractor is required to communicate with the Resident Project Representative and Airport Management. Lead times for required notifications will be established at the pre-construction meeting. A minimum 72-hour advance notification is required for operations affecting runways.

5.1 Phase Elements

5.1.1 Mobilization (60 Consecutive Calendar Days)

A mobilization period has been established to allow the Contractor to mobilize to the site, provide shop drawing submittals, and perform material testing for mix design purposes. During the mobilization period, no construction activities will occur, and no impact to Airport operations is expected. The Mobilization period will be 60 consecutive calendar days commencing when the Notice-to-Proceed (NTP) is issued.

5.1.2 PHASE 1 – Hangar Development (262 Consecutive Calendar Days)

A total of 262 consecutive calendar days are allocated for Phase 1 that includes the construction of the new hangar, reconstruction of a section of the apron adjacent to the new hangar, construction of asphalt paved areas, sidewalks, and landscaped areas. This phase also includes connection the new hangar to the water main and storm pipe systems along the south side of First Street. No impact to aircraft traffic is anticipated during the construction activities. Landside traffic utilizing First Street will be interrupted periodically during the trenching to connecting to the water main and stormwater lines along the southside of First Street. The Contractor will assign two (2) flag persons to the affected roadway segment to direct traffic.

5.1.3 Concrete and Asphalt Pavement Cure Period (30 Consecutive Calendar Days)

A 30-consecutive calendar day cure period is required for the concrete and asphalt pavement after the last day of paving and prior to the installation of final markings. The 30-day cure period shall commence on the last completed and accepted lot of paving. Temporary markings may be installed immediately following the installation of new pavement. No impact to airside or landside traffic is anticipated during this period.

5.1.4 PHASE 2 –Permanent Pavement Marking (5 Consecutive Calendar Days).

A total of 5 consecutive calendar days are allocated for Phase 2, which includes the installation of final pavement markings. Work within this phase shall be performed during the daytime working hours of 7:00 AM and 7:00 PM. Periodic interruption to aircraft traffic may be in effect during this phase. The Contractor will assign flag persons to the affected areas direct traffic.

5.2 Construction Safety Drawings

The project Construction Safety and Phasing Plans and the detailed work areas or sub-work areas are provided in Appendix C. Safety and Security Notes are provided in Appendix B.

5.3 Flexible Phasing

The drawings shown in **Appendix C** are approximate and intended as a general guideline for the Contractor to develop their construction phasing plan. The final construction phasing plan shall be submitted to the Engineer for approval prior to the start of construction.

6.0 AREAS AND OPERATIONS AFFECTED BY CONSTRUCTION

6.1 Identification of Affected Areas

- Closing or partial closing of runways, taxiways, or aprons:
  - Runways – No impact to runways is anticipated
  - Taxiways – No impact to taxiways is anticipated
  - Aprons – The portion of the apron affected by the construction and adjacent to the new hangar will be barricaded. This area will be closed to aircraft traffic for the duration of the construction, however, remaining portions of the apron outside the construction limits will be available for aircraft traffic.
- Closing of access routes used by Airport and support vehicles – No closures.
- Interruption of Utilities – Facilities utilizing the existing water main and stormwater lines along the southside of First Street will experience short periods of service disruption.
- Approach/departure surfaces affected by heights of objects –No impact to Approach/departure surfaces is anticipated.
- Construction Areas – These areas include the project work area, storage/stockpile areas, staging areas, and Contractor haul routes near active airfield surfaces. These areas are identified in **Appendix A**, Project Layout Plan, and **Appendix C**, Maintenance of Traffic.

6.2 Mitigation of Effects

This CSPP has established specific requirements and operational procedures necessary to maintain the safety and efficiency of Airport operations during the construction of this Project. All coordination pertaining to Airport operations during construction will be routed to the Resident Project Representative and Airport Operation. No NOTAMs will be needed during the construction activities.

- Temporary changes to runway, taxiway, and/or taxiing operations – The construction limits will be barricaded by using low profile, lighted barricades placed as shown on the plans. Runways, taxiways, and taxiing operations will not be affected by construction activities.
- Detours for Airport vehicles - The project work site shall remain open to all emergency vehicles. Proper routing of this traffic will be effectively communicated to all supervisory personnel involved in the construction project.
- Maintenance of essential utilities - The Contractor shall locate and/or arrange for the location of all the underground utilities. If an underground cable or utility is damaged due to the Contractor's negligence, the Contractor shall immediately repair the affected cable or utility at their own expense. Full coordination between Airport staff, field inspectors, and construction personnel will be exercised to ensure that all Airport power and control cables are fully protected prior to

any excavation. Locations of cabling and other underground utilities shall be marked prior to beginning excavation.

7.0 PROTECTION OF NAVAIDS

Materials/equipment storage and vehicle parking near electronic NAVAIDs will not be allowed.

8.0 CONTRACTOR ACCESS

Contractor parking and equipment staging areas have been identified as the Contractor Staging Area within the drawing set, and the Project Layout Plan provided in **Appendix A**. No other access points shall be allowed unless approved by the Resident Project Representative. All Contractor traffic authorized to enter the site shall be experienced in the route or guided by Contractor personnel. The Contractor shall be responsible for traffic control to and from the various construction areas on the site and for the operation and security of the access gate to the site. A Contractor's flagman or traffic control person shall monitor and coordinate all Contractor traffic at the access gate. The Contractor shall not permit any unauthorized construction personnel or traffic on the site. Access gates to the site shall be locked and secured at all times when not attended by the Contractor. If the Contractor chooses to leave any access gate open, it shall be attended by badged Contractor personnel familiar with the CSPP's requirements. The Contractor is responsible for immediately cleaning any debris deposited along the access route due to his construction traffic. Directional signing from the access gate along the delivery route to the storage area, plant site, or work site shall be as directed by the Resident Project Representative. In addition, the following requirements are applicable:

- All Contractor traffic authorized to travel on the Airport shall have been briefed as part of the Contractor's construction safety and security orientation program, be thoroughly familiar with the access procedures and route for travel or be escorted by personnel authorized by the Contractor's CSSO.
- The Contractor shall install work-site identification signs at the authorized access point(s). If, in the opinion of the Resident Project Representative, directional signs are needed for clarity, they shall be installed along the route authorized for access to each construction site.
- Under no circumstance will Contractor personnel be permitted to drive their individually owned vehicles to any construction area on the Airport. All vehicles must be parked in the area designated for employee parking.
- In addition to the inspection and cleanup required at the end of each shift, the Contractor is responsible for the immediate cleanup of any debris generated along the construction site access route(s) as a result of construction-related traffic or operations, whether or not created by Contractor personnel.

8.1 Location of Stockpiled Construction Materials

Stockpiled material shall be secured against displacement by aircraft engine, propeller blast, and ambient winds. Stockpiled materials and equipment storage shall not be permitted within an active RSA or Obstacle Free Zone (OFZ), nor will it be allowed within an active runway or taxiway's Object Free Area (OFA). The maximum height of stockpiled material shall not exceed 15 feet mean sea level (MSL).

8.2 Vehicle and Pedestrian Operations

8.2.1 Contractor Site Parking

Employee vehicles shall be parked in the staging area or off Airport property and transported to and from the work areas via the Contractor's vehicles.

8.2.2 Construction Equipment Parking

Contractor employees must park and service all construction vehicles in an area outside the OFA and never in the safety area of an active runway, taxiway, or taxilane. Unless a complex setup procedure makes moving specialized equipment impossible, inactive equipment must not park on a closed taxiway or runway. If it is necessary to leave specialized equipment on a closed taxiway or runway at night, the equipment must be well-lit. Employees must also park construction vehicles outside of the OFA when not in use (i.e., overnight, on weekends, or during other periods when construction is not active). Parked equipment shall not obstruct the visibility of visual aids, signs, or navigational aids serving active runways and taxiways.

8.2.3 Access and Haul Roads

The approved access and haul roads are the only permitted routes. The routes must be clearly marked to prevent inadvertent entry to areas open to Airport operations. The construction traffic on the haul route must not interfere with NAVAIDS or the approach surfaces of any operational runway.

8.2.4 Marking and Lighting of Vehicles

Marking and lighting of vehicles shall be in accordance with FAA AC 150/5210-5D, Painting, Marking and Lighting of Vehicles Used on an Airport. All Contractor vehicles and mobile equipment shall be identified by three-foot (3') square orange and white flags whenever such vehicle or equipment is operating on or near the AOA. Checkered orange and white squares shall be a minimum of 1-foot (1') square. The Contractor's name shall be clearly affixed on each side of such vehicles and equipment, all in accordance with current Airport requirements. During the hours between 30 minutes before sunset and 30 minutes after sunrise and at all times when visibility is impaired, vehicles and mobile equipment shall also be equipped with a flashing amber beacon light mounted on the top of the vehicle or equipment. Beacon lights shall provide:

- Three hundred and sixty-degree (360°) azimuth coverage.
- Effective intensity in the horizontal plane not less than 40 or more than 400 candelas.
- Beam spread measured to 1/10 peak intensity extending from ten to fifteen degrees (10-15°) above the horizontal. Sixty to ninety (60-90) flashes per minute.

The Contractor shall establish and maintain a list of Contractor and Subcontractor vehicles authorized to operate on the site. Contractor employee vehicles shall be restricted to landside parking and are not allowed in the AOA at any time. To be authorized to operate on the Airport, each Contractor or Subcontractor's vehicle shall:

- Be marked/flagged for high daytime visibility and lighted for nighttime operations. Vehicles that are not marked and/or lighted shall be escorted by a vehicle appropriately marked and/or lighted. Vehicles requiring escort shall be identified on the list.

- Be identified with the name and/or logo of the Contractor and be of sufficient size to be identified at a distance. Vehicles needing intermittent identification may be marked with tape or commercially available magnetically attached markers. Vehicles not appropriately identified shall be escorted by a vehicle that conforms to this requirement. Vehicles requiring escort shall be identified on the list.
- Be operated in a manner that does not compromise the safety of either landside or airside Airport operations. If, in the opinion of the Resident Project Representative, any vehicle is operated in a manner not fully consistent with this requirement, the Resident Project Representative has the right to restrict the vehicle's operation or prohibit its use on the Airport.

8.2.5 Vehicle Operations

All Contractor vehicles and mobile equipment not individually authorized by the Airport for independent operation in the AOA shall be operated under escort while in the AOA. The Airport must authorize the escort vehicle and its driver for escort duty and operation within the AOA. If access to the construction, staging, or storage sites requires the crossing of an active surface, all vehicles shall be escorted across said surface by an authorized Airport escort vehicle.

No crane will be allowed on the work site unless the equipment and its intended operation are approved by Airport Management. The Contractor shall provide the Resident Project Representative and Airport Management with not less than 72 hours' advance written notice requesting crane access to or near the AOA.

The Contractor shall be responsible for the actions of employees and Subcontractors. Personnel who do not abide by Airport rules and regulations are subject to prosecution. All non-badged Contractor employees shall be within voice and visual range of a badged escort at all times when in or near the AOA.

8.2.6 Radio Communication

Radio contact is required at all times while the Contractor has personnel and equipment in the active AOA. Radios shall be furnished by the Contractor and shall be capable of receiving New York Stewart International Airport (SWF) ground control – 122.95. Only authorized personnel shall utilize radios to communicate with ground control. This frequency shall be utilized when crossing active surfaces including entering and exiting the designated construction area. The Contractor may not cross active airfield pavement without being escorted. Sufficient radios shall be on site and operating at all times so that instructions or communications may be dispatched to all crews and/or supervisors working in the active AOA.

Vehicle drivers must confirm by personal observations that no aircraft is approaching their position (either in the air or on the ground) prior to crossing a runway, taxiway, taxilanes, or any other area open to aircraft operations. In addition, it is the responsibility of the escort vehicle driver to verify the movement/position of all escorted vehicles at any given time.

8.2.7 Airport Security

The Contractor shall be responsible for the security of their equipment and materials. The Contractor shall be responsible for the security of all gates utilized by the Contractor. As directed by the Airport, locks shall be placed on each gate used by the Contractor. The locks must be marked in a manner showing company ownership, and two sets of keys must be provided to the Airport. The gates shall always be locked or monitored by badged Contractor personnel. For joint-use gates, the Contractor shall interlock to existing locks or chains to allow access by other contractors or agencies permitted to use the gate. If a lock is found unsecured, the company owning the lock is in violation of Airport Rules and Regulations. In addition, unauthorized entry to the AOA through the gates may result in the responsible party being cited for violating Airport Regulations.

It is the Contractor's responsibility to prevent any security breach within their construction area or any route of entry to the construction area. The Contractor's employees, whether issued Airport security badges or not, must always have a valid governmental identification on their person. Failure to comply with these requirements will result in the employee being escorted out of the AOA, and fines may be imposed at the Contractor's expense.

9.0 WILDLIFE MANAGEMENT

The Contractor shall comply with all applicable federal, state, and local regulations regarding environmental protection and shall adhere to the following specific requirements.

9.1 Trash

The Contractor shall maintain a clean site free from all food scraps and trash. The Contractor shall identify the location of closed containers to collect food scraps and trash. The Contractor will make arrangements for trash container removal from the project site daily and the staging area every week. Daily inspections are required to ensure compliance prior to leaving the job site.

9.2 Tall Grass and Seeds

Grass species and other varieties of plants attractive to hazardous wildlife are not to be used on Airport property. Disturbed areas or areas needing re-vegetation should not be planted with seed mixtures containing millet or any other large seed-producing grass.

9.3 Poorly Maintained Fencing and Gates

See Section 8.2.7 Airport Security.

9.4 Wildlife Encounter

In the event of a wildlife encounter, the Contractor shall immediately notify the RPR.

9.5 Disruption of Existing Wildlife Habitat

Disruption to existing wildlife in the vicinity of the Project may occur. Any observed wildlife that could pose a danger to air traffic shall be reported immediately to the RPR.

9.6 Site Drainage

The Contractor is required to maintain proper and adequate work-site drainage at all times. Ponding water will not be allowed.

9.7 Standing Water

Water shall not be allowed to collect and pool for more than any single 24-hour period.

10.0 FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT

Loose materials shall be removed from or near active portion of the AOA, placed in protected areas, or otherwise secured to prevent dispersal into active portions of the AOA. Debris shall be promptly removed from AOA whether generated by the Contractor's operations or not. The Contractor shall exercise care in the transportation of materials within the AOA. Materials tracked or spilled in the AOA shall be removed immediately. When hauling, loading, grading, or any of the Contractor's activities are likely to cause the deposit of loose materials in the AOA, it shall be immediately removed using powered vacuum sweepers, loaders, trucks, etc., or by hand, as necessary.

11.0 HAZARDOUS MATERIALS (HAZMAT) MANAGEMENT

The Contractor shall prepare all required documentation, pay all fees, and perform all services and work necessary to obtain all permits and approvals from local, state, and federal regulatory agencies for the Contractor's staging, stockpile, blending, and batch plant areas and operations. The Contractor shall develop a Pollution Prevention Plan to conform to the Contractor's activities on the Project. The plan shall be in strict compliance with the National Pollutant Discharge Elimination System (NPDES) permit issued or approved by the U.S. Environmental Protection Agency (EPA) pursuant to 40 CFR Part 122.6. The plan shall address all measures to dispose of, control, or prevent the discharge of solid, hazardous, and sanitary wastes into the waters of the United States of America. The plan shall include procedures to control off-site tracking of soil by vehicles and construction equipment, as well as procedures for cleanup and reporting of non-stormwater discharges such as contaminated groundwater or accident spills.

The Contractor shall take all necessary precautions to prevent spills or leaks of fuels, oils, greases, hydraulic fluids, and other significant materials to comply with the requirements of the NPDES during project construction.

Should spills or leaks occur, the Contractor shall be fully and solely responsible for containment and cleanup and shall report the spill immediately to Airport Management/City Fire and Rescue Department and as soon as possible to the Engineer and/or Resident Project Representative. Other notification requirements may apply. This report shall be filed even if the spill does not reach surface waters since wells in the area may be contaminated by spills infiltrating the groundwater. The Contractor shall include the following minimum steps in their Best Management Practices and Pollution Prevention Plan:

11.1 Periodic Cleaning

Execute periodic cleaning to maintain the work site and adjacent properties free from accumulations of waste materials, rubbish, windblown debris, and dust resulting from construction operations.

11.2 On-Site Containers

Provide on-site containers to collect waste materials, debris, and rubbish. Protect any containers holding significant materials such as oil, grease, or oily rags from entering the stormwater systems.

11.3 Remove of Waste Materials

Remove waste materials, debris, and rubbish from the site periodically and dispose of the same at approved locations.

11.4 Disposal Operations

Conduct cleaning and disposal operations to comply with all local, state, and federal codes, ordinances, regulations, and anti-pollution laws, including NPDES requirements. Prior to beginning work, prepare and maintain on-site a Disposal Plan for the satisfactory disposal of all waste materials and debris.

11.5 Spill Source

Stop the source of the spill immediately, remembering to follow personal safety and protective measures and requirements.

11.6 Liquid Containment

Contain the liquid until cleanup is complete using appropriate barriers.

11.7 Fire Department Notification

Notify the fire department or other designated response team immediately if the spill is larger than can be cleaned using dry methods or if the spill is not immediately and safely contained. Report possible groundwater contamination immediately to the Airport, City, and Health Department.

11.8 Dry Method Usage

Use dry methods to clean up the spill if possible. Do not use emulsifiers or dispersants or wash the spill into surface or groundwater.

11.9 Contaminated Material

Place the contaminated material from cleanup operations in sealed and labeled drums protected against storm, surface, or groundwater contact. Arrange for a properly licensed waste disposal firm to collect and dispose of the contaminated materials.

11.10 Documentary Evidence

Provide documentary evidence, including test results as applicable, of successful cleanup and disposal of significant or hazardous materials spills.

11.11 Disposal of Waste Materials

All disposal of waste materials, excess excavation, and debris shall be off-site. Disposal locations are subject to approval by the Resident Project Representative. The Contractor shall be responsible for arranging for and obtaining off-site disposal areas, including payment for all costs associated with such disposal.

Should the Contractor encounter unlabeled drums, materials with evident petroleum contamination, or other potentially significant or hazardous materials, they shall immediately protect workers and nearby residents from exposure. The Contractor shall notify the Resident Project Representative and the appropriate hazardous materials (Hazmat) response team. The Resident Project Representative will issue instructions on proceeding or suspending construction after such notification.

12.0 NOTIFICATION OF CONSTRUCTION ACTIVITIES

12.1 Points of Contact

The Contractor shall provide and maintain a list of names and phone numbers for all parties affected by the Project. Include emergency notification procedures. List on-duty and off-duty contact information for each individual including those responsible for emergency maintenance of Airport construction hazard lighting and barricades.

12.2 NOTAMs

The Airport shall issue construction NOTAMs, if needed. The Airport is the only entity that can close or open a runway or taxiway. The Airport must be notified immediately if any NOTAM appears missing, incomplete, and/or inaccurate. Scheduled runway or taxiway closures shall be discussed with the Airport as far in advance as possible, but not less than seventy-two (72) hours in advance. See Section 6.1 Identification of Affected Areas to identify proposed closures.

12.3 Emergency Notification Procedures

All accidents causing personal injury or property damage shall be reported to the Airport immediately. The Contractor shall provide, at the site, such equipment, and medical facilities as are necessary to supply first aid service to anyone who may be injured in connection with the performance of the work, whether on or adjacent to the site, which causes death, personal injury, or property damage, giving full details and statements of witnesses. In addition, if death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone to 911.

12.4 Coordination with Emergency Personnel

See Section 12.3 Emergency Notification Procedures.

12.5 Notification to the FAA

12.5.1 FAR Part 77

Any person proposing construction or alteration of objects that affect navigable airspace as defined in Part 77 must notify the FAA. The Airport has filed FAA Form 7460-01 for this Project. The FAA

Airspace Number will be provided to the Contractor when available. No crane shall be allowed on the work site unless Airport Management approves the equipment and its intended operation. The Contractor shall provide the Resident Project Representative and Airport Management with not less than 72 hours advance written notice requesting crane access to the AOA. It will take approximately 60 to 90 days for the FAA to approve the use of a crane on and around an airport.

12.5.2 NAVAIDS

12.5.2.1 Airport-Owned/FAA-Maintained. If construction operations require a shutdown of more than 24 hours or more than four (4) hours daily on consecutive days of a NAVAID owned by the Airport but maintained by the FAA, provide a 45-day minimum notice to FAA/ATO Technical Operations prior to facility shutdown.

12.5.2.2 FAA-Owned. The Airport must notify the appropriate FAA Air Traffic Control Service Area Planning and Requirements (P&R) Group a minimum of 45 days prior to impacting the NAVAIDS (impacts to FAA equipment covered by a reimbursable agreement (RA) do not have to be reported by the Airport).

Coordinate work for any FAA-owned NAVAID shutdown with FAA Technical Operations. This includes any activity that requires FAA equipment to be removed from service, including any necessary reimbursable agreements and flight checks. Detail procedures that address unanticipated utility outages and cable cuts that could impact FAA NAVAIDS. In addition, provide several days' notice to schedule the actual shutdown.

13.0. INSPECTION REQUIREMENTS

13.1 Daily Inspections

Daily Inspections shall be conducted by the Contractor with the Airport Manager or Resident Project Representative using the Construction Project Daily Inspection Checklist.

13.2 Final Inspections

An inspection will be conducted with Airport Management in attendance prior to opening any closed movement area to aircraft traffic.

14.0 UNDERGROUND UTILITIES

The construction will require tie-ins to existing electrical, water main, storm lines, electrical and sewer systems. The Contractor shall coordinate all interruption to the RPR and Airport Management. The Contractor shall provide written notifications to the RPR of the duration, date and time of each service to be interrupted. It is the Contractor's responsibility to locate and flag all existing utilities in the area that are to be protected during construction.

15.0 PENALTIES

The Contractor shall be responsible for compliance with Airport rules and regulations by all employees and Subcontractors. Unauthorized entry to the AOA through the gates may result in the responsible party being cited for violating Airport Regulations. It is the Contractor's responsibility to prevent any security breach within their construction area or any route of entry to the construction area. The

Contractor's employees must have a valid governmental identification on their person at all times. Failure to comply with these requirements will result in the employee being escorted off the AOA.

16.0 SPECIAL CONDITIONS

During severe weather conditions or other operational emergencies, the Airport may direct the Contractor to relinquish areas under construction and prepare the areas for aircraft operations. See also Section 17.0 Runway and Taxiway Visual Aids. In this event, the Resident Project Representative or Airport Management will so direct the Contractor to evacuate the area, and the Resident Project Representative or Airport Management will specify the limits of the area to be evacuated, the term of evacuation, and the conditions governing the restoration work necessary to prepare the area for aircraft operation. The Contractor shall promptly and fully comply with the Resident Project Representative or Airport Operation's directive. Should the directive entail extra work under the Contract, as determined by the Resident Project Representative or Airport Management, the Contractor shall be reimbursed for such extra work in accordance with the Contract. Should the directive entail a delay in the completion of the Contract or any defined subdivision of the Contract, as determined by the Resident Project Representative or Airport Management, the Contractor may be granted an extension of time.

17.0 RUNWAY AND TAXIWAY VISUAL AIDS

17.1 General

Impact to Airport markings, lighting, signs, and visual NAVAIDs are not anticipated. Temporary and permanent markings will be in accordance with FAA AC 150/5340-1M, Standards for Airport Markings, and Technical Specification Item P-620, Runway and Taxiway Painting.

17.2 Closures

If the Contractor requires access to operational areas not delineated in the Construction Safety Plan Notes/Details, **Appendix B**, the Contractor shall participate in negotiations leading to imposing restrictions on Airport operations in the affected areas. The Contractor shall strictly abide by all conditions the Airport imposes relating to his entry and use of such areas and shall not enter these areas until granted temporary, conditional entry clearance by the Airport.

The Contractor may be required to pursue affected portions of the work on a continuous, 24-hour per day basis during construction of the various phases and sub-phases shown on the plans and described in the Contract Documents (such as when runways or taxiways, aprons, service or access roadways, service gates are closed for operations or when hazards of any kind arise).

Before any demolition or other work that will cause an interruption or modification to existing aircraft operations, the Contractor shall confer with and obtain authorization from the Resident Project Representative and Airport Management.

When the Contractor's operations require the closure of any runway, taxiway, apron, roadway, service gate, walkway, etc., the Contractor shall notify the Resident Project Representative and Airport Management not less than 72 hours prior to need. No runway, taxiway, apron, roadway, service gate, walkway, etc., shall be closed without prior permission from the Airport Management.

17.2.1 Temporarily Closed Runways

No runway closures are anticipated.

17.2.2 Temporarily Closed Taxiways

No taxiway closures are anticipated.

17.2.3 Partially Closed Runways

No partial closures or runways are anticipated.

17.2.4 Temporarily Closed Lighting and NAVAIDs

No impact to NAVAIDs is anticipated.

18.0 MARKING AND SIGNS FOR ACCESS ROUTES

The Contractor shall utilize existing service roads and/or airfield pavements, as identified in **Appendix A**, Project Layout Plan, for access routes to the site. The Contractor shall place signage along the route to prevent inadvertent entry to areas open to airport operations.

19.0 HAZARD MARKING, LIGHTING, AND SIGNING

19.1 General

Hazard Marking, Lighting, and Signing prevent aircraft from entering areas closed to aircraft and prevent construction personnel from entering areas open to aircraft. The Contractor shall comply with Section 19.2 Equipment and Section 19.3 Barricades.

19.2 Equipment

Portable floodlighting shall be provided, as required, for construction during nighttime operations. All work areas shall be illuminated to a level of five (5) horizontal foot candles calculated and measured in accordance with the current standards of the Illumination Engineering Society.

19.3 Barricades

The Contractor shall install lighting, marking, New York Department of Transportation (NYDOT) Type II barricades, low-profile barricades, signs, and other measures to delineate closed and hazardous areas during construction. In addition, the guidance and procedures provided by FAA AC 150/5340-1M, Standards for Airport Markings, shall be utilized. As depicted in the Safety and Security Notes/Details, **Appendix B**. Steady burning red obstruction lights are required to supplement lighted barricades for nighttime use or highlight hazardous or potentially dangerous objects. The location of these lights shall be as shown on the Plans or as directed by the Resident Project Representative and Airport Management. Obstruction lights, NYDOT Type II barricades, low-profile barricades, and signs shall not be located within runway, taxiway, or taxilane safety areas when the runway, taxiway, or taxilane are open to air traffic.

Barricades will be placed around each phase or subphase of the work in accordance with the Construction Safety and Phasing Plan and shall remain in place until completion of work in each phase. All locations shall be approved by the Resident Project Representative.

20.0 PROTECTION OF SAFETY AREAS, OBJECT-FREE AREAS, OBSTACLE-FREE ZONES, AND APPROACH/DEPARTURE SURFACES

20.1 Runway Safety Area (RSA)

Construction activities are not anticipated within RSAs.

20.2 Runway Object Free Area (ROFA)

Construction activities are not anticipated within ROFAs.

20.3 Taxiway Safety Area (TSA)

Construction activities are not anticipated within TSAs.

20.3.1 Excavations

Trenches and excavations affecting First Street shall be continuously monitored by flag persons during construction and are not permitted to remain open over night. Backfill trenches prior to reopening public roads to traffic. Construction contractors must use low-profile barricades with steady burning red lights, and prominently mark open trenches and excavations at the construction site, as approved by the Airport operator, and light them during hours of restricted visibility or darkness.

20.3.2 Erosion Control

Soil erosion must be controlled on or near AOA areas, construction areas must be cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations, and capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment.

20.4 Taxiway Object Free Area (TOFA)

Construction activity within TOFAs is not anticipated.

20.5 Obstacle Free Zone (OFZ)

No construction activities anticipated within the OFZs.

20.6 Runway Approach/Departure Surfaces

Personnel, material, and/or equipment must remain clear of the threshold sitting surfaces while the Runway is open for aircraft operations.

21.0 OTHER LIMITATIONS ON CONSTRUCTION

21.1 Burning or Blasting

No burning or blasting allowed on Airport property.

21.2 Restrictions

21.2.1 Construction suspension required during specific Airport operations

- Hurricane, snow storms, or disaster relief events.

21.2.2 Areas that cannot be worked on simultaneously

- Work must be completed according to the Construction Safety and Phasing Plan.

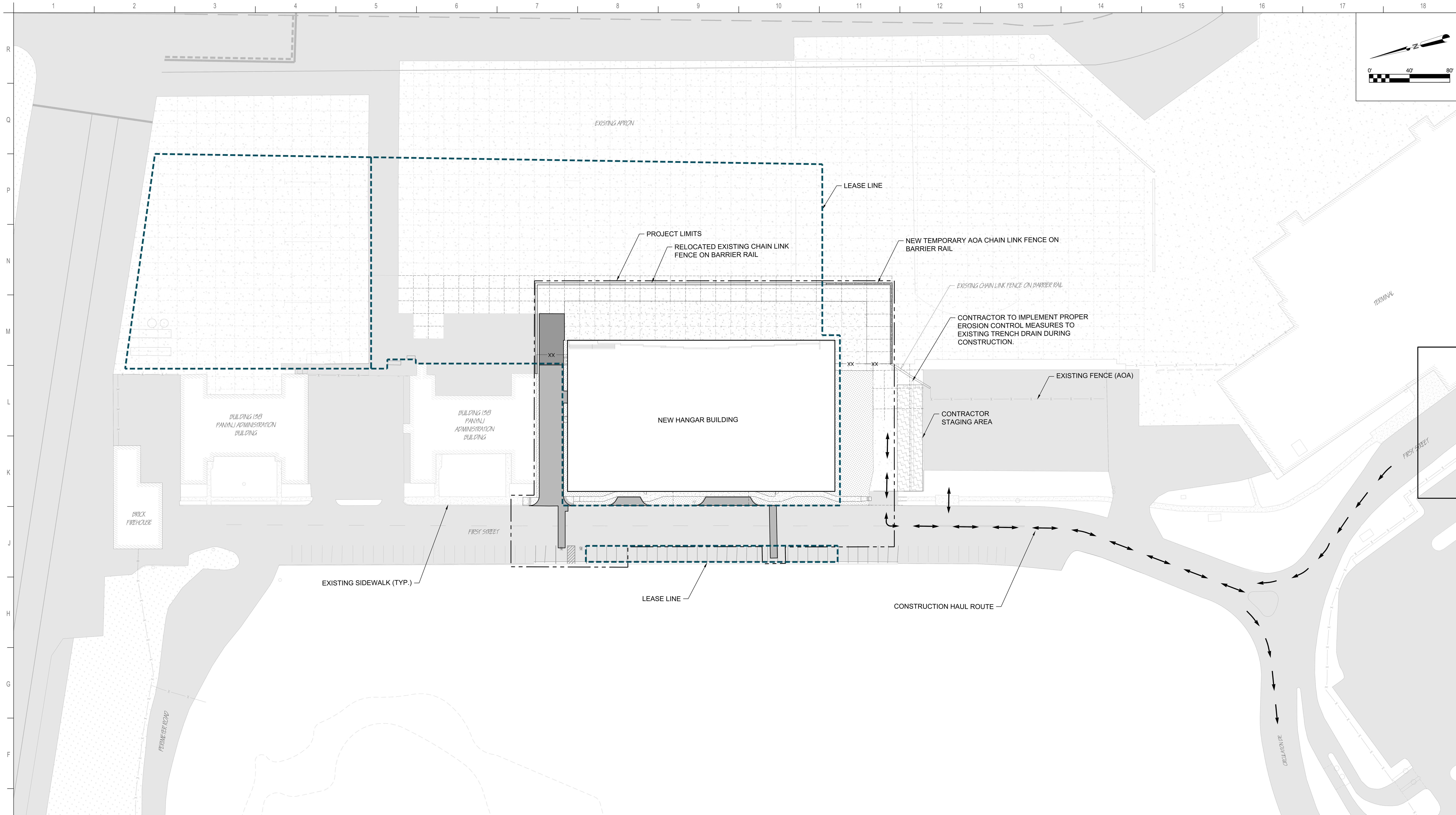
21.2.3 Day or night construction restrictions

- Construction is anticipated to be completed during the day. Nighttime work may be allowed subject to the approval of the Resident Project Representative and Airport Management.

21.2.4 Seasonal construction restrictions

- None.

Project Layout Plan



LEGEND

- PROJECT LIMITS
- EXISTING BUILDING
- EXISTING PAVEMENT
- EXISTING CONCRETE
- EXISTING TREE AND WETLAND AREA
- EXISTING CHAIN LINK FENCE (AOA)
- EXISTING CHAIN LINK FENCE
- NEW ASPHALT PAVEMENT
- NEW MILL AND OVERLAY PAVEMENT
- NEW CONCRETE
- NEW SOD
- CONTRACTOR STAGING AREA
- HAUL ROUTES/CONSTRUCTION ACCESS
- LEASE LANE
- XX —— XX NEW GALVANIZED STEEL CHAIN LINK FENCE

NOTES

1. SEE PHASING PLAN FOR ADDITIONAL HAUL ROUTE NOTES WITHIN SPECIFIC PROJECT PHASES.
2. REFER TO SAFETY AND SECURITY NOTES ON SHEET 050 FOR PROCEDURES ON SECURING THE AIR OPERATION AREA 9AOA) DURING CONSTRUCTION..
3. THE CONTRACTOR SHALL NOT HAUL MATERIALS OR EQUIPMENT ACROSS ANY ACTIVE RUNWAY OR TAXIWAY.
4. THE CONTRACTOR'S ACCESS TO THE CONSTRUCTION SITE AND HAUL ROADS ARE IDENTIFIED ON THE PLANS. THE CONTRACTOR SHALL NOT USE ANY ACCESS OR HAUL ROADS OTHER THAN THOSE APPROVED. THE CONTRACTOR MUST SUBMIT SPECIFIC PROPOSED ROUTES ASSOCIATED WITH CONSTRUCTION ACTIVITIES TO THE OWNER FOR EVALUATION AND APPROVAL AS PART OF THE SAFETY AND PHASING PLAN BEFORE BEGINNING CONSTRUCTION ACTIVITIES. THESE PROPOSED ROUTES MUST ALSO PROVIDE SPECIFICATIONS TO PREVENT INADVERTENT TO MOVEMENT AREAS. THE CONTRACTOR SHALL PAY SPECIAL ATTENTION TO ENSURE THAT CONSTRUCTION TRAFFIC ON HUAL ROADS DOES NOT INTERFERE WITH AIRSPACE PROTECTION SURFACES OF OPERATIONAL RUNWAYS.
5. THE CONTRACTOR SHALL GIVE THE RIGHT-OF-WAY TO THE PUBLIC WHILE USING PUBLIC ROADS. THE CONTRACTOR SHALL NOT BLOCK ROADWAYS AND ACCESS TO BUSINESSES. THE CONTRACTOR SHALL PROVIDE FLAGGER TO DIRECT TRAFFIC IF TRUCKS OR VEHICLES ARE TEMPORARY APRKED ON PUBLIC OR AIRPORT OWNED ROADWAYS. MAINTENANCE OF TRAFFIC SHALL MEET ALL LOCAL REQUIREMENTS AND GUIDELINES.
6. ANY USE OF PRIVATE PROPERTY BY THE CONTRACTOR. INCLUDING PRIVATE OR LEASED ROADWAYS AND APRONS, SHALL BE COORDINATED IN ADVANCE WITH THE PROPERTY OWNER OR LEASE HOLDER FOR APPROVAL.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY FINES FOR IMPROPER OR ILLEGAL USE OF PUBLIC OR PRIVATE PROPERTY IN THE PERFORMANCE OF THE WORK AT HIS/HER EXPENSE.
8. THE CONTRACTOR IS RESPONSIBLE FOR SECURING RGEIR STOCKPILE AND STAGING AREAS. EQUIPMENT, AND MATERIALS LOCATED ON AIRPORT PROPERTY.
9. TEMPORARY ROADS, HAULS, TRAFFIC AND WORK AREAS SHALL BE STABILIZED WITH DUST PALLIATIVE, PENETRATION ASPHALT, WOOD CHIPS, OR OTHER APPROVED MEASURES TO PREVENT OUST POLLUTION.
10. THE MAXIMUM ALLOWABLE HEIGHT OF CONSTRUCTION EQUIPMENT AND STOCKPILED MATERIALS IS GOVERNED BY FAA ADVISORY CIRCULAR (AC0 150/5372-2, CURRENT EDITION. WHEN EQUIPMENT IS EXPECTED TO PENETRATE THE FAR PART 77 SURFACE (FOR ANY RUNWAY IN OPERATION) OR WHEN CRANES WILL BE USED ON SITE, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AT LEASE SIXTY (60) DAYS PRIOR TO START OF CONSTRUCTION TO COORDINATE THE SUBMITTAL OF FAA FORM 7460-1 TO THE FAA AIRPORT DISTRICT OFFICE. PERMISSION TO USE CRANES SHALL BE ISSUED BY THE ENGINEER AFTER APPROVAL BY THE FAA. THE CONTRACTOR WILL BE SOLELY RESPONSIBLE FOR ANY AND ALL FAA FINES INCURRED FOR OPERATING CRANES WITHOUT FAA APPROVAL. TWENTY-FOUR (24) HOURS NOTICE SHALL BE GIVEN TO AIRPORT PRIOR TO CRANE DEPLOYMENT.

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REVISIONS

MARK	DESCRIPTION	DATE

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION
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ORLANDO, FL 32801

Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

PROJECT LAYOUT PLAN AND SITE IMPROVEMENTS

C020

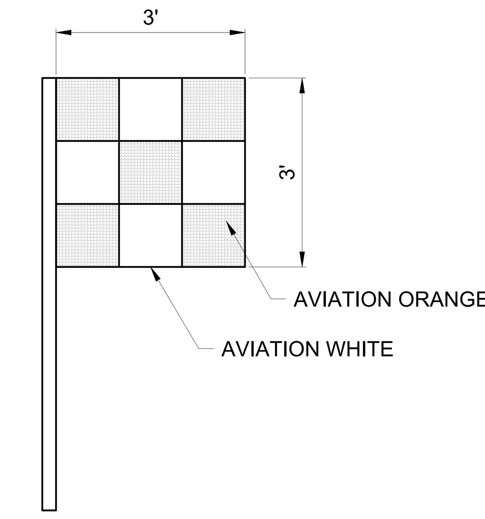
100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION

Safety and Security Notes & Details

SAFETY

1. CONTRACTOR SHALL BE FAMILIAR WITH THE FOLLOWING FAA SAFETY PROVISIONS AND IMPLEMENT THESE REQUIREMENTS DURING CONSTRUCTION. THE LATEST COPIES OF THESE GUIDELINES CAN BE OBTAINED FROM THE ENGINEER OR ON-LINE AT (WWW.FAA.GOV/REGULATIONS_POLICIES/).
   a) FAA ADVISORY CIRCULAR AC 150/5370-2G, "OPERATIONAL SAFETY ON AIRPORTS DURING CONSTRUCTION"
   b) FAA ADVISORY CIRCULAR AC 150/5210-5D, "PAINTING, MARKING AND LIGHTING OF VEHICLES USED ON AN AIRPORT
   c) CODE OF FEDERAL REGULATIONS, 14 CFR PART 77, SAFE, EFFICIENT USE, AND PRESERVATION OF THE NAVIGABLE AIRSPACE
   d) FAA ADVISORY CIRCULAR AC 150/5210-24, "AIRPORT FOREIGN OBJECT DEBRIS (FOD) MANAGEMENT"
   e) FAA ADVISORY CIRCULAR AC 150/5200-18C, "AIRPORT SAFETY SELF-INSPECTION"
   f) FAA ADVISORY CIRCULAR AC 150/5200-33B, "HAZARDOUS WILDLIFE ATTRACTIONS ON OR NEAR AIRPORTS"
2. CONTRACTOR SHALL COMPLY WITH THE SAFETY PLAN ASSOCIATED WITH THE CONSTRUCTION PROJECT AND ENSURE THAT CONSTRUCTION PERSONNEL ARE FAMILIAR WITH SAFETY PROCEDURES AND REGULATIONS ON THE AIRPORT.
3. CONTRACTOR SHALL PROVIDE A POINT OF CONTACT WHO WILL COORDINATE AN IMMEDIATE RESPONSE TO CORRECT ANY CONSTRUCTION-RELATED ACTIVITY THAT MAY ADVERSELY AFFECT THE OPERATIONAL SAFETY OF THE AIRPORT.
4. CONTRACTOR SHALL PROVIDE AN APPROVED SAFETY OFFICER/CONSTRUCTION INSPECTOR FAMILIAR WITH AIRPORT SAFETY TO MONITOR CONSTRUCTION ACTIVITIES.
5. CONTRACTOR SHALL RESTRICT MOVEMENT OF CONSTRUCTION VEHICLES TO CONSTRUCTION AREAS BY FLAGGING AND BARRICADING, OR PROVIDING ESCORTS, AS APPROPRIATE. NO EMPLOYEES OF ANY CONTRACTOR, SUBCONTRACTOR, OR OTHER CONSTRUCTION PERSONNEL WILL BE PERMITTED TO OPERATE VEHICLES OR EQUIPMENT ON AIRPORT PROPERTY UNTIL THEY HAVE COMPLETED THE OWNER'S DRIVERS TRAINING COURSE.
6. CONTRACTOR SHALL ENSURE THAT NO EMPLOYEES, EMPLOYEES OF SUBCONTRACTORS OR SUPPLIERS, OR OTHER PERSONS ENTER ANY PART OF THE AIR OPERATIONS AREAS (AOA) FROM THE CONSTRUCTION SITE UNLESS AUTHORIZED.
7. CONTRACTOR EMPLOYEES SHALL PARK AND SERVICE ALL CONSTRUCTION VEHICLES IN AN AREA DESIGNATED BY THE OWNER OUTSIDE THE RUNWAY SAFETY AREAS (RSA) AND OBSTACLE FREE ZONE (OFZ) AND NEVER ON A CLOSED TAXIWAY OR RUNWAY. EMPLOYEES SHALL ALSO PARK CONSTRUCTION VEHICLES OUTSIDE THE OBJECT FREE AREA (OFA) WHEN NOT IN USE BY CONSTRUCTION PERSONNEL (E.G., OVERNIGHT, ON WEEKENDS, OR DURING OTHER PERIODS WHEN CONSTRUCTION IS NOT ACTIVE).
8. CONTRACTOR PERSONNEL ENGAGED IN ACTIVITIES INVOLVING UNESCORTED OPERATION ON AIRCRAFT MOVEMENT AREAS SHALL OBSERVE THE PROPER PROCEDURES FOR COMMUNICATIONS.
9. CONTRACTOR SHALL PROMINENTLY MARK OPEN TRENCHES AND EXCAVATIONS AT THE CONSTRUCTION SITE WITH RED OR ORANGE FLAGS, AS APPROVED BY THE OWNER, AND LIGHT THEM WITH RED LIGHTS DURING HOURS OF RESTRICTED VISIBILITY OR DARKNESS.
10. OPEN TRENCHES OR EXCAVATIONS ARE NOT PERMITTED WITHIN A SAFETY AREA WHILE THE ASSOCIATED RUNWAY OR TAXIWAY IS OPEN. IF POSSIBLE, BACKFILL TRENCHES BEFORE THE RUNWAYS/TAXIWAYS ARE OPENED. IF THE RUNWAYS/TAXIWAYS MUST BE OPENED BEFORE EXCAVATIONS ARE BACKFILLED, COVER THE EXCAVATIONS APPROPRIATELY. COVERING FOR OPEN TRENCHES MUST BE DESIGNED TO ALLOW THE SAFE OPERATION OF THE HEAVIEST AIRCRAFT OPERATING ON THE RUNWAYS/TAXIWAY TO CROSS THE TRENCH WITHOUT DAMAGE TO THE AIRCRAFT
11. EXCAVATIONS AND OPEN TRENCHES ARE NOT PERMITTED WITHIN THE TSA OF AN ACTIVE TAXIWAY AND APRON PAVEMENT.
12. CONTRACTOR SHALL SEPARATE THE CONSTRUCTION SITE AND NONMOVEMENT AREAS IN WHICH NO PART OF AN AIRCRAFT MAY ENTER BY USING BARRICADES THAT ARE MARKED WITH DIAGONAL, ALTERNATING ORANGE AND WHITE STRIPES. BARRICADES MAY BE SUPPLEMENTED WITH ALTERNATING ORANGE AND WHITE FLAGS AT LEAST 3 FEET BY 3 FEET SQUARE AND MADE AND INSTALLED SO THEY ARE ALWAYS IN AN EXTENDED POSITION, PROPERLY ORIENTED, AND SECURELY FASTENED TO ELIMINATE JET ENGINE INGESTION AND/OR PROPELLER WASH DISPERSION.
13. STOCKPILED MATERIALS AND EQUIPMENT STORAGE ARE NOT PERMITTED WITHIN THE RSA AND OFZ OF AN OPERATIONAL RUNWAY. CONTRACTOR SHALL ENSURE THAT STOCKPILED MATERIALS AND EQUIPMENT ADJACENT TO THESE AREAS ARE PROMINENTLY MARKED AND LIGHTED DURING HOURS OF RESTRICTED VISIBILITY OR DARKNESS. THIS INCLUDES DETERMINING AND VERIFYING THAT MATERIALS ARE STORED AT AN APPROVED LOCATION TO PREVENT FOREIGN OBJECT DAMAGE AND ATTRACTION OF WILDLIFE.
14. CONTRACTOR MAY NOT USE OPEN-FLAME WELDING OR TORCHES UNLESS ADEQUATE FIRE SAFETY PRECAUTIONS ARE PROVIDED AND THE OWNER HAS APPROVED THEIR USE.
15. WASTE AND LOOSE MATERIALS, COMMONLY REFERRED TO AS FOD, ARE CAPABLE OF CAUSING DAMAGE TO AIRCRAFT LANDING GEARS, PROPELLERS, AND JET ENGINES. CONTRACTOR SHALL NOT LEAVE OR PLACE FOD ON OR NEAR ACTIVE AIRCRAFT MOVEMENT AREAS. MATERIALS TRACKED ONTO THESE AREAS MUST BE CONTINUOUSLY REMOVED DURING CONSTRUCTION. CONTRACTOR SHALL ALSO CAREFULLY CONTROL AND CONTINUOUSLY REMOVE WASTE OR LOOSE MATERIALS THAT MIGHT ATTRACT WILDLIFE.
16. ALL CONTRACTOR VEHICLES AND MOBILE EQUIPMENT OPERATING IN THE AOA SHALL BE IDENTIFIED BY THREE-FOOT (3') SQUARE ORANGE AND WHITE FLAGS WHENEVER SUCH VEHICLE AND EQUIPMENT ARE OPERATING ON THE AOA. IN ADDITION, SUCH VEHICLES AND EQUIPMENT SHALL HAVE THE CONTRACTOR'S NAME CLEARLY AFFIXED ON EACH SIDE OF SUCH VEHICLES AND EQUIPMENT. DURING THE HOURS BETWEEN SUNSET AND SUNRISE AND AT ALL TIMES WHEN VISIBILITY IS IMPAIRED, VEHICLES AND MOBILE EQUIPMENT SHALL ALSO BE EQUIPPED WITH A REVOLVING YELLOW BEACON LIGHT MOUNTED ON THE TOP OF THE VEHICLE OR EQUIPMENT. BEACON LIGHTS SHALL PROVIDE:
   a) THREE HUNDRED AND SIXTY DEGREE AZIMUTH COVERAGE.
   b) EFFECTIVE INTENSITY IN THE HORIZONTAL PLANE NOT LESS THAN 40 OR MORE
   c) THAN 400 CANDELAS. BEAM SPREAD MEASURED TO 1/10 PEAK INTENSITY EXTENDING FROM 10 DEGREES TO 15 DEGREES ABOVE THE HORIZONTAL.
   d) SIXTY TO NINETY FLASHES PER MINUTE.
17. NO CRANE SHALL BE ALLOWED ON THE WORK SITE UNTIL THE EQUIPMENT AND ITS INTENDED OPERATION ARE APPROVED BY THE OWNER.. THE CONTRACTOR SHALL PROVIDE THE OWNER WITH:
   a) THE OWNER HAS FILED A 7460 (AIRSPACE ANALYSIS) WITH THE FAA FOR THE USE OF A CRANE ON THIS PROJECT WHICH GIVES SPECIFIC WORKING LIMITS WITHIN EACH PHASE.
   b) CONTRACTOR SHALL COORDINATE WITH OWNER AND OBTAIN THE AIRSPACE DETERMINATION AND ADHERE TO ALL REQUIREMENTS PRIOR TO MOBILIZATION OF THE CRANE.
18. WHEN ACCESS IS APPROVED BY THE OWNER, THE TIP OF THE CRANE BOOM SHALL BE IDENTIFIED BY THE ORANGE AND WHITE FLAG AND, IF APPROPRIATE, BY RED OBSTRUCTION LIGHTS.
19. DURING PERIODS OF SEVERE WEATHER CONDITIONS OR OTHER OPERATIONAL EMERGENCIES, THE OWNER MAY DIRECT THE CONTRACTOR TO RELINQUISH AREAS UNDER CONSTRUCTION AND TO PREPARE THE AREAS FOR AIRCRAFT OPERATIONS. IN THIS EVENT THE ENGINEER WILL SO DIRECT THE CONTRACTOR TO EVACUATE THE AREA AND THE ENGINEER WILL SPECIFY THE LIMITS OF THE AREA TO BE EVACUATED, THE TERM OF EVACUATION AND THE CONDITIONS GOVERNING THE RESTORATION WORK NECESSARY TO PREPARE THE AREA FOR AIRCRAFT OPERATION. THE CONTRACTOR SHALL PROMPTLY AND FULLY COMPLY WITH THE ENGINEER'S DIRECTIVE. SHOULD THE DIRECTIVE ENTAIL EXTRA WORK UNDER THE CONTRACT, AS DETERMINED BY THE ENGINEER, THE CONTRACTOR WILL BE REIMBURSED FOR SUCH EXTRA WORK. SHOULD THE DIRECTIVE ENTAIL A DELAY IN THE COMPLETION OF THE CONTRACT OR ANY DEFINED SUBDIVISION OF THE CONTRACT, AS DETERMINED BY THE ENGINEER, THE CONTRACTOR MAY BE GRANTED AN EXTENSION OF TIME.
20. VEHICULAR TRAFFIC SHALL NOT CROSS ACTIVE AIRCRAFT MOVEMENT AREAS (RUNWAYS, TAXIWAYS OR AIRCRAFT PARKING APRON). SEE CONSTRUCTION ACCESS, STAGING AND PHASING PLANS, SHEET (C040).
21. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACTIONS OF EMPLOYEES AND SUBCONTRACTORS. PERSONNEL WHO DO NOT ABIDE BY AIRPORT RULES AND REGULATIONS ARE SUBJECT TO PROSECUTION.
22. ALL ACCIDENTS CAUSING PERSONAL INJURY OR PROPERTY DAMAGE SHALL BE REPORTED TO THE OWNER IMMEDIATELY. THE CONTRACTOR(S) SHALL PROVIDE, AT THE SITE, SUCH EQUIPMENT AND MEDICAL FACILITIES AS ARE NECESSARY TO SUPPLY FIRST AID SERVICE TO ANYONE WHO MAY BE INJURED IN CONNECTION WITH THE PERFORMANCE OF THE WORK, WHETHER ON OR ADJACENT TO THE SITE. IN ADDITION, IF DEATH OR SERIOUS INJURIES OR SERIOUS DAMAGES ARE CAUSED, THE ACCIDENT SHALL BE REPORTED IMMEDIATELY BY TELEPHONE TO 911 DISPATCH.
23. THE CONTRACTOR'S EMPLOYEES, MUST HAVE A VALID GOVERNMENTAL IDENTIFICATION ON THEIR PERSON AT ALL TIMES. FAILURE TO COMPLY WITH THESE REQUIREMENTS WILL RESULT IN THE EMPLOYEE BEING ESCORTED OFF THE AOA AND FINES MAY BE IMPOSED AT THE CONTRACTOR'S EXPENSE.
24. ANY DELAY IN CONSTRUCTION OF PROJECT DUE TO VIOLATION OF FEDERAL AND AIRPORT REGULATIONS SHALL BE ABSORBED BY THE CONTRACTOR AND ADDITIONAL APPROVED MEASURES BY THE CONTRACTOR SHALL BE EMPLOYED TO MAINTAIN THE ORIGINALLY APPROVED CONSTRUCTION SCHEDULE.
25. CONTRACTOR SHALL MONITOR GROUND FREQUENCY IF PERSONNEL AND EQUIPMENT ARE WORKING IN THE AIRPORT OPERATIONAL AREAS. AIRCRAFT SHALL HAVE THE RIGHT-OF-WAY AT ALL TIMES. CONTRACTOR SHALL MAKE ALL PERSONNEL FAMILIAR WITH THE LIMITS OF THE RUNWAY AND CONNECTORS TO ENSURE NO EQUIPMENT OR PERSONNEL ENTER THESE ACTIVE AREAS. ANY WORK INSIDE THE TAXIWAY SAFETY AREA (TSA) WILL REQUIRE TEMPORARY CLOSURE OF THE TAXIWAY.
26. CONTRACTOR SHALL ENSURE THAT CONSTRUCTION PERSONNEL ARE FAMILIAR WITH SAFETY PROCEDURES AND REGULATIONS ON THE AIRPORT AND SHALL PROVIDE A POINT OF CONTACT WHO WILL COORDINATE AN IMMEDIATE RESPONSE TO CORRECT ANY CONSTRUCTION-RELATED ACTIVITY THAT MAY ADVERSELY AFFECT THE OPERATIONAL SAFETY OF THE AIRPORT.
27. CONTRACTOR SHALL IDENTIFY THE CONTRACTOR'S ON-SITE EMPLOYEES RESPONSIBLE DURING CONSTRUCTION. AT LEAST ONE OF THESE EMPLOYEES MUST BE ONSITE WHENEVER ACTIVE CONSTRUCTION IS TAKING PLACE.
28. CONTRACTOR SHALL CONDUCT INSPECTIONS SUFFICIENTLY FREQUENTLY TO ENSURE THAT THERE ARE NO ALTERED CONSTRUCTION ACTIVITIES THAT COULD CREATE POTENTIAL SAFETY HAZARDS.
29. CONTRACTOR SHALL FURNISH AND INSTALL TEMPORARY CONSTRUCTION GATES AS DIRECTED BY THE CONSTRUCTION MANAGER AT NO COST TO THE OWNER. GATES SHALL REMAIN LOCKED OR MONITORED BY A BADGED GATE GUARD AT ALL TIMES. CONTRACTOR SHALL SUPPLY THE CONSTRUCTION MANAGER WITH TWO COPIES OF THE GATE KEYS AT THE THE START OF THE PROJECT.
30. SHOULD AN AIRCRAFT EMERGENCY OCCUR ANYPLACE ON THE AIRPORT, THE CONTRACTOR WILL BE REQUIRED TO MOVE ALL PERSONNEL AND EQUIPMENT BEYOND THE SAFETY AREA OF THE RUNWAY AND TAXIWAYS AND TO REFRAIN FROM MOVING OUT OF THESE AREAS TO RESUME WORK UNTIL SPECIFICALLY AUTHORIZED BY AIRPORT PERSONNEL. THE AREA AROUND THE DOWNED AIRCRAFT SHALL BE EVACUATED AND NOT REENTERED BY THE CONTRACTOR UNTIL GIVEN PERMISSION, EXCEPT FOR LIFESAVING ACTIVITIES.



NOTE:
1. ALL VEHICLES SHALL BE EQUIPPED WITH A FLAG WHILE IN THE AOA
2. SEE SAFETY NOTES FOR CONSTRUCTION SAFETY FLAG MOUNTING LOCATION REQUIREMENT

4 CONSTRUCTION SAFETY FLAG
N.T.S.

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REVISIONS

MARK	DESCRIPTION	DATE

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION
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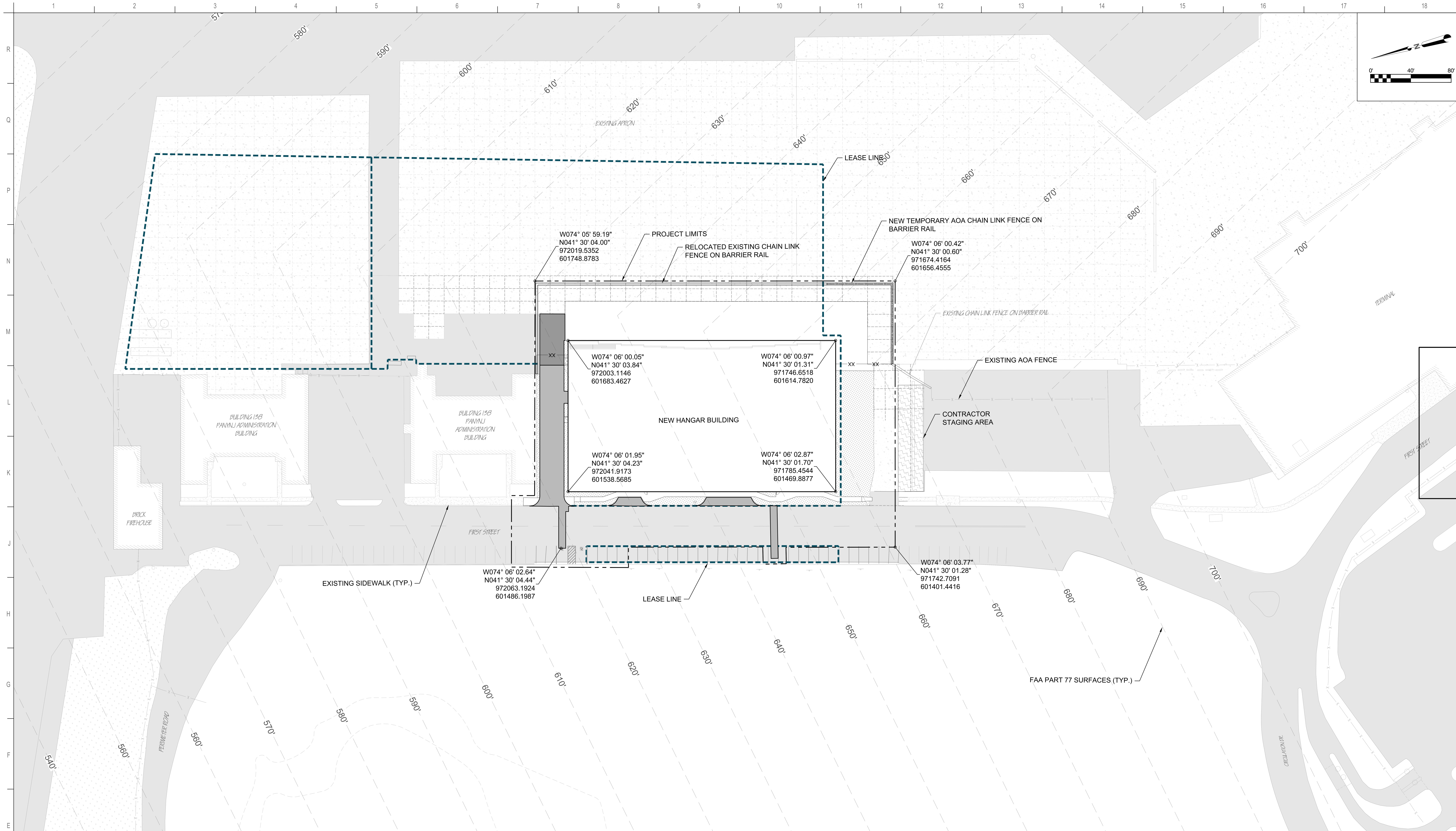
Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

SAFETY AND SECURITY NOTES AND DETAIL

C050

100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION



LEGEND

- PROJECT LIMITS
- EXISTING BUILDING
- EXISTING PAVEMENT
- EXISTING CONCRETE
- EXISTING TREE AND WETLAND AREA
- EXISTING CHAIN LINK FENCE (AOA)
- EXISTING CHAIN LINK FENCE
- NEW ASPHALT PAVEMENT
- NEW MILL AND OVERLAY PAVEMENT
- NEW CONCRETE
- NEW SOD
- CONTRACTOR STAGING AREA
- LEASE LANE
- XX —— XX NEW GALVANIZED STEEL CHAIN LINK FENCE

SAFETY NOTES:

1. PERSONNEL AND EQUIPMENT SHALL NOT ENTER THE AIRFIELD MOVEMENT AREA WITHOUT PRIOR APPROVAL OF THE CONSTRUCTION MANAGER, AND AIRPORT OPERATIONS.
2. THE MAXIMUM ALLOWABLE HEIGHT OF CONSTRUCTION EQUIPMENT AND STOCKPILED MATERIALS IS GOVERNED BY FAA ADVISORY CIRCULAR (AC) 150/5370-2, CURRENT EDITION. WHEN EQUIPMENT IS EXPECTED TO PENETRATE THE FAR PART 77 SURFACE (FOR ANY RUNWAY IN OPERATION) OR WHEN CRANES WILL BE USED ON SITE, THE CONTRACTOR SHALL NOTIFY THE ENGINEER AT LEAST NINETY (90) DAYS PRIOR TO START OF CONSTRUCTION TO COORDINATE THE SUBMITTAL OF FAA FORM 7460-1 TO THE FAA AIRPORT DISTRICT OFFICE. PERMISSION TO USE CRANES SHALL BE ISSUED BY THE ENGINEER AFTER APPROVAL BY THE FAA. THE CONTRACTOR WILL BE SOLELY RESPONSIBLE FOR ANY AND ALL FAA FINES INCURRED FOR OPERATING CRANES WITHOUT FAA APPROVAL. TWENTY-FOUR (24) HOURS NOTICE SHALL BE GIVEN TO AIRPORT PRIOR TO CRANE DEPLOYMENT. NO TIME EXTENSION WILL BE GRANTED FOR INADEQUATE NOTICE FOR USE OF A CRANE.
3. WORK WITHIN THE SAFETY AND OBJECT FREE AREAS WILL REQUIRE CLOSURE OF THE RUNWAY/TAXIWAY TO AIR TRAFFIC. A NOTAM MUST BE FILED BY AIRPORT MANAGEMENT AT LEAST FORTY-EIGHT (48) HOURS IN ADVANCE OF CLOSING RUNWAYS AND TAXIWAYS TO AIR TRAFFIC. CONTRACTOR SHALL NOTIFY AIRPORT MANAGEMENT AND CONSTRUCTION MANAGER WITH SUFFICIENT LEAD TIME FOR FILING A NOTAM.
4. ELEVATIONS SHOWN GIVEN IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NVAD 88), AND DO NOT INDICATE THE AVAILABLE HEIGHT ABOVE EXISTING GROUND.
5. FAA PART 77 IMAGINARY AIRSPACE CONTOUR ELEVATION (TYP.). THE CONTOURS REPRESENT THE ALLOWABLE HEIGHT OF OBJECTS INCLUDING CONSTRUCTION EQUIPMENT RELATIVE TO THE RESPECTIVE RUNWAY CENTERLINE ELEVATION WHILE THE RUNWAY REMAINS OPEN. PENETRATIONS INTO THE SURFACES REQUIRE CLOSURE OF THE RUNWAY AND MUST BE COORDINATED WITH THE FAA AND THE AIRPORT WELL IN ADVANCE OF CLOSURE

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REVISIONS

MARK	DESCRIPTION	DATE

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION

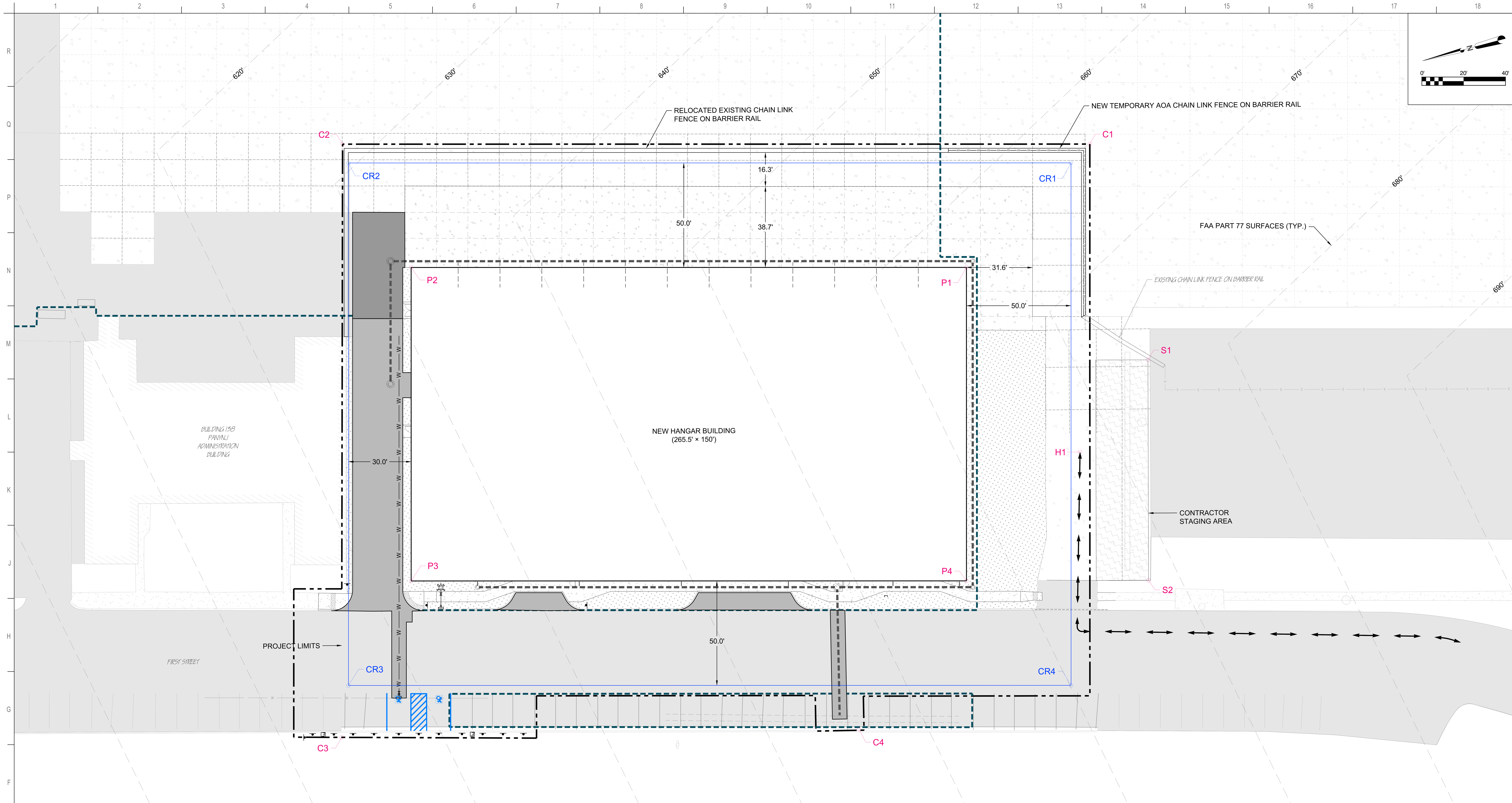
201 S. ORANGE AVE. SUITE 1100 S
ORLANDO, FL 32801

Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

AIRSPACE PROTECTION PLAN

C052

100% PERMIT SET



LEGEND

- PROJECT LIMITS
- EXISTING BUILDING
- EXISTING PAVEMENT
- EXISTING CONCRETE
- EXISTING TREE AND WETLAND AREA
- EXISTING WATER PIPE
- EXISTING STORM PIPE
- NEW ASPHALT PAVEMENT
- NEW MILL AND OVERLAY PAVEMENT
- NEW SOD
- CONTRACTOR STAGING AREA
- EXISTING CHAIN LINK FENCE (AOA)
- HAUL ROUTES/CONSTRUCTION ACCESS
- LEASE LANE
- NEW TEMPORARY AOA CHAIN LINK FENCE ON BARRIER RAIL

SURVEY NOTES:

1. THIS PLAN REPRESENTS EXISTING CONDITIONS OF THE FUTURE LEASE AREA OF SIGNATURE FLIGHT SUPPORT. SITE IS LOCATED WITHIN STEWART INTERNATIONAL AIRPORT AND IS A PORTION OF SECTION 91, LOT 24 IN BLOCK 1 AS SHOWN ON THE TAX MAP OF THE TOWN OF NEW WINDSOR, ORANGE COUNTY, NEW YORK.
2. THE LOCATION OF UNDERGROUND UTILITIES SHOWN ON THIS SURVEY ARE BASED UPON THE LOCATION OF AT GRADE UTILITIES AND MARK–OUT BY OTHERS. NOT ALL UTILITIES, INCLUDING THOSE ABANDONED OR NOT IN SERVICE, MAY BE SHOWN. BEFORE ANY EXCAVATION IS TO BEGIN, ALL UNDERGROUND UTILITIES SHOULD BE VERIFIED AS TO LOCATION, SIZE AND TYPE BY THE PROPER UTILITY COMPANIES.
3. BOUNDARY INFORMATION IS NOT SHOWN ON THIS PLAN. THIS PLAN IS INTENDED TO SHOW TOPOGRAPHICAL DATA FOR AN INTERNAL LEASE AREA OF STEWART INTERNATIONAL AIRPORT.
4. THIS SURVEY IS PREPARED WITHOUT THE BENEFIT OF A TITLE COMMITMENT AND MAY BE SUBJECT TO COVENANTS, RESTRICTIONS AND/OR EASEMENTS, EITHER WRITTEN OR IMPLIED, THAT ARE NOT SHOWN.
5. THE HORIZONTAL DATUM IS BASED UPON NAD 1983 (NY STATE PLANE COORDINATE SYSTEM EAST ZONE) PER AIRPORT CONTROL MONUMENTS (NGS PID AE2328 AND AE2329). UNITS ARE BASED ON US SURVEY FEET.
6. THE VERTICAL DATUM IS BASED UPON NAVD 1988 PER AIRPORT CONTROL MONUMENTS (NGS PID AE2328 AND AE2329).

TEMPORARY CONSTRUCTION EQUIPMENT HEIGHT INFORMATION

POINT ID	DESCRIPTION	LATITUDE	LONGITUDE	SITE ELEV. (MSL)	MAXIMUM EQUIPMENT HEIGHT	OVERALL HEIGHT (MSL)	PART 77 ELEV. (MSL)
C1	SOUTH CORNER OF PROJECT	N41° 30' 00.60"	W74° 06' 00.42"	457'	25'	482'	664'
C2	NORTH-EAST CORNER OF PROJECT	N41° 30' 04.00"	W74° 05' 59.19"	458'	25'	483'	628'
C3	NORTH CORNER OF PROJECT	N41° 30' 04.74"	W74° 06' 02.79"	458'	25'	483'	614'
C4	SOUTH-WEST CORNER OF PROJECT	N41° 30' 02.38"	W74° 06' 03.59"	457"	25'	482'	646'
CR1	SOUTH CORNER OF CRANE	N41° 30' 00.70"	W74° 06' 00.51"	457'	150'	607'	664'
CR2	NORTH-EAST CORNER OF CRANE	N41° 30' 04.00"	W74° 05' 59.31"	458'	150'	608'	630'
CR3	NORTH CORNER OF CRANE	N41° 30' 04.35"	W74° 06' 02.48"	457'	150'	607'	616'
CR4	SOUTH-WEST CORNER OF CRANE	N41° 30' 01.35"	W74° 06' 03.68"	457'	150'	607'	660'
H1	CONSTRUCTION HAUL ROUTH	N41° 30' 01.02"	W74° 06' 02.28"	457'	25'	482'	668'
S1	SOUTH CORNER OF STAGING AREA	N41° 30' 00.60"	W74° 06' 01.83"	458'	25'	483'	668'
S2	SOUTH-WEST CORNER OF STAGING AREA	N41° 30' 00.87"	W74° 06' 03.17"	458'	25'	483'	675'

PERMANENT STRUCTURE HEIGHT INFORMATION

POINT ID	DESCRIPTION	LATITUDE	LONGITUDE	SITE ELEV. (MSL)	MAXIMUM FIXTURE HEIGHT	OVERALL HEIGHT (MSL)	PART 77 ELEV. (MSL)
P1	SOUTH CORNER OF BUILDING	N41° 30' 01.31"	W74° 06' 00.97"	458'	70.5'	528.5'	666'
P2	NORTH-EAST CORNER OF BUILDING	N41° 30' 03.84"	W74° 06' 00.05"	458'	70.5'	528.5'	632'
P3	NORTH CORNER OF BUILDING	N41° 30' 04.23"	W74° 06' 01.95"	458'	62'	520'	623'
P4	SOUTH-WEST CORNER OF BUILDING	N41° 30' 01.70"	W74° 06' 02.87"	458'	62'	520'	657'

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REVISIONS

MARK	DESCRIPTION	DATE

TERMINAL AND HANGAR

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Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

AIRSPACE 7460 - PLAN

C053

100% PERMIT SET

Maintenance of Traffic Plan (MOT)

GENERAL NOTES

1. THE TYPICAL DETAILS DEPICTED ON THE STANDARD SHEETS AND IN THE MUTCD, REFLECT THE MINIMUM REQUIREMENTS.

2. PROPOSED REVISIONS TO THE TRAFFIC CONTROL PLAN SHALL BE PROVIDED, IN WRITING, TO THE PANYNJ. FOR REVIEW AND APPROVAL BY THE REGIONAL DIRECTOR OR HIS/HER DESIGNEE FIVE (5) WORK DAYS PRIOR TO THE PLANNED IMPLEMENTATION OF SUCH PROPOSED REVISIONS, EXCEPT FOR CHANGES THAT ALTER THE SCOPE OF THE TRAFFIC CONTROL PLAN. SUCH CHANGES IN SCOPE MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL BY THE REGIONAL DIRECTOR OR HIS/HER DESIGNEE THIRTY (30) WORKING DAYS PRIOR TO IMPLEMENTATION OF SUCH REVISIONS.

3. THE NAMES, ADDRESSES, AND TELEPHONE NUMBERS OF STAFF WHO ARE AUTHORIZED TO SECURE LABOR, MATERIALS, AND EQUIPMENT FOR EMERGENCY REPAIRS OUTSIDE NORMAL WORKING HOURS SHALL BE PROVIDED, IN WRITING, TO THE PANYNJ ENGINEER. THE ENGINEER WILL PROVIDE THE SUBMITTED INFORMATION TO REGIONAL MANAGEMENT, THE NEW YORK STATE POLICE, THE RESIDENT ENGINEER, AND THE LOCAL POLICE.

4. STANDARD SHEET 619-503 MAY BE USED FOR AN OFFSITE DETOUR SETUP FOR BOTH LONG TERM AND SHORT TERM WORK DURATIONS.

5. FOLLOW REGIONAL HIGH-VOLUME RESTRICTIONS. CONSULT WITH DOT ENGINEER IF EXCEPTION NEEDED.

6. PLAN AHEAD TO AVOID CONFLICTING WORK ZONES. CHECK FOR CONSTRUCTION PROJECTS, CLOSURES, & RESTRICTIONS AT WWW.511NY.ORG, WWW.DOT.NY.GOV/PROJECTS, AND WITH PANYNJ.

7. DOCUMENT AND REPORT WORK ZONE INCIDENTS USING EITHER THE DEPARTMENT'S WORK ZONE INCIDENT FORM, OR THE CONSTRUCTION INCIDENT REPORTING SYSTEM, AS APPROPRIATE.

8. CONSIDER CLOSURE WIDTH & CLEAR WIDTH FOR WIDE VEHICLES ON WIDE LOAD ROUTES.

ACTIVITY AREA

1. A 500' MINIMUM LONGITUDINAL DISTANCE SHALL BE MAINTAINED BETWEEN CONSTRUCTION OPERATIONS ON ALTERNATE SIDES OF THE ROADWAY, UNLESS OTHERWISE APPROVED BY THE ENGINEER.

2. WHEN TWO OR MORE AREAS ARE ADJACENT, OVERLAP, OR ARE IN CLOSE PROXIMITY, THE CONTRACTOR SHALL ENSURE THERE ARE NO CONFLICTING SIGNS AND THAT LANE CONTINUITY IS MAINTAINED THROUGHOUT ALL WORK AREAS.

SIGNS

1. THE LOCATIONS OF THE SIGNS SHOWN ON THE WORK ZONE TRAFFIC CONTROL PLANS AND DETAILS MAY BE ADJUSTED BASED ON SIGHT DISTANCE AND OTHER CONSIDERATIONS. THE FINAL LOCATIONS OF SIGNS ARE SUBJECT TO APPROVAL OF THE PANYNJ.

2. FOR LONG TERM WORK DURATIONS, ANY EXISTING SIGNS, INCLUDING OVERHEAD SIGNS, WHICH CONFLICT WITH THE TEMPORARY TRAFFIC CONTROL SIGN LAYOUT SHALL BE COVERED, REMOVED, STORED OR RESET, AS APPROVED BY THE ENGINEER. ALL APPROPRIATE EXISTING SIGNS SHALL BE RESTORED TO THEIR ORIGINAL CONDITION AND/OR LOCATION UNLESS OTHERWISE REPLACED IN THIS CONTRACT.

3. SIGNS AT OR NEAR INTERSECTIONS SHALL BE PLACED SO THAT THEY DO NOT OBSTRUCT A MOTORIST'S LINE OF SIGHT.

4. ~~SIGNS MOUNTED ON THE MEDIAN OF DIVIDED HIGHWAYS WHERE MEDIAN BARRIER IS IN-PLACE MAY BE MOUNTED ON THE BARRIER WITH A SADDLE TYPE BRACKET OR OMMITED WITH THE APPROVAL OF THE DOT ENGINEER. LAYING THE SIGN DOWN IN A HORIZONTAL POSITION IS NOT PERMITTED.~~

5. THE DIMENSIONS OF WORK ZONE TRAFFIC CONTROL SIGNS ARE DESCRIBED IN THE MUTCD. ANY CHANGES TO THE DIMENSIONS SHALL BE APPROVED BY THE PANYNJ.

6. NYR9-12 SHALL BE USED IN PLACE OF NYR9-11 WHEN A REDUCED REGULATORY SPEED LIMIT SIGN IS AUTHORIZED.

7. ~~RIGID AND FLEXIBLE "ROLL-UP" SIGNS MAY BE USED FOR MOBILE, SHORT DURATION AND SHORT-TERM STATIONARY WORK. RIGID SIGNS MUST BE MOUNTED AT LEAST 5 FEET ABOVE GRADE (7 FEET WHERE THERE ARE PEDESTRIANS OR PARKED CARS). FLEXIBLE SIGNS SHALL BE MOUNTED AT LEAST ONE FOOT ABOVE GRADE. MESH SIGNS SHALL NOT BE USED. USE RETRO REFLECTORIZED RIGID SIGNS FOR NIGHTTIME WORK.~~

CHANNELIZING DEVICES

1. WHERE POSSIBLE ALL CHANNELIZING AND GUIDING DEVICES ARE TO BE PLACED SO AS TO PROVIDE A MINIMUM 2' LATERAL CLEARANCE TO THE TRAVELED WAY.

PUBLIC ACCESS

1. PROPERTY OWNERS WHOSE DRIVEWAYS WILL BE MADE INACCESSIBLE SHALL BE NOTIFIED AT LEAST 24 HOURS PRIOR TO RESTRICTING USE OF THE DRIVEWAY. FOR MULTIPLE ACCESS PROPERTIES, AT LEAST ONE DRIVEWAY SHALL BE OPEN AT ALL TIMES. ACCESS SHALL BE RESTORED TO ALL DRIVEWAYS AS SOON AS POSSIBLE.

2. SUITABLE RAMPS SHALL BE INSTALLED TO MAINTAIN SMOOTH TRANSITIONS FROM RESIDENTIAL AND COMMERCIAL DRIVEWAYS TO AND FROM THE WORK AREA.

LANE CLOSURES

1. LANE CLOSURES SHALL BE LOCATED TO PROVIDE OPTIMUM VISIBILITY, I.E. BEFORE CURVES AND CRESTS, TO THE EXTENT CONDITIONS PERMIT.

2. THE ENGINEER MAY REQUIRE THAT ALL LANES BE RE-OPENED AT ANY TIME IF THE ROUTE IS NEEDED FOR EMERGENCY PURPOSES. THIS COULD INCLUDE INCIDENTS AT LOCATIONS OUTSIDE THE CONTRACT LIMITS.

3. ARROW PANELS SHALL BE LEGIBLE CONTINUOUSLY FROM ANY POINT WITHIN THE ROADWAY (INCLUSIVE OF SHOULDERS) FROM 1,500 FEET IN ADVANCE OF THE LANE CLOSURE TAPER TO THE BEGINNING OF THE LANE CLOSURE TAPER.

LANE WIDTHS

1. UNLESS AUTHORIZED BY THE ENGINEER, THE MINIMUM LANE WIDTHS FOR WORK ZONE TRAVEL LANES SHALL BE 10'.

2. A WRITTEN NOTE SHALL BE PROVIDED TO THE ENGINEER, A MINIMUM OF 21 CALENDAR DAYS IN ADVANCE OF PERFORMING ANY WORK THAT RESULTS IN THE REDUCED WIDTH OF AN EXISTING ROADWAY, SO THAT THE ENGINEER MAY NOTIFY THE PANYNJ.

PROTECTIVE VEHICLES

1. A PROTECTIVE VEHICLE IS A LARGE DUMP TRUCK, A LARGE RACK TRUCK OR OTHER VEHICLE HAVING A GROSS WEIGHT OF AT LEAST 24,000 POUNDS. IF THE PROTECTIVE VEHICLE ENCROACHES INTO THE TRAVEL LANE, OR IF IT REMAINS ENTIRELY ON THE SHOULDER OF ANY HIGH SPEED ROAD (45 MPH OR HIGHER), IT SHALL BE EQUIPPED WITH A DEPLOYED TRUCK/TRAILER MOUNTED IMPACT ATTENUATOR (TMIA, SEE TABLE 011-01 ON SHEET 619-11). PROTECTIVE VEHICLES MAY BE LOADED WITH SAND, GRAVEL, OR FINE AGGREGATE AS BALLAST TO ENHANCE THE VEHICLE'S GROSS WEIGHT. ANY BALLAST ADDED TO ENHANCE THE VEHICLE'S GROSS WEIGHT SHALL BE SECURED AS NOT TO BECOME DISLODGED IF IMPACTED.

2. A PROTECTIVE VEHICLE USED IN A MOVING OPERATION IS REFERRED TO AS A SHADOW VEHICLE.

3. A PROTECTIVE VEHICLE USED IN A STATIONARY OPERATION IS REFERRED TO AS A BARRIER VEHICLE.

4. IN A MOVING OPERATION OR A STATIONARY OPERATION THAT OCCUPIES A LOCATION FOR UP TO 1 HOUR, THE OPERATOR SHALL REMAIN IN THE PROTECTIVE VEHICLE WITH THE SAFETY BELT AND HEADREST PROPERLY ADJUSTED, MAINTAIN VEHICLE SPACING, AND KEEP THE WHEELS ALIGNED WITH THE LANE STRIPING. TWO-WAY RADIOS SHOULD BE USED TO COMMUNICATE BETWEEN THE OPERATOR AND THE WORK CREW.

5. IN A STATIONARY OPERATION THAT OCCUPIES A LOCATION FOR MORE THAN 1 HOUR, ONCE THE PROTECTIVE VEHICLE HAS BEEN APPROPRIATELY PLACED, IT SHOULD BE UNOCCUPIED. UNOCCUPIED VEHICLE SHALL BE POSITIONED PARALLEL TO TRAFFIC, PARKING BRAKE SET, PLACED IN 2ND GEAR (MANUAL TRANSMISSIONS /ENGINE OFF) OR PARK / NEUTRAL (AUTOMATIC TRANSMISSIONS) AND HAVE THE FRONT WHEELS ALIGNED WITH THE LANE STRIPING AND LANE TO MAINTAIN LANE DISCIPLINE AND TO STAY IN LANE IF STRUCK.

6. WHEN A PROTECTIVE VEHICLE IS USED IN ADVANCE OF EITHER MOVING OR STATIONARY OPERATIONS TO DISPLAY SIGN MESSAGES, IT IS REFERRED TO AS AN ADVANCE WARNING VEHICLE. ADVANCED WARNING VEHICLES MAY BE OCCUPIED OR UNOCCUPIED. WHEN SIGNS ARE MOUNTED ON AN ADVANCED WARNING VEHICLE, THEY SHALL NOT OBSTRUCT VISIBILITY OF ANY LIGHTS (TAILLIGHTS OR WARNING LIGHTS) OR SIDE-VIEW MIRRORS ON THE VEHICLE.

7. NO WORK ACTIVITY, EQUIPMENT, VEHICLES AND/OR MATERIALS SHALL BE LOCATED BETWEEN THE PROTECTIVE VEHICLE AND THE ACTIVE WORK AREA (ROLL AHEAD DISTANCE).

8. PROTECTIVE VEHICLES MAY BE REQUIRED IN CONJUNCTION WITH POLICE PRESENCE IN THE WORK ZONE, TO BE INCLUDED IN THE UNIT BID PRICE FOR BASIC WORK ZONE TRAFFIC CONTROL, FOR CAPITOL CONSTRUCTION PROJECTS.

9. DIRECT VERBAL COMMUNICATION BETWEEN THE PROTECTIVE VEHICLES AND THE WORK VEHICLE(S) / EQUIPMENT SHALL BE UTILIZED WHERE AVAILABLE.

WORK DURATION DEFINITIONS

1. THERE ARE MAINLY FIVE WORK DURATIONS:

   A. LONG-TERM IS STATIONARY WORK THAT OCCUPIES A LOCATION MORE THAN 3 CONSECUTIVE DAYS.

   B. INTERMEDIATE-TERM IS STATIONARY WORK THAT OCCUPIES A LOCATION MORE THAN ONE DAYLIGHT PERIOD UP TO 3 CONSECUTIVE DAYS, OR NIGHTTIME WORK LASTING MORE THAN 1 HOUR.

   C. SHORT-TERM IS STATIONARY DAYTIME WORK THAT OCCUPIES A LOCATION FOR MORE THAN 1 HOUR WITHIN A SINGLE DAYLIGHT PERIOD.

   D. SHORT DURATION IS WORK THAT OCCUPIES A LOCATION UP TO 1 HOUR. IT CAN BE PERFORMED DURING THE DAYTIME OR AT NIGHT IN ACCORDANCE WITH NOTES N1 TO N10 NOTES ON NIGHTTIME WORK.

   E. MOBILE IS WORK THAT MOVES INTERMITTENTLY OR CONTINUOUSLY WHERE THE WORK AT ANY SPECIFIC LOCATION COMPLETES WITHIN 15 MINUTES. IT IS USED FOR VEHICLE BASED OPERATIONS AND DOES NOT INVOLVE WORKERS ON FOOT. IT CAN BE PERFORMED DURING THE DAYTIME OR AT NIGHT IN ACCORDANCE WITH NOTES N1 TO N10 NOTES ON NIGHTTIME WORK.

2. SPECIAL OPERATIONS ARE WORK OPERATIONS THAT DO NOT FIT INTO ONE OF THE ABOVE FIVE CATEGORIES. SPECIAL OPERATIONS INCLUDE:

   A. STOP AND GO OPERATIONS - WORK THAT COMPLETES WITHIN 5 MINUTES AND ALLOWS WORKERS ON FOOT.

   B. OTHER OPERATIONS INCLUDING MOWING, MULCHING/HERBICIDE OPERATIONS, TEMPORARY ROAD/INTERSECTION CLOSURES, ETC.

ROADWAY TYPE DEFINITIONS

1. FREEWAY:

   A. INTERSTATE: INTERREGIONAL HIGH-SPEED, HIGH-VOLUME, DIVIDED FACILITIES WITH COMPLETE CONTROL OF ACCESS.

   B. PARKWAY: DIVIDED HIGHWAYS FOR NON-COMMERCIAL TRAFFIC WITH FULL CONTROL OF ACCESS, GRADE PARKWAY SEPARATIONS, INTERCHANGES, AND OCCASIONAL AT-GRADE INTERSECTIONS. PARKWAYS ARE DESIGNATED BY LAW.

ROADWAY TYPE DEFINITIONS (CONTINUED)

2. EXPRESSWAY: DIVIDED HIGHWAYS FOR THROUGH TRAFFIC WITH FULL OR PARTIAL CONTROL OF ACCESS AND GENERALLY WITH GRADE SEPARATIONS AT MAJOR CROSSROADS. ALL FREEWAY STANDARD SHEETS ARE APPLICABLE TO EXPRESSWAY.

3. NON-FREEWAY:

   A. MULTILANE DIVIDED HIGHWAY

   B. MULTILANE UNDIVIDED HIGHWAY

   C. TWO-LANE TWO-WAY ROADWAY

ALL NON-FREEWAYS CAN BE EITHER URBAN OR RURAL:

URBAN: (MEETS MORE THAN 1 OF THE FOLLOWING CRITERIA)

- HIGH DENSITY DEVELOPMENT
- ON-STREET PARKING
- VARIED BUILDING SETBACKS
- MULTI-STORY AND LOW-TO MEDIUM-RISE STRUCTURES FOR RESIDENTIAL
- COMMERCIAL, AND EDUCATIONAL USES, STRUCTURES THAT ACCOMMODATE MIXED USES: COMMERCIAL, RESIDENTIAL, AND PARKING
- LIGHT INDUSTRIAL, AND SOMETIMES HEAVY INDUSTRIAL, LAND USE
- PROMINENT DESTINATIONS WITH SPECIALIZED STRUCTURES, E.G., LARGE THEATERS, SPORTS FACILITIES OR CONFERENCE CENTERS
- HIGH LEVELS OF PEDESTRIAN AND BICYCLIST ACTIVITY, WITH NEARLY CONTINUOUS SIDEWALKS AND MARKED CROSSWALKS
- HIGHER DENSITY OF TRANSIT STOPS AND ROUTES
- DRIVEWAY DENSITIES GREATER THAN 25 DRIVEWAYS/MILE ON EACH SIDE OF THE ROAD
- MINOR COMMERCIAL DRIVEWAY DENSITIES OF 10 DRIVEWAYS/MILE OR GREATER
- MAJOR COMMERCIAL DRIVEWAYS
- HIGH DENSITY OF CROSS STREETS

RURAL: DOES NOT MEET MORE THAN ONE OF THE ABOVE CRITERIA.

NOTES FOR NIGHTTIME OPERATIONS:

N1. WORK OCCURRING AFTER SUNSET AND BEFORE SUNRISE WILL BE CONSIDERED NIGHTTIME OPERATIONS.

N2. ALL SIGNS, STOP/SLOW PADDLES AND RED FLAGS USED TO WARN/ALERT/CONTROL TRAFFIC SHALL BE RETROREFLECTIVE.

N3. ALL WORKERS INVOLVED SHALL WEAR PROTECTIVE HELMETS AND NIGHTTIME APPAREL IN ACCORDANCE WITH §107-05A. HIGH VISIBILITY APPAREL AT ALL TIMES.

N4. VEHICLES OPERATING ON THE PAVEMENT OF A CLOSED ROADWAY OR TRAVEL LANE SHALL DISPLAY ROTATING AMBER BEACONS OR FLASHING LED BEACONS AT ALL TIMES.

N5. LEVEL I ILLUMINATION SHALL BE PROVIDED NEAR THE BEGINNING OF LANE CLOSURE TAPERS AND AT ROAD CLOSURES, INCLUDING THE SETUP AND REMOVAL OF THE CLOSURE TAPERS.

N6. LEVEL II ILLUMINATION SHALL BE PROVIDED FOR FLAGGING STATIONS, ASPHALT PAVING, MILLING, AND CONCRETE PLACEMENT AND/OR REMOVAL OPERATIONS, INCLUDING BRIDGE DECKS, 50 FEET AHEAD OF AND 100 FEET BEHIND A PAVING OR MILLING MACHINE.

N7. LEVEL III ILLUMINATION SHALL BE PROVIDED FOR PAVEMENT OR STRUCTURAL CRACK FILLING, JOINT REPAIR, PAVEMENT PATCHING AND REPAIRS, INSTALLATION OF SIGNAL EQUIPMENT OR OTHER ELECTRICAL/MECHANICAL EQUIPMENT, AND OTHER TASKS INVOLVING FINE DETAILS OR INTRICATE PARTS AND EQUIPMENT.

N8. ALL LIGHTING SHALL BE DESIGNED, INSTALLED, AND OPERATED TO AVOID GLARE THAT AFFECTS TRAFFIC ON THE ROADWAY OR THAT CAUSES ANNOYANCE OR DISCOMFORT FOR RESIDENCES ADJOINING THE ROADWAY.

N9. PRIOR TO THE START OF NIGHTTIME OPERATIONS, A WRITTEN NIGHTTIME OPERATIONS AND LIGHTING PLAN IS REQUIRED FOR APPROVAL FROM THE DOT ENGINEER.

N10. SEE STANDARD SPECIFICATIONS §619 FOR ADDITIONAL REQUIREMENTS AND CONSIDERATIONS.

N11. FLAGGERS SHALL USE A FLASHLIGHT WITH RED GLOW CONE/RED LED BATON FOR FLAGGING IN NON-ILLUMINATED FLAGGER STATIONS DURING NIGHTTIME OPERATIONS.

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL GENERAL NOTES

APPROVED APRIL 8, 2022	ISSUED UNDER EI 22-008
Robert Limoges ROBERT LIMOGES, P.E. DIRECTOR, OTSM	619-010

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REVISIONS

MARK	DESCRIPTION	DATE
1.	PERMIT COMMENTS.	06/28/24

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SIGNATURE AVIATION
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Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

WORK ZONE TRAFFIC CONTROL GENERAL NOTES

C021

100% PERMIT SET

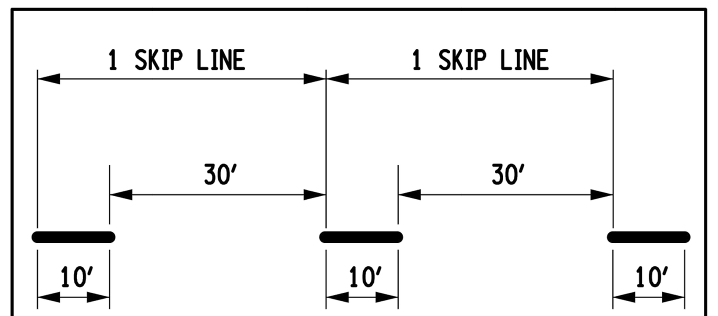
NOT RELEASED FOR CONSTRUCTION

WORK ZONE TRAFFIC CONTROL LEGEND

SYMBOL	DESCRIPTION
	ARROW PANEL
	ARROW PANEL, CAUTION MODE
	ARROW PANEL TRAILER OR SUPPORT
	CHANGEABLE MESSAGE SIGN (PVMS)
	CHANNELIZING DEVICE
	CONE
	CRASH CUSHION/TEMPORARY IMPACT ATTENUATOR
	DIRECTION OF TEMPORARY TRAFFIC DETOUR
	DIRECTION OF TRAFFIC
	AUTOMATED FLAGGER ASSISTANCE DEVICE WITH OPERATOR
	FLAGGER
	FLAG TREE
	LUMINAIRE
	MOWER
	PARKWAY GRASS SHOULDER
	PAVEMENT MARKINGS THAT SHALL BE REMOVED FOR A LONG TERM PROJECT
PVMS	PORTABLE VARIABLE MESSAGE SIGN
	ORANGE FLAGS (MIN. 18" X 18")
	TRAILER FOR ARROW PANEL OR PORTABLE VARIABLE MESSAGE SIGN (PVMS)

WORK ZONE TRAFFIC CONTROL LEGEND

SYMBOL	DESCRIPTION
	SIGN, TEMPORARY
	SPOTTER
	TEMPORARY POSITIVE BARRIER
	TEMPORARY POSITIVE BARRIER WITH WARNING LIGHTS
	TEMPORARY TRAFFIC SIGNAL HEAD
	TYPE III BARRICADE
	WARNING LIGHTS
	WORK AREA
	WORK VEHICLE
	WORK VEHICLE (MULCHING/HERBICIDE OPERATION)
	WORK VEHICLE (PAVEMENT MARKING)
	WORK VEHICLE (SIGNAL WORK)
PV	PROTECTIVE VEHICLE
PVL	PROTECTIVE VEHICLE LIGHT
PVH	PROTECTIVE VEHICLE HEAVY
	TRUCK/TRAILER MOUNTED IMPACT ATTENUATOR (TMIA)



DETAIL 011A - EXISTING SKIP LINES

NEW YORK STATE OF OPPORTUNITY. | Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL
GENERAL TABLES AND LEGEND
(SHEET 1 OF 2)

ERRATA 2 EFF. 09/01/23
ISSUED WITH EB 23-016

ERRATA 1 EFF. 05/01/2023
ISSUED WITH EB 22-033

APPROVED DECEMBER 21, 2022

Robert Limoges

ROBERT LIMOGES, P.E.
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ISSUED UNDER EI 22-033

619-011

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REVISIONS

MARK	DESCRIPTION	DATE
1.	PERMIT COMMENTS.	06/28/24

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION
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ORLANDO, FL 32801

Issue Date: 06/28/2024
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Drawn By: YY
Checked By: MM

WORK ZONE TRAFFIC CONTROL GENERAL TABLES AND LEGEND

C022

100% PERMIT SET

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TABLE 011-01: PROTECTIVE VEHICLE REQUIREMENTS [A,B]

CLOSURE TYPE	DURATION / ROAD TYPE & SPEED / EXPOSURE CONDITIONS (SEE NOTE 1)	MOBILE OPERATION AND STOP & GO: FREEWAY	MOBILE: NON-FREEWAY ≥ 45 MPH	MOBILE: NON-FREEWAY 35 - 40 MPH	MOBILE: NON-FREEWAY ≤ 30 MPH	SHORT DURATION OPERATION: FREEWAY	SHORT DURATION: NON-FREEWAY ≥ 45 MPH	SHORT DURATION: NON-FREEWAY 35 - 40 MPH	SHORT DURATION: NON-FREEWAY ≤ 30 MPH	SHORT TERM OPERATION: FREEWAY	SHORT TERM: NON-FREEWAY ≥ 45 MPH	SHORT TERM: NON-FREEWAY 35 - 40 MPH	SHORT TERM: NON-FREEWAY ≤ 30 MPH	INTERMEDIATE TERM OPERATION: FREEWAY	INTERMEDIATE TERM: NON-FREEWAY ≥ 45 MPH	INTERMEDIATE TERM: NON-FREEWAY 35 - 40 MPH	INTERMEDIATE TERM: NON-FREEWAY ≤ 30 MPH	LONG TERM OPERATION: FREEWAY	LONG TERM: NON-FREEWAY ≥ 45 MPH	LONG TERM: NON-FREEWAY 35 - 40 MPH	LONG TERM: NON-FREEWAY ≤ 30 MPH
LANE CLOSURE OR ENCROACHMENT	WORKERS ON FOOT OR WORK VEHICLE EXPOSED TO TRAFFIC	PVH+TMIA	PVH+TMIA	PVL+TMIA	PVL	PVH+TMIA	PVH+TMIA	PVL+TMIA	PVL	PVH+TMIA	PVH+TMIA	PVL+TMIA	PVL	PVH+TMIA	PVH+TMIA	PVL+TMIA	SEE NOTE 2	PVH+TMIA	PVH+TMIA	PVL+TMIA	SEE NOTE 2
LANE CLOSURE OR ENCROACHMENT	-NO WORKERS ON FOOT -NO WORK VEHICLE EXPOSED TO TRAFFIC -OTHER HAZARDS EXPOSED (IE EQUIPMENT, MATERIALS)					PVH+TMIA	PVH+TMIA	PVL	PVL	PVH+TMIA	PVH+TMIA	PVL	SEE NOTE 2	PVH+TMIA	PVH+TMIA	SEE NOTE 2	SEE NOTE 2	PVH+TMIA	PVH+TMIA	SEE NOTE 2	SEE NOTE 2
SHOULDER CLOSURE OR ENCROACHMENT	WORKERS ON FOOT OR WORK VEHICLE EXPOSED TO TRAFFIC	PVH+TMIA	PVH+TMIA	PVL+TMIA	PVL	PVH+TMIA	PVH+TMIA	PVL	PVL	PVH+TMIA	PVH+TMIA	PVL	PVL	PVH+TMIA	PVH+TMIA	SEE NOTE 2	SEE NOTE 2	PVH+TMIA	PVH+TMIA	SEE NOTE 2	SEE NOTE 2
SHOULDER CLOSURE OR ENCROACHMENT	-NO WORKERS ON FOOT -NO WORK VEHICLE EXPOSED TO TRAFFIC -OTHER HAZARDS EXPOSED (IE EQUIPMENT, MATERIALS, EXCAVATION)					PVH+TMIA	PVH+TMIA	PVL	PVL	PVH+TMIA	PVH+TMIA	PVL	SEE NOTE 2	PVH+TMIA	SEE NOTE 3	SEE NOTE 2	SEE NOTE 2	PVH+TMIA	SEE NOTE 3	SEE NOTE 2	SEE NOTE 2

LEGEND
PVL - PROTECTIVE VEHICLE LIGHT (MINIMUM GROSS WEIGHT 9,500 LBS. OR GREATER) (SEE NOTE 5)
PVH - PROTECTIVE VEHICLE HEAVY (MINIMUM GROSS WEIGHT 22,000 LBS. OR GREATER)
TMIA - TRUCK/TRAILER MOUNTED IMPACT ATTENUATOR

A. THESE PROTECTIVE VEHICLE REQUIREMENTS ARE NOT APPLICABLE TO PAVING AND MILLING OPERATIONS. A STANDARD BUFFER SPACE SHALL BE PROVIDED FOR THESE OPERATIONS IN ACCORDANCE WITH TABLE 011-03.

B. THESE PROTECTIVE VEHICLE REQUIREMENTS ARE NOT APPLICABLE TO FLAGGING OPERATIONS. PROTECTIVE VEHICLES WITH APPROPRIATE ROLL AHEAD DISTANCE MAY BE USED IN ADVANCE OF THE WORK AREA IF DEEMED NECESSARY PANYNJ.

NOTES
1. ~~THE EXPOSURE CONDITIONS ASSUME THERE IS NO POSITIVE PROTECTION PRESENT.~~

2. EITHER A PROTECTIVE LIGHT (PVL) OR THE STANDARD BUFFER SPACE (SEE TABLE 011-03) SHALL BE PROVIDED.

3. ~~EITHER A PROTECTIVE VEHICLE HEAVY (PVH) OR THE STANDARD BUFFER SPACE (SEE TABLE 011-03) SHALL BE PROVIDED.~~

4. ~~TRUCK/TRAILER MOUNTED IMPACT ATTENUATORS (TMIA) SHALL NOT BE MOUNTED/INSTALLED ON VEHICLES WITH A GROSS VEHICLE WEIGHT (GVW) LESS THAN WHAT IS MINIMALLY REQUIRED BY THE MANUFACTURER OF THE TMIA.~~

5. ~~THE USE OF A PROTECTIVE VEHICLE LIGHT (PVL) AS A SHADOW VEHICLE IS LIMITED TO NON-FREEWAY ROADWAYS WHERE THE POSTED SPEED LIMITS IS ≤ 40 MPH UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.~~

TABLE 011-02: TAPER LENGTHS & NUMBER OF CONES CHART

PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	TAPER LENGTH: (FT.)/ # OF SKIP LINES/ # OF CHANNELIZING DEVICES — LATERAL SHIFT OF TRAFFIC FLOW PATH (FT.) 4	5	6	7	8	9	10	11	12	SHOULDER TAPER LENGTH: (FT.)/ # OF SKIP LINES/ # OF CHANNELIZING DEVICES — FOR SHOULDER WIDTH ≤ 4 FT.	5 - 7 FT.	8 FT.	9 FT.	10 FT.	11 FT.	12 FT.
25	40/1/2	80/2/3	80/2/3	80/2/3	80/2/3	120/3/4	120/3/4	120/3/4	120/3/4	40/1/2	40/1/2	40/1/2	40/1/2	40/1/2	40/1/2	40/1/2
30	80/2/3	80/2/3	80/2/3	120/3/4	120/3/4	160/4/5	160/4/5	160/4/5	200/5/6	40/1/2	40/1/2	40/1/2	40/1/2	80/2/3	80/2/3	80/2/3
35	80/2/3	120/3/4	120/3/4	160/4/5	160/4/5	200/5/6	200/5/6	240/6/7	240/6/7	40/1/2	40/1/2	80/2/3	80/2/3	80/2/3	80/2/3	80/2/3
40	120/3/4	160/4/5	160/4/5	200/5/6	240/6/7	240/6/7	280/7/8	320/8/9	320/8/9	40/1/2	80/2/3	80/2/3	80/2/3	120/3/4	120/3/4	120/3/4
45	200/5/6	240/6/7	280/7/8	320/8/9	360/9/10	400/10/11	440/11/12	520/13/14	560/14/15	80/2/3	80/2/3	120/3/4	120/3/4	120/3/4	120/3/4	160/4/5
50	200/5/6	240/6/7	320/8/9	360/9/10	400/10/11	440/11/12	520/13/14	560/14/15	600/15/16	80/2/3	120/3/4	160/4/5	160/4/5	160/4/5	160/4/5	160/4/5
55	240/6/7	280/7/8	320/8/9	400/10/11	440/11/12	520/13/14	560/14/15	600/15/16	6[illegible]/17/18	80/2/3	120/3/4	160/4/5	160/4/5	160/4/5	200/5/6	200/5/6
60	240/6/7	320/8/9	360/9/10	440/11/12	480/12/13	560/14/15	600/[illegible]	680/17/18	[illegible]20/18/[illegible]	80/2/3	120/3/4	160/4/5	200/5/6	200/5/6	240/6/7	240/6/7
65	280/7/8	320/8/9	400/10/11	480/12/13	520/13/14	600/15/16	640/16/17	720/[illegible]/19	800/19/20	[illegible]/2/3	160/4/5	200/5/6	240/6/7	240/6/7	280/7/8	280/7/8

- THIS TABLE WAS CREATED WITH REFERENCE TO MUTCD TABLE 6H-4.

** THE NUMBER OF CHANNELIZING DEVICES SHOWN IS CALCULATED BASED ON A 40FT DEVICE SPACING. THE NUMBER OF CHANNELIZING DEVICES CAN BE ADJUSTED AS NECESSARY.

TABLE 011-03 LONGITUDINAL BUFFER SPACE

PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	DISTANCE (FT.)/ # OF SKIP LINES
25	155 / 4
30	200 / 5
[illegible]	250 / 6
40	305 / 8
45	360 / 9
50	425 / 11
[illegible]	495 / 13
65	645 / 16

- THIS TABLE IS THE SAME AS MUTCD TABLE 6C-2.

TABLE 011-04: ROLL AHEAD DISTANCE FOR PROTECTIVE VEHICLES

ROLL AHEAD DISTANCE (FT.)/# OF SKIP LINES FOR VEHICLES

PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	PROTECTIVE VEHICLES WEIGHING 9,500 TO 21,999 LBS. GVW: STATIONARY OPERATION	9,500 TO 21,999 LBS. GVW: MOVING OPERATION (15 MPH MAX.)	PROTECTIVE VEHICLES WEIGHING 22,000 LBS. OR GREATER GVW: STATIONARY OPERATION	22,000 LBS. OR GREATER GVW: MOVING OPERATION (15 MPH MAX.)
≥ 60	200/5	240/6	160/4	200/5
45 - 55	160/4	200/5	120/3	160/4
≤ 40	120/3	120/3	80/2	120/3

TABLE 011-05 FLARE RATES FOR POSITIVE BARRIER

TYPE OF POSITIVE BARRIER	POSTED SPEED LIMIT: 30 MPH	40 MPH	50 MPH	55 MPH	60 MPH
TEMPORARY POSITIVE BARRIER	8:1	11:1	14:1	16:1	20:1
BOX BEAM OR HEAVY POST CORRUGATED BEAM	7:1	9:1	11:1	12:1	15:1

TABLE 011-06 ADVANCE WARNING SIGN SPACING

ROAD TYPE	DISTANCE BETWEEN SIGNS: A (FT.)	B (FT.)	C (FT.)	SIGN LEGEND: XX	YY
URBAN (≤ 30 MPH*)	100	100	100	AHEAD	AHEAD
URBAN (35-40 MPH*)	200	200	200	AHEAD	AHEAD
URBAN (≥ 45 MPH*)	350	350	350	1000 FT.	AHEAD
RURAL	500	500	500	1500 FT.	1000 FT.
FREEWAY**	1000	1500	2640	1 MILE	1/2 MILE

- PRECONSTRUCTION POSTED SPEED LIMIT.

** THIS TABLE IS THE SAME AS MUTCD TABLE NY6H-3.

TABLE 011-07 TAPER LENGTH FOR TEMPORARY TRAFFIC CONTROL ZONES

TYPE OF TAPER	TAPER LENGTH (L)
MERGING TAPER	L
SHIFTING TAPER	L/2
SHOULDER TAPER	L/3
ONE-LANE, TWO-WAY TRAFFIC TAPER	50 FT. MIN -100 FT. MAX
DOWNSTREAM TAPER	50 FT. MIN -100 FT. MAX

- THIS TABLE IS THE SAME AS MUTCD TABLE 6C-3.

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL GENERAL TABLES AND LEGEND (SHEET 2 OF 2)

APPROVED DECEMBER 21, 2022

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TERMINAL AND HANGAR

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Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

WORK ZONE TRAFFIC CONTROL GENERAL TABLES AND LEGEND

C023

100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION

WORK ZONE TRAFFIC CONTROL SIGN TABLE

SIGN	SIGN DESIGNATION	COLOR CODE	NON-FREEWAY	EXPRESSWAY	FREEWAY
EX[illegible]	E5-1	C	-------	72"X60"	72"X60"
ROAD WORK NEXT [illegible]	G20-1	A	[illegible]"X18"	[illegible]8"X24"	48"X24"
END ROAD WORK	G20-2	A	36"X18"	[illegible]8"X24"	48"X24[illegible]
PILOT CAR FOLLOW ME	G20-4	A	36"X18"	------	------
WORK ZONE	G20-5aP	A	24"X1[illegible]	3[illegible]"X24"	36"X2[illegible]
INTERSTATE 22 / INTERSTATE 22	M1-1	G	1 OR [illegible] DIGITS 2[illegible]X24"	3[illegible]X36"	36"X[illegible]"
INTERSTATE 495	M1-1†	G	3 DIGITS 30"X24"	45[illegible]36"	45"[illegible]6"
X / XX	M1-4	B	1 OR 2 DIGITS 24"X24"	36"[illegible]6"	36[illegible]36"
XXX	[illegible]-4†	B	3 DIGITS 30"X24"	45"X[illegible]"	4[illegible]X36"
NORTH	M3[illegible]	SEE NOTE 3	24"X12"	36"X18[illegible]	[illegible]6"X18"
EAST	M3-2				
SOUTH	M3-[illegible]				
WEST	M[illegible]4				
DETOUR	[illegible]4-8	A	24"X12"	36"X18"	36"X18"
END DETOUR	M4-8a	A	24"X18"	24"X18"	24"X18"
DETOUR / DETOUR / DE[illegible]UR	M4-9 M4-9L M4-9R	A	[illegible]30"X24"	48"X36"	48"X36"
DE[illegible]OUR / DETOUR	M4-9a	A	30"X2[illegible]	30"X24"	-------
DETOUR / DETOUR	M4-9b	A	30"X24"	30"X24"	-------
[illegible]ETOUR / DET[illegible]R	M4-9c	A	30"X[illegible]"	30"X2[illegible]	-------
DETOU[illegible]	M4-10L	A	48"X18"	48"X[illegible]8"	48[illegible]X18"
DETOUR	M4-10R				
	[illegible]5-1	[illegible]E [illegible]TE 3	21"X15"	30[illegible]21"	30[illegible]21"
	M5[illegible]	SEE NOTE 3	21"X15"	30[illegible]21"	30"[illegible]1"
	M6-1	[illegible]EE N[illegible]E 3	21"X15"	3[illegible]"X21"	30"X2[illegible]"
	M[illegible]2				
	M6-3				
	M6-4				
XX / X[illegible]	NYM3-1	B	24"X24"	[illegible]6"X36"	36"X36"
X[illegible]X	NYM3-2	B	30[illegible]24"	45"X36"	45"X36"
XXXA	NYM3-3	B	30"X24"	45"X36"	45"X36"

WORK ZONE TRAFFIC CONTROL SIGN TABLE

SIGN	SIGN DESIGNATION	COLOR CODE	NON-FREEWAY	EXPRESSWAY	FREEWAY
STATE LAW LICENSE SUSPENDED AFTER TWO WORK ZONE SPEEDING TICKETS	NYR9-11	B	24"X42"	48"X84"	48"X84"
STATE LAW FINES DOUBLED FOR SPEEDING IN [illegible]ORK ZONES	NYR9-12	B	24"X36"	[illegible]6"X54"	48"X72[illegible]
R[illegible]BLE S[illegible]PS	NYW4-17	A	36[illegible]36"	4[illegible]"X48"	48"X[illegible]"
WET PAINT	NYW8-30	A	[illegible]8"X24"	48[illegible]X24"	48"[illegible]4"
STAY IN LANE	NYW8-31	A	48"X24"	48[illegible]24"	48[illegible]24"
DO NOT PASS	NYW8-32	A	48"X24"	48"[illegible]4"	48[illegible]X24"
LANE CLOSED	NYW8-33	A	48"X24"	48"X[illegible]4"	4[illegible]X24"
STOP	R1-1	[illegible]	36"X36"	36"X3[illegible]"	[illegible]"X48"
YIELD	[illegible]-2	E	36"X36"X36"	48"X48"X[illegible]8"	6[illegible]X60"X60"
SPEED LIMIT XX	R2-[illegible]	B	24"X30" OR 30"X36" (SEE NOTE 5)	36"X48"	36"X48"
END HIGHER FINES ZONE	R2-1[illegible]	B	24"X30"	36"X48"	36"X48"
END WORK ZONE SPEED LIMIT	R[illegible]-12	B	24"X36"	36"X54"	36"X54"
DO NOT PASS	R4-1	[illegible]	24"X30"	36"X48"	36"X48"
	R4-7	B	24"X30"	36"X48"	36"X48"
	R4-7c NARROW	B	18"X30"	-------	-------
	R4-8	B	24"X30"	36"X48"	36"X48"
	R4-8c NARROW	B	18"X30"	-------	-------
STAY IN LA[illegible]	R4-9	B	[illegible]"X30"	36"X48"	36"X48"
D[illegible]OT [illegible]TER	R5-1	E	36"[illegible]6"	36"X36[illegible]	48"X48"
P	R8-3	E	24"X24[illegible]	36"X3[illegible]	[illegible]8"X48"
PEDESTRIAN CROSSWALK	R9-8	B	36"X18"	36"X1[illegible]"	------
SIDEWALK CLOSED	R9-9	B	24"X12"	24"X[illegible]"	[illegible]------
[illegible]ALK CLOSED USE [illegible] SIDE	R9-10	B	24"[illegible]2"	24"[illegible]2"	--[illegible]---
SIDEWALK CLOSED USE OTHER SIDE / SIDEWALK CLOSED USE OTHER SIDE	R9-10L R9-10R	B	24"X12"	2[illegible]X12"	---[illegible]--
SIDEWALK CLOSED AHEAD CROSS HERE / SIDEWALK CLOSED AHEAD CROSS HERE	R9-11[illegible] R9-1[illegible]	B	24"X18"	[illegible]"X18"	-----
SIDEWALK CLOSED CROSS HERE / SIDEWALK CLOSED CROSS HE[illegible]	R9-11aL R9-11aR	B	24"X12"	24"X12"	-------
[illegible]OP [illegible]ERE ON RED	R10-6	B	24"X3[illegible]	24"X36"	-------

WORK ZONE TRAFFIC CONTROL SIGN TABLE

SIGN	SIGN DESIGNATION	COLOR CODE	NON-FREEWAY	EXPRESSWAY	FREEWAY
ROAD CLOSED / BRIDGE CLOSED	R11-2	B	48"X[illegible]"	48"X30"	48"X30"
[illegible]RIDGE [illegible]UT	R11-2 (MOD.)				
ROAD [illegible]OSED XX MILES [illegible]HEAD LOCAL TRAF[illegible] ONLY	R11-3a	B	[illegible]0"X30"	[illegible]"X30"	------
	W1-4L W1-4R	A	36"X36"	48[illegible]X48"	48"X[illegible]"
	W1-4bL W1-4bR	A	36"X36"	48"X[illegible]"	4[illegible]X48"
	W1-[illegible] W1-4[illegible]	A	36"X36"	48"X48"	[illegible]8"X48"
	[illegible]-6L	A	48"X24"	60"X30"	60"X30"
	W1-6R	A			
	W1-8L	(N[illegible] BORD[illegible]R)	18"X24"	30"X36"	30"X36"
	W1-8R	A (NO BORDER)			
	W3-1	A[4]	36"X36"	48"X48"	48"X48"
	W3-2	A[4]	36[illegible]36"	48"X48"	[illegible]8"X48"
	W3-3	A[4]	36"X36[illegible]	48"X4[illegible]	[illegible]"X48"
BE PREPARED TO STOP	W3-4	A	36"X36"	48"[illegible]8"	48[illegible]48"
[illegible]PEED [illegible]	W3-5	A[4]	[illegible]X36"	48[illegible]X48"	48"X[illegible]"
	W4-1L W[illegible]R	A	36"X36"	[illegible]"X48"	48"X4[illegible]
	W4-2L W4-2R	A	[illegible]6"X36"	48"X48"	48"X48"

WORK ZONE TRAFFIC CONTROL SIGN TABLE

SIGN	SIGN DESIGNATION	COLOR CODE	NON-FREEWAY	EXPRESSWAY	FREEWAY
SLOW TRAFFIC AHEAD	NYW23-1	A	36"X36"	48"X48"	48"X48"
WORK ZONE	G20-5aP	6F.12	2[illegible]"X18"	36"X24"	36"X24"
EXIT OPEN	E5-2	6F.28	48"X36"	48"X36"	48"X36"
EXIT CL[illegible]SED	E5-2a	6F.28	48"X36"	48"X36"	[illegible]"X36"

COLOR CODE LEGEND

CODE	DESCRIPTION
A	BLACK LEGEND AND BORDER ON AN ORANGE BACKGROUND
B	BLACK LEGEND AND BORDER ON A WHITE BACKGROUND
C	WHITE LEGEND AND BORDER ON A GREEN BACKGROUND
D	WHITE LEGEND AND BORDER ON A RED BACKGROUND
E	RED LEGEND AND BORDER ON A WHITE BACKGROUND
F	BLACK LEGEND AND BORDER ON A FLOURESCENT YELLOW GREEN BACKGROUND
G	WHITE LEGEND AND BORDER ON A BLUE AND RED BACKGROUND

NOTES:

1. DIMENSIONS ARE SHOWN AS WIDTH X HEIGHT.
2. FOR SIGNAGE NOT SHOWN ON THESE TABLES REFER TO THE M.U.T.C.D.
3. COLORS FOR DIRECTION PLAQUES, ADVANCE TURN ARROWS, AND DIRECTIONAL ARROWS SHALL MATCH THE ROUTE OR INTERSTATE SIGN THAT THEY SUPPLEMENT AS PER THE M.U.T.C.D.
4. MULTICOLORED SYMBOL IMPOSED ON SIGN WITH BLACK LEGEND AND BORDER ON AN ORANGE BACKGROUND.
5. FOR R2-1 SIGN LARGER DIMENSIONS SHALL BE USED WHEN SIGN FACES MULTIPLE LANES ON A CONVENTIONAL ROAD.

NEW YORK STATE OF OPPORTUNITY. | Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL SIGN TABLE (SHEET 1 OF 3)

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WORK ZONE TRAFFIC CONTROL SIGN TABLE

C024

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WORK ZONE TRAFFIC CONTROL SIGN TABLE

SIGN	SIGN DESIGNATION	COLOR CODE	NON-FREEWAY	EXPRESSWAY	FREEWAY
ROAD NARROWS	W5-1	A	36"X36"	48"X48"	48"X4[illegible]
[illegible]AMP N[illegible]ROWS	W5-4	A	36"X36"	48"X48"	[illegible]"X48"
	W6-3	A	36"X36"	48"X48"	48"X48"
NEXT 7 MILES	W7-3aP	A	24"X18"	36"X30"	36"X30"
BUMP	W8-1	A	36"X36"	48"X4[illegible]	48"X48"
PAVEMENT ENDS	W8-3	A	36"X36"	[illegible]"X48"	48"X48"
LOOSE GRAVEL	W[illegible]-7	A	36"X36"	48"X48"	48"X48"
ROUGH ROAD	W8-8	A	36"X36"	48"X48"	48"X48"
LOW SHOULDER	W8-9	A	36[illegible]36"	48"X48"	48"X48"
NO CENTER LINE	W8-12	[illegible]	36"X36"	-------	-------
FALLEN ROCKS	W8-14	A	36"X36"	48"X48"	48"X48"
GROOVED PAVEMENT	W8-15	A	[illegible]"X36"	48"X48"	48"X48"
	W8-17	A	36"X3[illegible]	48"X48"	48"X48"
SHOULDER DROP-OFF	W8-[illegible]p	A	24"X18"	30"X24"	30"X24"
NO SHOULDER	[illegible]8-23	A	36"X36"	48"X48"	48"X48"
STEEL PLATE ON PAVEMENT	W8-24	A	36"X36"	48[illegible]48"	48"X48"
CENTER LANE CLOSED AHEAD	W9-3	A	36"X36"	48"X48[illegible]	48"X48"
	W11-1L* W11-1R	A OR F	36"X36"	36"X36"	-------
	W11-2L* W11-2R	F	36"X36"	36"X36"	[illegible]-----
	W11-15L* W11-15R	F	36"X36"	36"X36"	-----[illegible]
IN LANE	NYW5-32P*	A	24"X18"	24"X18"	-------

WORK ZONE TRAFFIC CONTROL SIGN TABLE

SIGN	SIGN DESIGNATION	COLOR CODE	NON-FREEWAY	EXPRESSWAY	FREEWAY
XX MPH	W13-1P	A	24"X2[illegible]	30"X30"	30"X30"
[illegible] RAM[illegible]	W13-4	A	36"X36"	[illegible]6"X36"	36"X36"
NO PASSING ZONE	W13-4P	A	48"X48"X36"	[illegible]------	------[illegible]
500 FEET	[illegible]2P	A	24"X18"	3[illegible]X24"	-----[illegible]
NEXT 500 FT	W16-4P	SEE NOTE 3 A OR F	30"X24"	--[illegible]----	----[illegible]-
	W16-5PL W16-5PR	[illegible]	24"X18"	---[illegible]--	---[illegible]--
	W16-7PL W16-7PR	SEE NOTE 3 A OR F	[illegible]4"X12"	30"X[illegible]"	--[illegible]---
AHEAD	W16-9P	SEE NOTE 3 A OR F	24"X1[illegible]	30"X1[illegible]	[illegible]-----
ROAD WORK AHEAD / ROAD WORK XXX FT / ROAD WORK X MILE	W20-1	A	36"X36"	48"X48[illegible]	[illegible]8"X48"
DETOUR AH[illegible] / DETOUR XXX FT / DET[illegible] X MILE	W20-2	[illegible]	36"X36"	48"X48"	48"X48"
ROAD CLOSED AHEAD / ROAD CLOSED XXXX [illegible] / ROAD CLOSED X MILE	W20-3	A	36"X36"	48"X48"	48"X48"
ONE LANE ROAD AHEAD / ONE LANE ROAD XXX FT / ONE LANE ROAD X MILE	W20-4	A	36"X36"	48"X48[illegible]	[illegible]8"X48"
LEFT LANE CLOSED AHEAD / LEFT LANE CLOSED 1500 FT / LEFT LANE CLOSED 1 MILE / RIGHT LANE CLOSED AHEAD / RIGHT LANE CLOSED 1500 FT / RIGHT LANE CLOSED 1 MILE	W20-5	A	36"X36"	48"X[illegible]"	48[illegible]48"
2 LEFT LANES CLOSED AHEAD / 2 LEFT LANES CLOSED 1500 FT / 2 LEFT LAN[illegible] / 2 RIGHT [illegible] / 2 RIGHT [illegible] / 2 RIGHT LANES CLOSED 1 MILE	W20-5a	A	36"X36"	[illegible]"X48"	48"X48[illegible]
	W20-7	A	36"X36"	48"X48"	48"X48"

WORK ZONE TRAFFIC CONTROL SIGN TABLE

SIGN	SIGN DESIGNATION	COLOR CODE	NON-FREEWAY	EXPRESSWAY	FREEWAY
	W21-1	A	36"X36"	48"X48"	48"[illegible]8"
SLOW MO[illegible]G VEHICLE	W21-4	A	36"X18"	48"X24"	48"X24"
SHOULDER WORK	W21-5	A	36"X36"	48"X4[illegible]	48"X48"
LEFT SHOULDER CLOSED / RIGHT SHOULDER CLOSED	[illegible]21-5aL W[illegible]1-5aR	A	36"X36"	48"X48"	48"X48"
LEFT SHOULDER CLOSED AHEAD / LEFT SHOULDER CLOSED XXX FT / LEFT SHOULDER CLOSED X MILE / RIGHT SHOULDER CLOSED AHEAD / RIGHT SHOULDER CLOSED XXX FT / RIGHT SHOULDER CLOSED X MILE	W21-5bL W21-5bR	[illegible]	[illegible]6"X36"	48"X48"	48"X48"
MOWING AHEAD	W21-8	A	3[illegible]36"	48"X48"	48"X48"
BLASTING ZONE AHEAD / BLASTING ZONE XXX FT / BLASTING ZONE X MILE	W[illegible]2-1	A	36"X36"	48"X48"	48"X48"
TURN OFF 2-WAY RADIO AND CELL PHONE	W22-2	A	42"X36"	42"[illegible]6"	42"X36"
END BLASTIN[illegible] ZONE	W22-3	A	42"X36"	42"X36"	42"X36"
SLOW [illegible]AFFIC [illegible]AD	W23-1	A	48"X24"	48"X24"	[illegible]"X24"
NEW TRAFFIC PATTERN AHEAD	W23-2	A	36"X36"	48"X48"	48"X4[illegible]

COLOR CODE LEGEND

CODE	DESCRIPTION
A	BLACK LEGEND AND BORDER ON AN ORANGE BACKGROUND
B	BLACK LEGEND AND BORDER ON A WHITE BACKGROUND
C	WHITE LEGEND AND BORDER ON A GREEN BACKGROUND
D	WHITE LEGEND AND BORDER ON A RED BACKGROUND
E	RED LEGEND AND BORDER ON A WHITE BACKGROUND
F	BLACK LEGEND AND BORDER ON A FLOURESCENT YELLOW GREEN BACKGROUND
G	WHITE LEGEND AND BORDER ON A BLUE AND RED BACKGROUND

NOTES:

1. DIMENSIONS ARE SHOWN AS WIDTH X HEIGHT.
2. FOR SIGNAGE NOT SHOWN ON THESE TABLES REFER TO THE M.U.T.C.D.
3. WHEN USED IN CONJUNCTION WITH A BICYCLE SIGN (W11-1) OR PEDESTRIAN CROSSING (W11-2) COLOR CODE SHALL MATCH.

* A FLOURESCENT YELLOW-GREEN BACKGROUND COLOR SHALL BE USED FOR THIS SIGN PLAQUE.

ERRATA 1 EFF. 05/01/24
ISSUED WITH EB 24-007

NEW YORK STATE OF OPPORTUNITY. | Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL
SIGN TABLE
(SHEET 2 OF 3)

APPROVED DECEMBER 2, 2021
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ROBERT LIMOGES, P.E.
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ISSUED UNDER EI 21-028
619-012

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REVISIONS

MARK	DESCRIPTION	DATE
1.	PERMIT COMMENTS.	06/28/24

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION
201 S. ORANGE AVE. SUITE 1100 S
ORLANDO, FL 32801

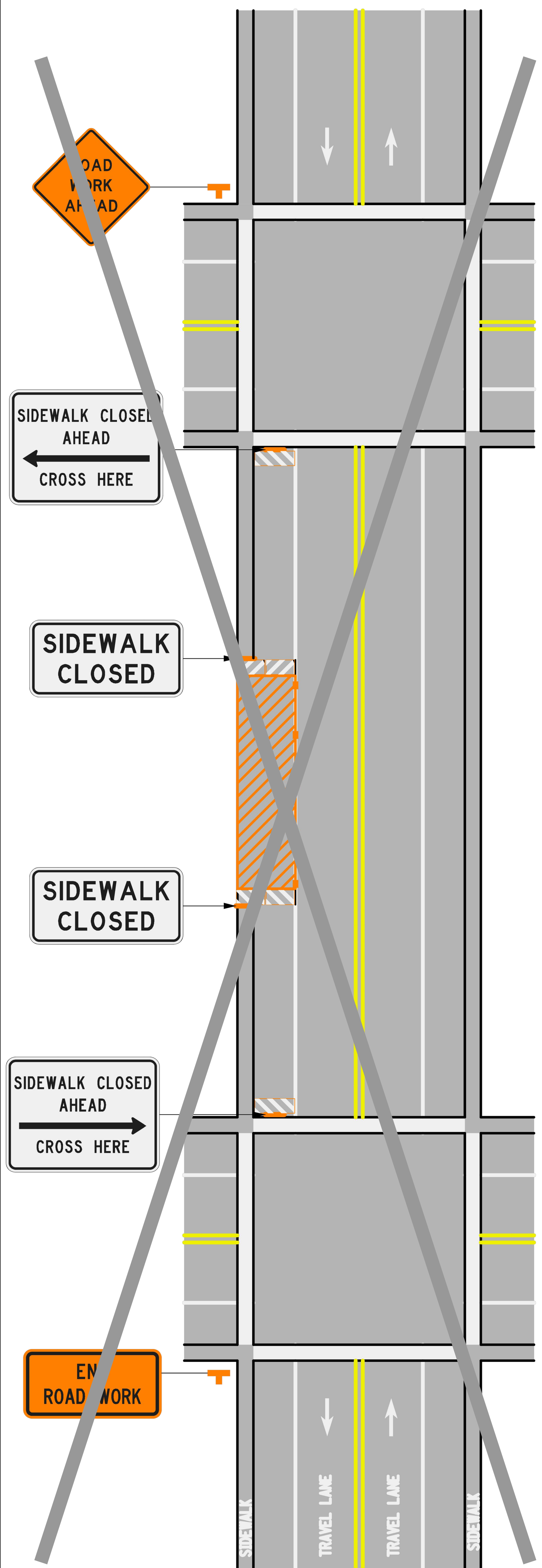
Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

WORK ZONE TRAFFIC CONTROL SIGN TABLE

C025 1

100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION



NOT TO SCALE

SIDEWALK DETOUR

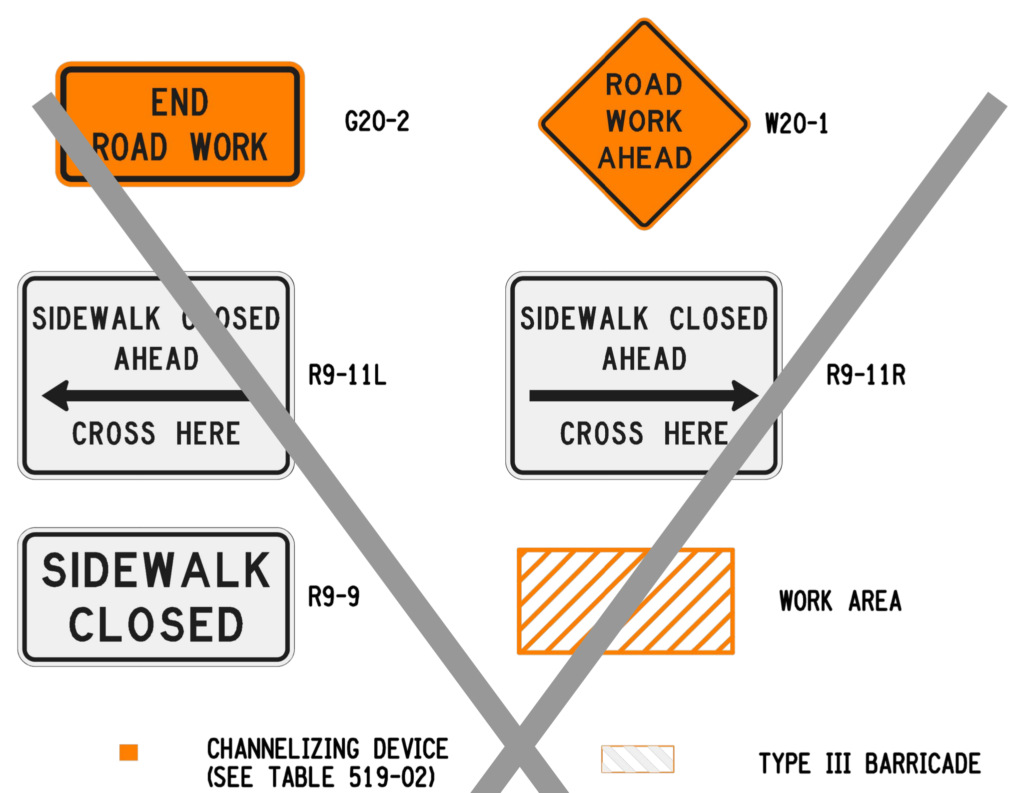


TABLE 519-01: REQUIRED SIGN SIZES*		
SIGN	NON-FREEWAY	FREEWAY
G20-2	36x18	48x24
R9-11L/R9-11R**	24x18	24x18
R9-9**	24x12	24x12
W20-1	36x36	48x48

*FREEWAY SIZES MAY BE USED ON NON-FREEWAY, IF SPACE CONSTRAINTS DO NOT EXIST.
**SIGNS NOT FOR FREEWAY USE

NOTES:

1. LONG-TERM STATIONARY WORK THAT OCCUPIES A LOCATION MORE THAN 3 CONSECUTIVE DAYS. THIS SETUP CAN ALSO BE USED FOR INTERMEDIATE TERM WORK.
2. ANY ALTERNATIVE PEDESTRIAN PATHWAY MUST HAVE AT LEAST THE SAME LEVEL OF ACCESSIBILITY AS THE ONE IT IS REPLACING.
3. ONLY THE WORK ZONE TRAFFIC CONTROL DEVICES RELATED TO PEDESTRIANS ARE SHOWN, OTHER DEVICES, SUCH AS LANE/SHOULDER CLOSURE SIGNING, ROAD NARROWS SIGNS (W5-1), OR NO PARKING SIGNS MAY BE USED TO CONTROL VEHICULAR TRAFFIC.
4. TYPE III BARRICADES SHALL BE THE FULL WIDTH OF THE PATH BEING CLOSED.
5. ACCESS TO BUSINESS ENTRANCES AND TRANSIT STOPS WILL NEED TO BE MAINTAINED. IF THE PEDESTRIAN FACILITY CURRENTLY HAS A TRANSIT STOP THAT WILL BE AFFECTED BY THE WORK ZONE, PRACTITIONERS SHOULD CONSULT THE TRANSIT AUTHORITIES THAT SERVICE THE AFFECTED STOP TO DETERMINE HOW TO ACCOMMODATE THE STOP.

NOTES ON NIGHTTIME WORK:

N1. WORK OCCURRING AFTER SUNSET AND BEFORE SUNRISE WILL BE CONSIDERED NIGHTTIME OPERATIONS.

N2. ALL SIGNS, STOP/SLOW PADDLES AND RED FLAGS USED TO WARN/ALERT/CONTROL TRAFFIC SHALL BE RETROREFLECTIVE.

N3. ALL WORKERS INVOLVED SHALL WEAR PROTECTIVE HELMETS AND NIGHTTIME APPAREL IN ACCORDANCE WITH §107-05A. HIGH VISIBILITY APPAREL AT ALL TIMES.

N4. VEHICLES OPERATING ON THE PAVEMENT OF A CLOSED ROADWAY OR TRAVEL LANE SHALL DISPLAY ROTATING AMBER BEACONS OR FLASHING LED BEACONS AT ALL TIMES.

N5. LEVEL I ILLUMINATION SHALL BE PROVIDED NEAR THE BEGINNING OF LANE CLOSURE TAPERS AND AT ROAD CLOSURES, INCLUDING THE SETUP AND REMOVAL OF THE CLOSURE TAPERS.

N6. LEVEL II ILLUMINATION SHALL BE PROVIDED FOR FLAGGING STATIONS, ASPHALT PAVING, MILLING, AND CONCRETE PLACEMENT AND/OR REMOVAL OPERATIONS, INCLUDING BRIDGE DECKS, 50 FEET AHEAD OF AND 100 FEET BEHIND A PAVING OR MILLING MACHINE.

N7. LEVEL III ILLUMINATION SHALL BE PROVIDED FOR PAVEMENT OR STRUCTURAL CRACK FILLING, JOINT REPAIR, PAVEMENT PATCHING AND REPAIRS, INSTALLATION OF SIGNAL EQUIPMENT OR OTHER ELECTRICAL/MECHANICAL EQUIPMENT, AND OTHER TASKS INVOLVING FINE DETAILS OR INTRICATE PARTS AND EQUIPMENT.

N8. ALL LIGHTING SHALL BE DESIGNED, INSTALLED, AND OPERATED TO AVOID GLARE THAT AFFECTS TRAFFIC ON THE ROADWAY OR THAT CAUSES ANNOYANCE OR DISCOMFORT FOR RESIDENCES ADJOINING THE ROADWAY.

N9. PRIOR TO THE START OF NIGHTTIME OPERATIONS, A WRITTEN NIGHTTIME OPERATIONS AND LIGHTING PLAN IS REQUIRED FOR APPROVAL.

N10. AT NIGHT, EACH TYPE III CONSTRUCTION BARRICADE USED TO CLOSE A ROADWAY, A SEGMENT OF A ROADWAY OR A SIDEWALK SHALL BE EQUIPPED WITH ONE FLASHING WARNING LIGHT.

N11. SEE NIGHTTIME SAFETY BULLETIN, HDM §16.5.7, & STANDARD SPECIFICATIONS §619 FOR ADDITIONAL REQUIREMENTS AND CONSIDERATIONS.

TABLE 519-02: CHANNELIZING DEVICE APPLICATION FOR LONG-TERM STATIONARY WORK ZONES											
WORK ZONE PROVISIONS	MAXIMUM DEVICE SPACING (CENTER TO CENTER)	CHANNELIZING DEVICE									
LONG-TERM STATIONARY WORK ZONES INVOLVE WORK THAT OCCUPIES A LOCATION FOR MORE THAN 3 CONSECUTIVE DAYS.		DRUMS	STANDARD CONES	TALL CONES	EXTRA TALL CONES	TEMPORARY TUBULAR MARKERS	INTERIM TUBULAR MARKERS	VERTICAL PANELS	OVERSIZED VERTICAL PANELS	TYPE II BARRICADES	TYPE III BARRICADES
SHOULDER/MERGING/ SHIFTING TAPERS	20 FT.	X							X	X	

NOTES: X= ALLOWED BLANK = NOT ALLOWED

NEW YORK STATE OF OPPORTUNITY. | Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL
TWO-LANE TWO-WAY ROADWAY
SIDEWALK DETOUR/DIVERSION
LONG TERM OPERATION
(SHEET 1 OF 2)

APPROVED DECEMBER 2, 2021 | ISSUED UNDER EI 21-028

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REVISIONS		
MARK	DESCRIPTION	DATE
1.	PERMIT COMMENTS.	06/28/24

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION
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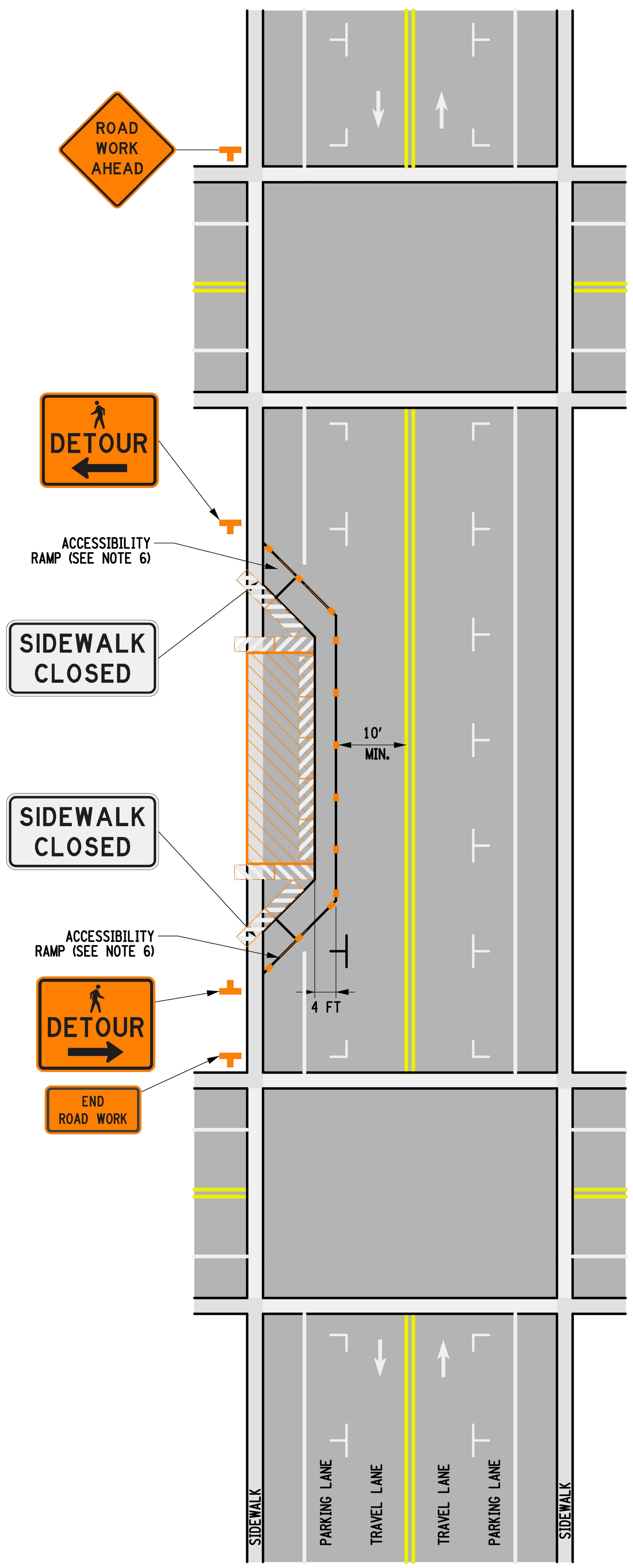
Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

WORK ZONE TRAFFIC CONTROL TWO-LANE TWO-WAY ROADWAY

C026

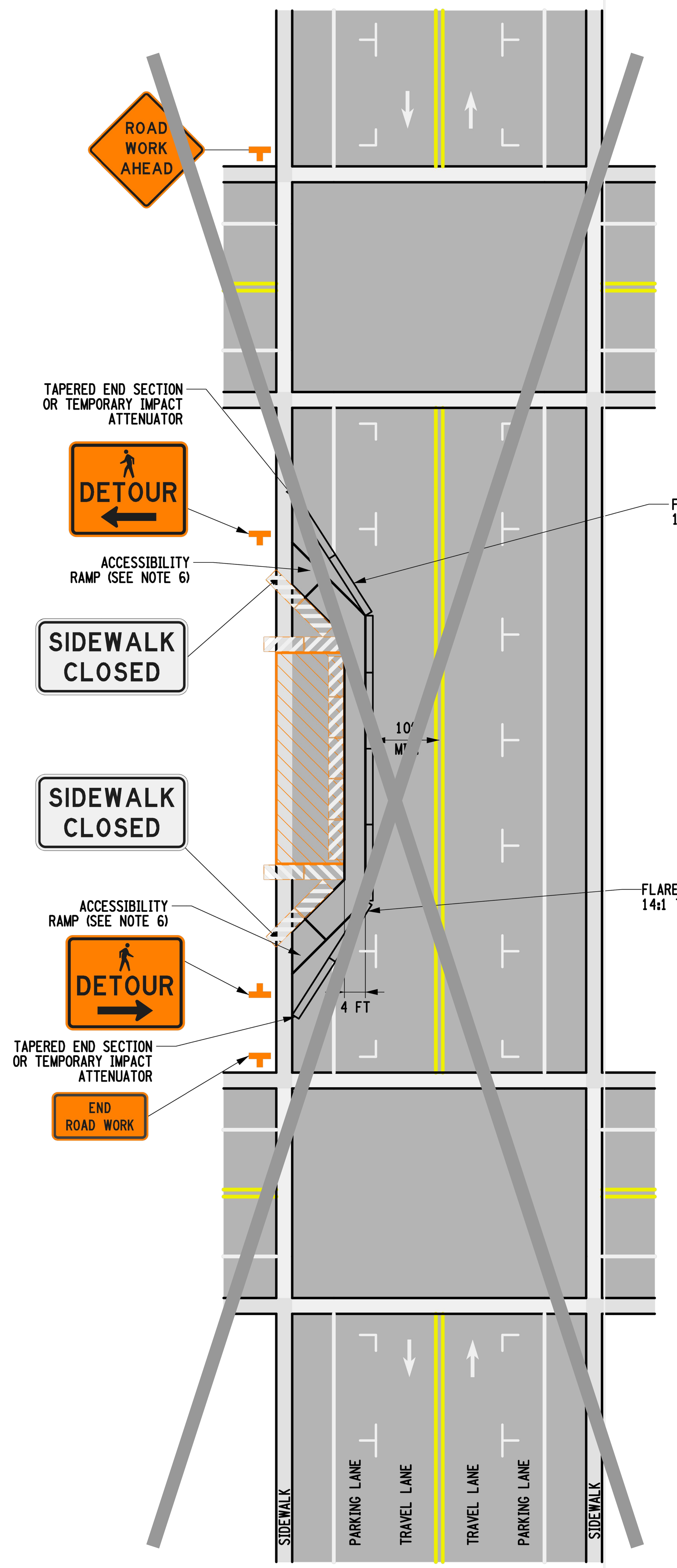
100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION



NOT TO SCALE

DETAIL 519A: SIDEWALK DIVERSION
- POSTED SPEED LIMIT < 45 MPH



DETAIL 519B: SIDEWALK DIVERSION
- POSTED SPEED LIMIT ≥ 45 MPH

NOTES:

1. LONG-TERM IS STATIONARY WORK THAT OCCUPIES A LOCATION MORE THAN 3 CONSECUTIVE DAYS. THIS SETUP CAN ALSO BE USED FOR INTERMEDIATE TERM WORK.
2. ANY SIDEWALK DIVERSION MUST BE ADA COMPLIANT AND FOLLOW THE 2011 PUBLIC RIGHTS-OF-WAY ACCESSIBILITY GUIDELINES (PROWAG). TEMPORARY RAMPS AND OTHER TEMPORARY PEDESTRIAN FACILITIES SHALL BE PAID FOR UNDER THE APPROPRIATE ITEM FOR HOT MIX ASPHALT (HMA) SIDEWALKS.
3. PROWAG SECTION R205 AND MUTCD PART 6 SHALL APPLY TO ALL TEMPORARY ALTERNATIVE PEDESTRIAN PATHWAYS.
4. ONLY THE WORK ZONE TRAFFIC CONTROL DEVICES RELATED TO PEDESTRIANS ARE SHOWN. OTHER DEVICES, SUCH AS LANE/SHOULDER CLOSURE SIGNING, ROAD NARROWS SIGNS (W5-4), OR NO PARKING SIGNS MAY BE USED TO CONTROL VEHICULAR TRAFFIC.
5. TYPE III BARRICADES SHALL BE THE FULL WIDTH OF THE PATH BEING CLOSED.
6. THE GRADE (RUNNING SLOPE) OF A TEMPORARY CURB RAMP FOR DESIGN AND LAYOUT SHALL BE A MAXIMUM OF 7.5%. THE GRADE FOR ADA ACCESSIBILITY AND WORK ACCEPTANCE SHALL BE A MAXIMUM OF 8.3%.
7. ACCESS TO BUSINESS ENTRANCES AND TRANSIT STOPS WILL NEED TO BE MAINTAINED. IF THE PEDESTRIAN FACILITY CURRENTLY HAS A TRANSIT STOP THAT WILL BE AFFECTED BY THE WORK ZONE, PRACTITIONERS SHOULD CONSULT THE TRANSIT AUTHORITIES THAT SERVICE THE AFFECTED STOP TO DETERMINE HOW TO ACCOMMODATE THE STOP.

NOTES ON NIGHTTIME WORK:

N1. WORK OCCURRING AFTER SUNSET AND BEFORE SUNRISE WILL BE CONSIDERED NIGHTTIME OPERATIONS.

N2. ALL SIGNS, STOP/SLOW PADDLES AND RED FLAGS USED TO WARN/ALERT/CONTROL TRAFFIC SHALL BE RETROREFLECTIVE.

N3. ALL WORKERS INVOLVED SHALL WEAR PROTECTIVE HELMETS AND NIGHTTIME APPAREL IN ACCORDANCE WITH §107-05A. HIGH VISIBILITY APPAREL AT ALL TIMES.

N4. VEHICLES OPERATING ON THE PAVEMENT OF A CLOSED ROADWAY OR TRAVEL LANE SHALL DISPLAY ROTATING AMBER BEACONS OR FLASHING LED BEACONS AT ALL TIMES.

N5. LEVEL I ILLUMINATION SHALL BE PROVIDED NEAR THE BEGINNING OF LANE CLOSURE TAPERS AND AT ROAD CLOSURES, INCLUDING THE SETUP AND REMOVAL OF THE CLOSURE TAPERS.

N6. LEVEL II ILLUMINATION SHALL BE PROVIDED FOR FLAGGING STATIONS, ASPHALT PAVING, MILLING, AND CONCRETE PLACEMENT AND/OR REMOVAL OPERATIONS, INCLUDING BRIDGE DECKS, 50 FEET AHEAD OF AND 100 FEET BEHIND A PAVING OR MILLING MACHINE.

N7. LEVEL III ILLUMINATION SHALL BE PROVIDED FOR PAVEMENT OR STRUCTURAL CRACK FILLING, JOINT REPAIR, PAVEMENT PATCHING AND REPAIRS, INSTALLATION OF SIGNAL EQUIPMENT OR OTHER ELECTRICAL/MECHANICAL EQUIPMENT, AND OTHER TASKS INVOLVING FINE DETAILS OR INTRICATE PARTS AND EQUIPMENT.

N8. ALL LIGHTING SHALL BE DESIGNED, INSTALLED, AND OPERATED TO AVOID GLARE THAT AFFECTS TRAFFIC ON THE ROADWAY OR THAT CAUSES ANNOYANCE OR DISCOMFORT FOR RESIDENCES ADJOINING THE ROADWAY.

N9. PRIOR TO THE START OF NIGHTTIME OPERATIONS, A WRITTEN NIGHTTIME OPERATIONS AND LIGHTING PLAN IS REQUIRED FOR APPROVAL.

N10. AT NIGHT, EACH TYPE III CONSTRUCTION BARRICADE USED TO CLOSE A ROADWAY, A SEGMENT OF A ROADWAY OR A SIDEWALK SHALL BE EQUIPPED WITH ONE FLASHING WARNING LIGHT.

N11. SEE NIGHTTIME SAFETY BULLETIN, HDM §16.5.7, & STANDARD SPECIFICATIONS §619 FOR ADDITIONAL REQUIREMENTS AND CONSIDERATIONS.

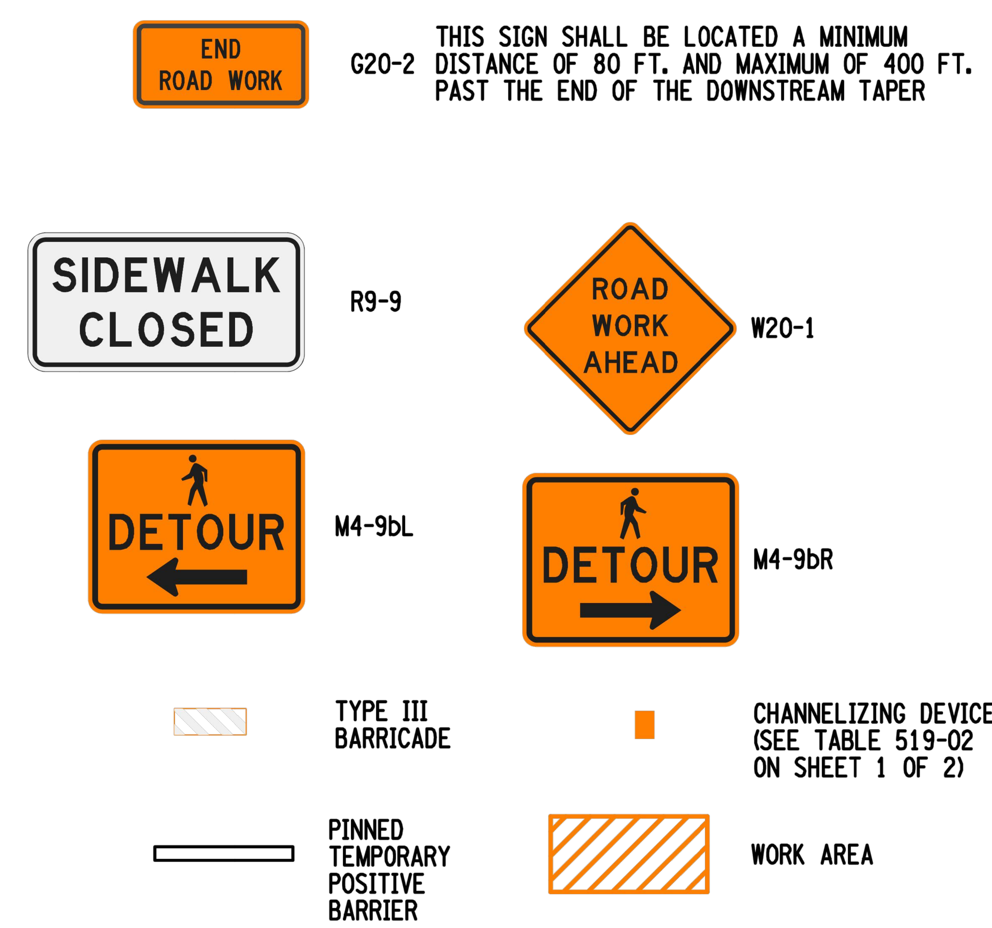


TABLE 519-03: REQUIRED SIGN SIZES*

SIGN	NON-FREEWAY	FREEWAY
G20-2	36x18	48x24
M4-9bL/M4-9bR**	30x24	30[illegible]
R9-9**	24x12	24x12
W20-1	36x36	48x48

*FREEWAY SIZES MAY BE USED ON NON-FREEWAY, IF SPACE CONSTRAINTS DO NOT EXIST.
**SIGNS NOT FOR FREEWAY USE.

NEW YORK STATE OF OPPORTUNITY. | Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL
TWO-LANE TWO-WAY ROADWAY
SIDEWALK DETOUR/DIVERSION
LONG TERM OPERATION
(SHEET 2 OF 2)

APPROVED DECEMBER 2, 2021 | ISSUED UNDER EI 21-028

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MARK	DESCRIPTION	DATE
1.	PERMIT COMMENTS.	06/28/24

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

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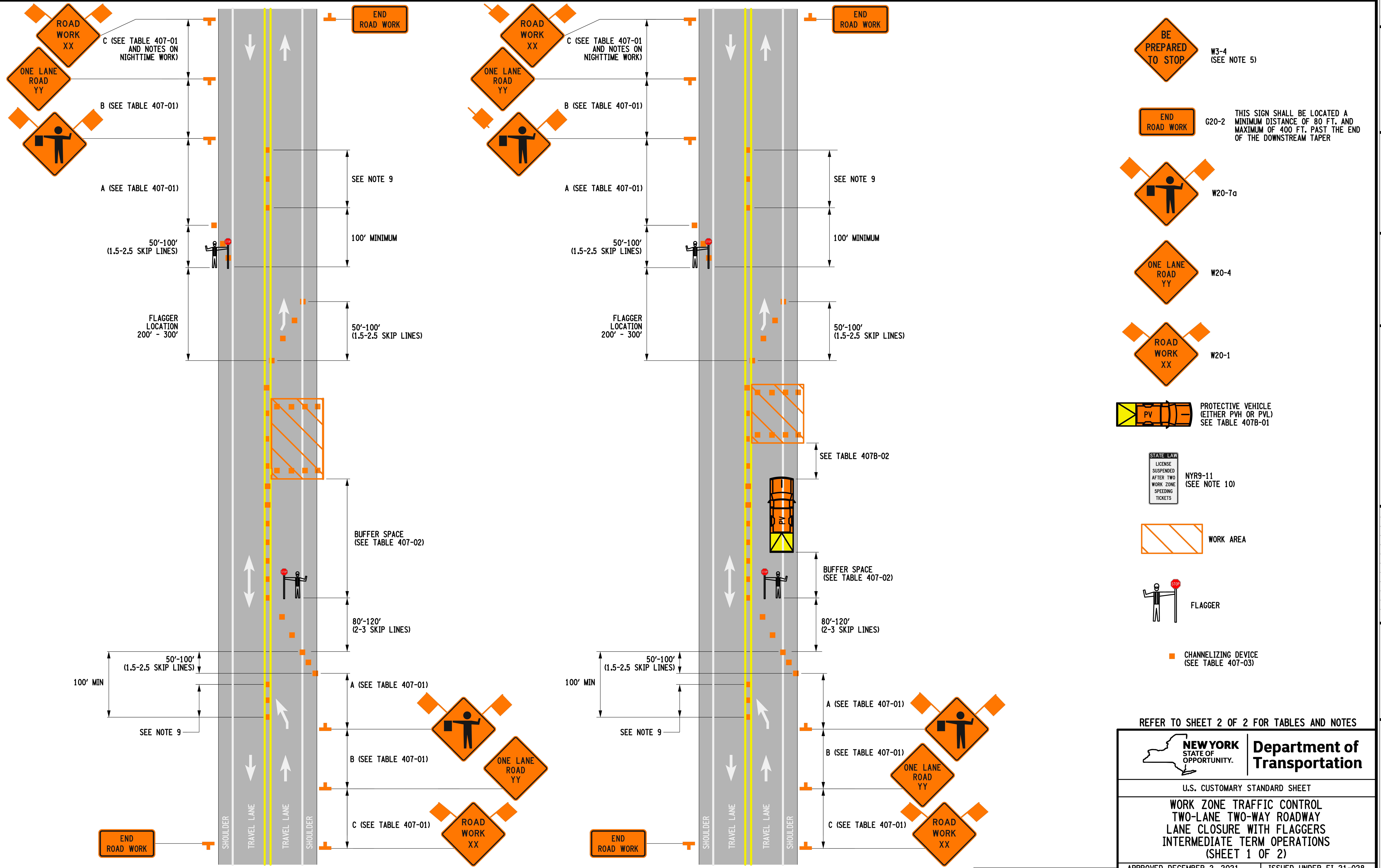
Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

WORK ZONE TRAFFIC CONTROL TWO-LANE TWO-WAY ROADWAY

C027

100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION



NOT TO SCALE

407A: REQUIRED SETUP

307B: OPTIONAL SETUP WITH PROTECTIVE VEHICLE (SEE NOTE 6)

REFER TO SHEET 2 OF 2 FOR TABLES AND NOTES

NEW YORK STATE OF OPPORTUNITY. Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL
TWO-LANE TWO-WAY ROADWAY
LANE CLOSURE WITH FLAGGERS
INTERMEDIATE TERM OPERATIONS
(SHEET 1 OF 2)

APPROVED DECEMBER 2, 2021

Robert Limoges

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ISSUED UNDER EI 21-028

619-407

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ISSUED WITH EB 23-016

ERRATA 1 EFF. 01/01/23
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REVISIONS

MARK	DESCRIPTION	DATE
1.	PERMIT COMMENTS.	06/28/24

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION

201 S. ORANGE AVE. SUITE 1100 S
ORLANDO, FL 32801

Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

WORK ZONE TRAFFIC CONTROL TWO-LANE TWO-WAY ROADWAY

C028

100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION

TABLE 407-01: ADVANCE WARNING SIGN SPACING

ROAD TYPE	DISTANCE BETWEEN SIGNS			SIGN LEGEND	
	A (FT.)	B (FT.)	C (FT.)	XX	YY
URBAN (≤ 30 MPH•)	100	100	100	AHEAD	AHEAD
URBAN (35-40 MPH•)	200	200	200	AHEAD	[illegible]
URBAN (≥ 45 MPH•)	[illegible]	[illegible]	[illegible]	1000 FT.	AHEAD
[illegible]	500	500	500	[illegible]	[illegible]

• PRECONSTRUCTION POSTED SPEED LIMIT

TABLE 407-02: LONGITUDINAL BUFFER SPACE

PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	LONGITUDINAL BUFFER SPACE DISTANCE (FT.)/ • OF SKIP LINES
25	155/4
30	200/5
[illegible]	[illegible]
40	305/8
45	360/9
[illegible]	[illegible]
55	495/13

TABLE 407-03: CHANNELIZING DEVICE APPLICATION FOR INTERMEDIATE-TERM STATIONARY WORK ZONES

WORK ZONE PROVISIONS	MAXIMUM DEVICE SPACING (CENTER TO CENTER)	MUTCD COMPLIANT CHANNELIZING DEVICE								
INTERMEDIATE-TERM STATIONARY WORK ZONES INVOLVE WORK THAT OCCUPIES A LOCATION FOR MORE THAN 1 DAYLIGHT PERIOD UP TO 3 CONSECUTIVE DAYS, OR NIGHTTIME WORK THAT OCCUPIES A LOCATION FOR MORE THAN 1 HOUR		DRUMS	STANDARD CONES	TALL CONES	EXTRA TALL CONES	TEMPORARY TUBULAR MARKERS	INTERIM TUBULAR MARKERS	VERTICAL PANELS	OVERSIZED VERTICAL PANELS	TYPE III BARRICADES
SHOULDER/MERGING/ SHIFTING TAPERS	20 FT. •	X							X	
	40 FT.	X							X	
MARKING FOR TRANSVERSE BUMPS[1]	N/A	X[2]			X[2]				X[2]	
TRANSVERSE DEVICE WITHIN CLOSED TRAFFIC LANE AND/OR SHOULDER	800 FT.	X		X	X			X	X	0
REMOVAL OF EXISTING GUIDE RAIL	80 FT. / 40 FT.	X		X	X	X		X	X	0

NOTES: X= ALLOWED, BLANK = NOT ALLOWED, 0 = OPTIONAL

1. - A TYPE 1 OBJECT MARKER MAY BE USED IN LIEU OF CHANNELIZING DEVICE.
2. - CHANNELIZING DEVICES SHALL BE EQUIPPED WITH A FLASHING WARNING LIGHT.

• SEE NOTE 4 ON SHEET 1 OF 2.

TABLE 407-04: REQUIRED SIGN SIZES•

SIGN	NON-FREEWAY	FREEWAY
G20-2	36x18	48x24
W3-4	36x36	[illegible]x48
W20-1	36x36	48x[illegible]
W20-4	36x36	[illegible]x48
W20-7	36x36	48x48
WARNING FLAG	18x18	18x18

•FREEWAY SIZES MAY BE USED ON NON-FREEWAY, IF SPACE CONSTRAINTS DO NOT EXIST.

TABLE 407B-01: PROTECTIVE VEHICLE REQUIREMENTS

CLOSURE TYPE	ROAD TYPE & SPEED	NON-FREEWAY		
		≥ 45 MPH	35 - 40 MPH	≤ 30 MPH
	EXPOSURE CONDITIONS (SEE NOTE 1)			
LANE CLOSURE OR ENCROACHMENT	WORKERS ON FOOT OR WORK VEHICLE EXPOSED TO TRAFFIC	PVH+TMIA	PVL+TMIA	SEE NOTE 2
	-NO WORKERS ON FOOT -NO WORK VEHICLE EXPOSED TO TRAFFIC -OTHER HAZARDS EXPOSED (IE EQUIPMENT, MATERIALS)	PVH+TMIA	SEE NOTE 2	SEE NOTE 2
SHOULDER CLOSURE OR ENCROACHMENT	WORKERS ON FOOT OR WORK VEHICLE EXPOSED TO TRAFFIC	PVH+TMIA	SEE NOTE 2	SEE NOTE 2
	-NO WORKERS ON FOOT -NO WORK VEHICLE EXPOSED TO TRAFFIC -OTHER HAZARDS EXPOSED (IE EQUIPMENT, MATERIALS, EXCAVATION)	SEE NOTE 3	SEE NOTE 2	SEE NOTE 2

LEGEND
PVL - PROTECTIVE VEHICLE LIGHT (MINIMUM GROSS WEIGHT 9,500 LBS. OR GREATER) (SEE NOTE 4)
PVH - PROTECTIVE VEHICLE HEAVY (MINIMUM GROSS WEIGHT 22,000 LBS. OR GREATER)
TMIA - TRUCK/TRAILER MOUNTED IMPACT ATTENUATOR

NOTES
1. THE EXPOSURE CONDITIONS ASSUME THERE IS NO POSITIVE PROTECTION PRESENT.
2. EITHER A PROTECTIVE LIGHT (PVL) OR THE STANDARD BUFFER SPACE (SEE TABLE 011-03) SHALL BE PROVIDED.
3. TRUCK/TRAILER MOUNTED IMPACT ATTENUATORS (TMIA) SHALL NOT BE MOUNTED/INSTALLED ON VEHICLES WITH A GROSS VEHICLE WEIGHT (GVW) LESS THAN WHAT IS MINIMALLY REQUIRED BY THE MANUFACTURER OF THE TMIA.
4. THE USE OF A PROTECTIVE VEHICLE LIGHT (PVL) AS A SHADOW VEHICLE IS LIMITED TO NON-FREEWAY ROADWAYS WHERE THE POSTED SPEED LIMITS IS ≤ 40 MPH UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER.

TABLE 407B-02: ROLL AHEAD DISTANCE FOR PROTECTIVE VEHICLES

ROLL AHEAD DISTANCE (FT.)/# OF SKIP LINES FOR VEHICLES		
PRECONSTRUCTION POSTED SPEED LIMIT (MPH)	STATIONARY OPERATION	
	PROTECTIVE VEHICLES WEIGHING 9,500 TO 21,999 LBS. GVW	PROTECTIVE VEHICLES WEIGHING 22,000 LBS. OR GREATER GVW
[illegible]	[illegible]	[illegible]
≤ 40	120/3	80/2

NOTES:

1. INTERMEDIATE-TERM IS STATIONARY WORK THAT OCCUPIES A LOCATION MORE THAN ONE DAYLIGHT PERIOD UP TO 3 CONSECUTIVE DAYS, OR NIGHTTIME WORK LASTING MORE THAN 1 HOUR.
2. WHEN A SIDE ROAD OR DRIVEWAY INTERSECTS THE ROADWAY WITHIN A WORK ZONE TRAFFIC CONTROL AREA, ADDITIONAL TEMPORARY TRAFFIC CONTROL DEVICES AND/OR FLAGGERS SHALL BE PLACED AS NEEDED. ADDITIONAL FLAGGERS SHALL BE LOCATED AT ALL INTERSECTIONS AND COMMERCIAL DRIVEWAYS LOCATED WITHIN OR NEAR THE ACTIVE WORK SPACE. NO WORK ACTIVITY, EQUIPMENT, OR STORAGE OF VEHICLES, OR MATERIAL SHALL OCCUR WITHIN THE BUFFER SPACE AT ANY TIME.
3. CHANNELIZING DEVICE SPACING (CENTER TO CENTER) SHALL NOT EXCEED 20' IN THE ACTIVE WORK SPACE.
4. CHANNELIZING DEVICES SHALL BE PLACED TRANSVERSELY A MINIMUM OF EVERY 800' AS SHOWN WHEN A PAVED SHOULDER HAVING A WIDTH OF 8' OR GREATER IS CLOSED FOR A DISTANCE GREATER THAN 800'.
5. IF THE TRAFFIC IS EXPECTED TO QUEUE PAST THE W20-4 SIGN, A W3-4 SIGN SHOULD BE ADDED HALFWAY BETWEEN THE W20-4 AND W20-1 SIGNS.
6. IF CONDITION WARRANTS, PROTECTIVE VEHICLE WITH APPROPRIATE ROLL AHEAD DISTANCE MAY BE USED IN ADVANCE OF THE WORK AREA. TO USE PROTECTIVE VEHICLE, BUFFER SPACE SHALL BE PROVIDED ACCORDINGLY, AND THE WHEELS SHALL BE ALIGNED WITH THE LANE STRIPING.
7. FLAGGER SIGN (W20-7a) AND ONE LANE ROAD AHEAD SIGN (W20-4) SHALL BE REMOVED, COVERED OR TURNED AWAY FROM ROAD USERS WHEN FLAGGING OPERATIONS ARE NOT OCCURRING.
8. ALL FLAGGERS SHALL USE 24" (MIN.) OCTAGON SHAPED STOP/SLOW PADDLES HAVING 6' STAFF. THE PADDLE IS THE PREFERRED DEVICE, BUT THE FLAG MAY BE USED AT INTERSECTIONS WHERE THE STOP/SLOW PADDLE WOULD OFFER CONTRADICTING INFORMATION TO DRIVERS TRAVELING IN OPPOSITE DIRECTIONS/LEGS OF THE INTERSECTION OR DURING INCIDENT MANAGEMENT SITUATIONS.
9. CENTERLINE CONES MAY BE ADDED TO ENHANCE THE VISIBILITY OF THE FLAGGER STATION. IF CONES ARE USED, PLACE THEM 100 FT. (MINIMUM) FROM FLAGGER.
10. THE NY9-11 SIGN IS RECOMMENDED. WHEN USED, IT SHALL BE PLACED IN ADVANCE OF THE FIRST ADVANCE WARNING SIGN. THE PLACEMENT DISTANCE SHALL BE 1000' FOR POSTED SPEED LIMITS OF 45 MPH OR HIGHER, AND 300' - 500' FOR POSTED SPEED LIMITS OF LESS THAN 45 MPH.

NOTES FOR NIGHTTIME OPERATIONS:

N1. WORK OCCURRING AFTER SUNSET AND BEFORE SUNRISE WILL BE CONSIDERED NIGHTTIME OPERATIONS.
N2. ALL SIGNS, STOP / SLOW PADDLES AND RED FLAGS USED TO WARN / ALERT / CONTROL TRAFFIC SHALL BE RETROREFLECTIVE.
N3. ALL WORKERS INVOLVED SHALL WEAR PROTECTIVE HELMET AND NIGHTTIME APPAREL IN ACCORDANCE WITH y107-05A. HIGH VISIBILITY APPAREL AT ALL TIMES.
N4. VEHICLES OPERATING ON THE PAVEMENT OF A CLOSED ROADWAY OR TRAVEL LANE SHALL DISPLAY ROTATING AMBER BEACONS AT ALL TIMES.
N5. LEVEL I ILLUMINATION SHALL BE PROVIDED NEAR THE BEGINNING OF LANE CLOSURE TAPERS AND AT ROAD CLOSURES, INCLUDING THE SETUP AND REMOVAL OF THE CLOSURE TAPERS.
N6. LEVEL II ILLUMINATION SHALL BE PROVIDED FOR FLAGGING STATIONS, ASPHALT PAVING, MILLING, AND CONCRETE PLACEMENT AND/OR REMOVAL OPERATIONS,INCLUDING BRIDGE DECKS, 50 FEET AHEAD OF AND 100 FEET BEHIND A PAVING OR MILLING MACHINE.
N7. LEVEL III ILLUMINATION SHALL BE PROVIDED FOR PAVEMENT OR STRUCTURAL CRACK FILLING, JOINT REPAIR, PAVEMENT PATCHING AND REPAIRS, INSTALLATION OF SIGNAL EQUIPMENT OR OTHER ELECTRICAL/MECHANICAL, AND OTHER TASKS INVOLVING FINE DETAILS OR INTRICATE PARTS AND EQUIPMENT.
N8. ALL LIGHTING SHALL BE DESIGNED, INSTALLED, AND OPERATED TO AVOID GLARE THAT AFFECTS TRAFFIC ON THE ROADWAY OR THAT CAUSES ANNOYANCE OR DISCOMFORT FOR RESIDENCES ADJOINING THE ROADWAY.
N9. PRIOR TO THE START OF NIGHTTIME OPERATIONS, A WRITTEN NIGHTTIME OPERATIONS AND LIGHTING PLAN IS REQUIRED FOR APPROVAL FROM THE DOT ENGINEER.
N10. SEE STANDARD SPECIFICATIONS y619 FOR ADDITONAL REQUIREMENTS AND CONSIDERATIONS.
N11. FLAGGERS SHALL USE A FLASHLIGHT WITH A RED GLOW CONE/RED LED BATON FOR FLAGGING IN NON-ILLUMINATED FLAGGER STATIONS DURING NIGHTTIME OPERATIONS.

ERRATA 1 EFF. 09/01/23
ISSUED WITH EB 23-016

NEW YORK STATE OF OPPORTUNITY. | Department of Transportation

U.S. CUSTOMARY STANDARD SHEET

WORK ZONE TRAFFIC CONTROL
TWO-LANE TWO-WAY ROADWAY
LANE CLOSURE WITH FLAGGERS
INTERMEDIATE TERM OPERATION
(SHEET 2 OF 2)

APPROVED APRIL 8, 2022 | ISSUED UNDER EI 22-008

Robert Limoges
ROBERT LIMOGES, P.E.
DIRECTOR, OTSM

619-407

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TAMPA, FL 33618

REVISIONS

MARK	DESCRIPTION	DATE
1.	PERMIT COMMENTS.	06/28/24

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION
201 S. ORANGE AVE. SUITE 1100 S
ORLANDO, FL 32801

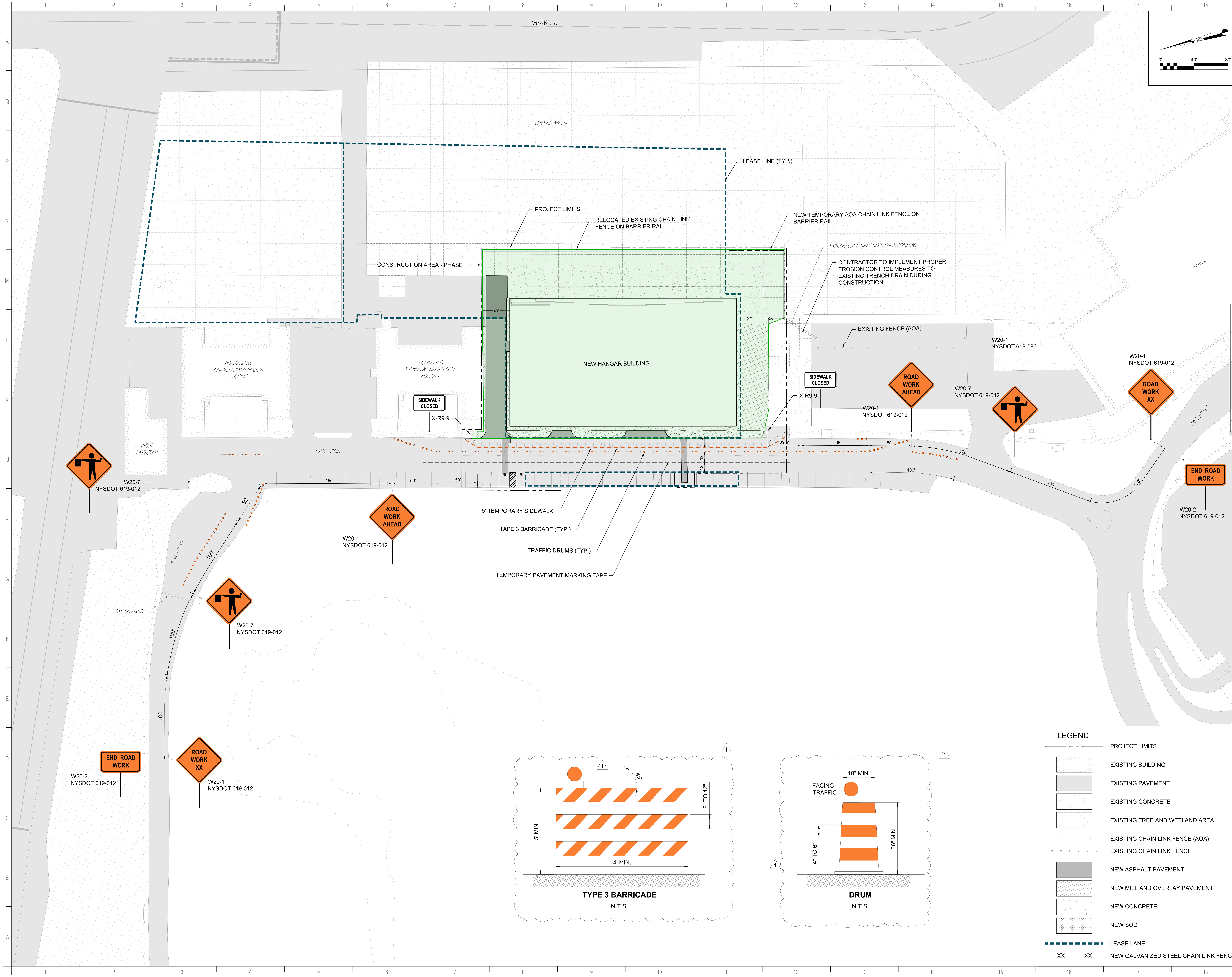
Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

WORK ZONE TRAFFIC CONTROL TWO-LANE TWO-WAY ROADWAY

C029

100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION



LEGEND

- PROJECT LIMITS
- EXISTING BUILDING
- EXISTING PAVEMENT
- EXISTING CONCRETE
- EXISTING TREE AND WETLAND AREA
- EXISTING CHAIN LINK FENCE (AOA)
- EXISTING CHAIN LINK FENCE
- NEW ASPHALT PAVEMENT
- NEW MILL AND OVERLAY PAVEMENT
- NEW CONCRETE
- NEW SOD
- LEASE LANE
- —XX——XX— NEW GALVANIZED STEEL CHAIN LINK FENCE

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AT: STEWART INTERNATIONAL AIRPORT (SWF)

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ORLANDO, FL 32801

Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

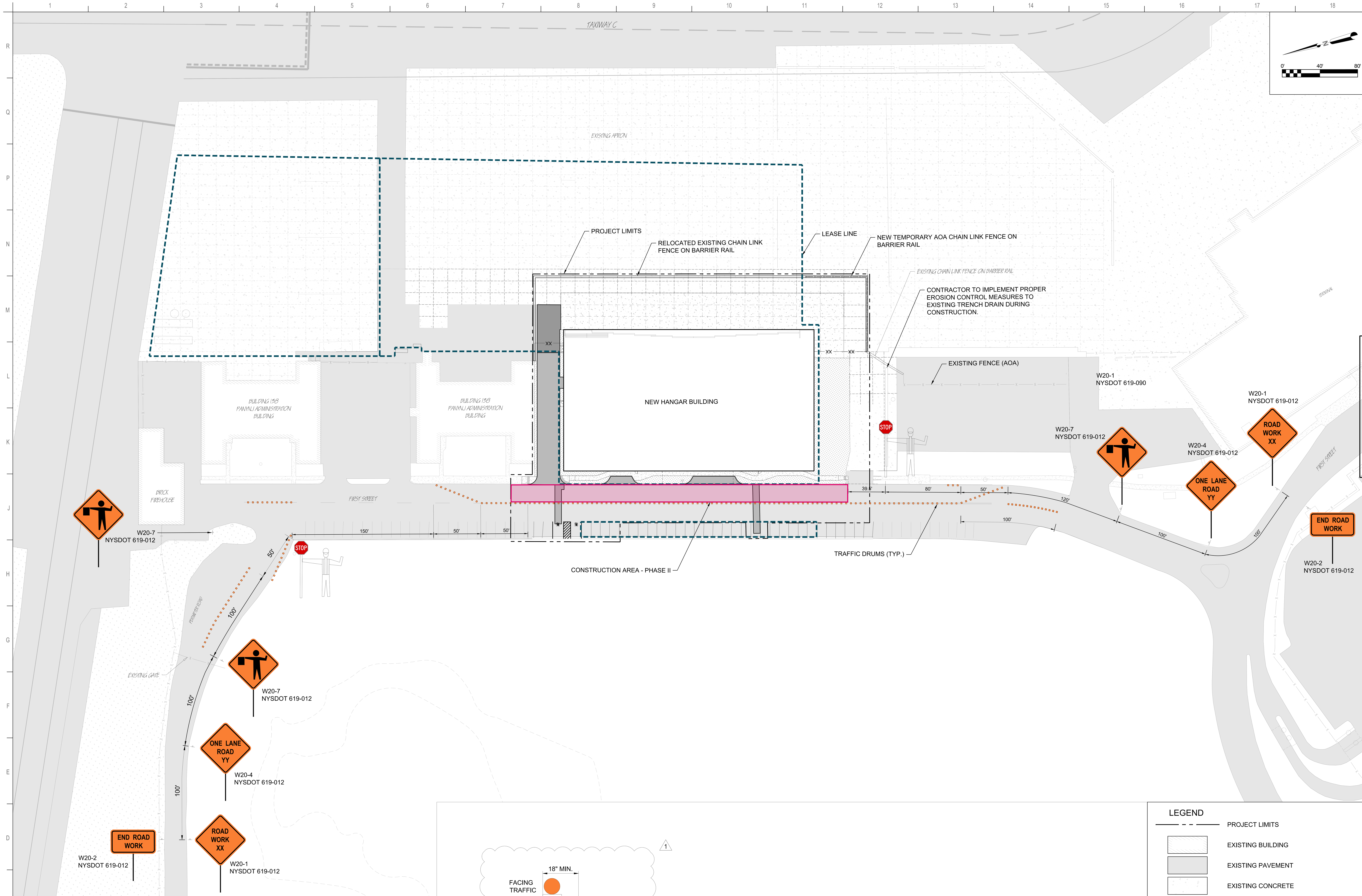
MAINTENANCE OF TRAFFIC PLAN - PHASE I

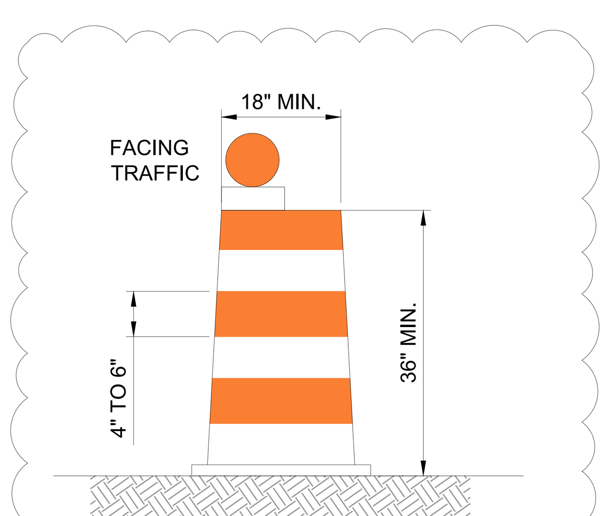
C030

100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION

Plotted: C:\Users\Graham\MOHSEN DESIGN GROUP Dropbox\MDG\Projects\SWF\HDG23005-SWF-SFS Terminal and Hangar\00-Drawings\23005-SWF-SFS-C030-PH1.dwg -- Graham





DRUM

N.T.S.

NOTES:

1. ALL OPEN TRENCHES SHALL BE COVERED WITH TEMPORARY ROADWAY PLATES IF EXCAVATION IS NOT CLOSED DURING WORK HOURS. ALL OPEN TRENCHES WITHIN PEDESTRIAN WALKWAYS AND CROSSWALKS TO BE OPENED TO TRAFFIC SHALL BE COVERED WITH THE APPROPRIATE PROTECTION.
2. TEMPORARY ROADWAY PLATES SHALL BE STEEL, SIZED TO COVER ROADWAY EXCAVATIONS WITH THICKNESS AND EDGE SUPPORT ADEQUATE TO ACCOMODATE HS-20-44 LOADING PER SECTION 3.7.6 IN THE AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES".

LEGEND

- PROJECT LIMITS
- EXISTING BUILDING
- EXISTING PAVEMENT
- EXISTING CONCRETE
- EXISTING TREE AND WETLAND AREA
- EXISTING CHAIN LINK FENCE (AOA)
- EXISTING CHAIN LINK FENCE
- NEW ASPHALT PAVEMENT
- NEW MILL AND OVERLAY PAVEMENT
- NEW CONCRETE
- NEW SOD
- LEASE LANE
- XX — XX NEW GALVANIZED STEEL CHAIN LINK FENCE

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REVISIONS

MARK	DESCRIPTION	DATE
1.	PERMIT COMMENTS.	06/28/24

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION
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ORLANDO, FL 32801

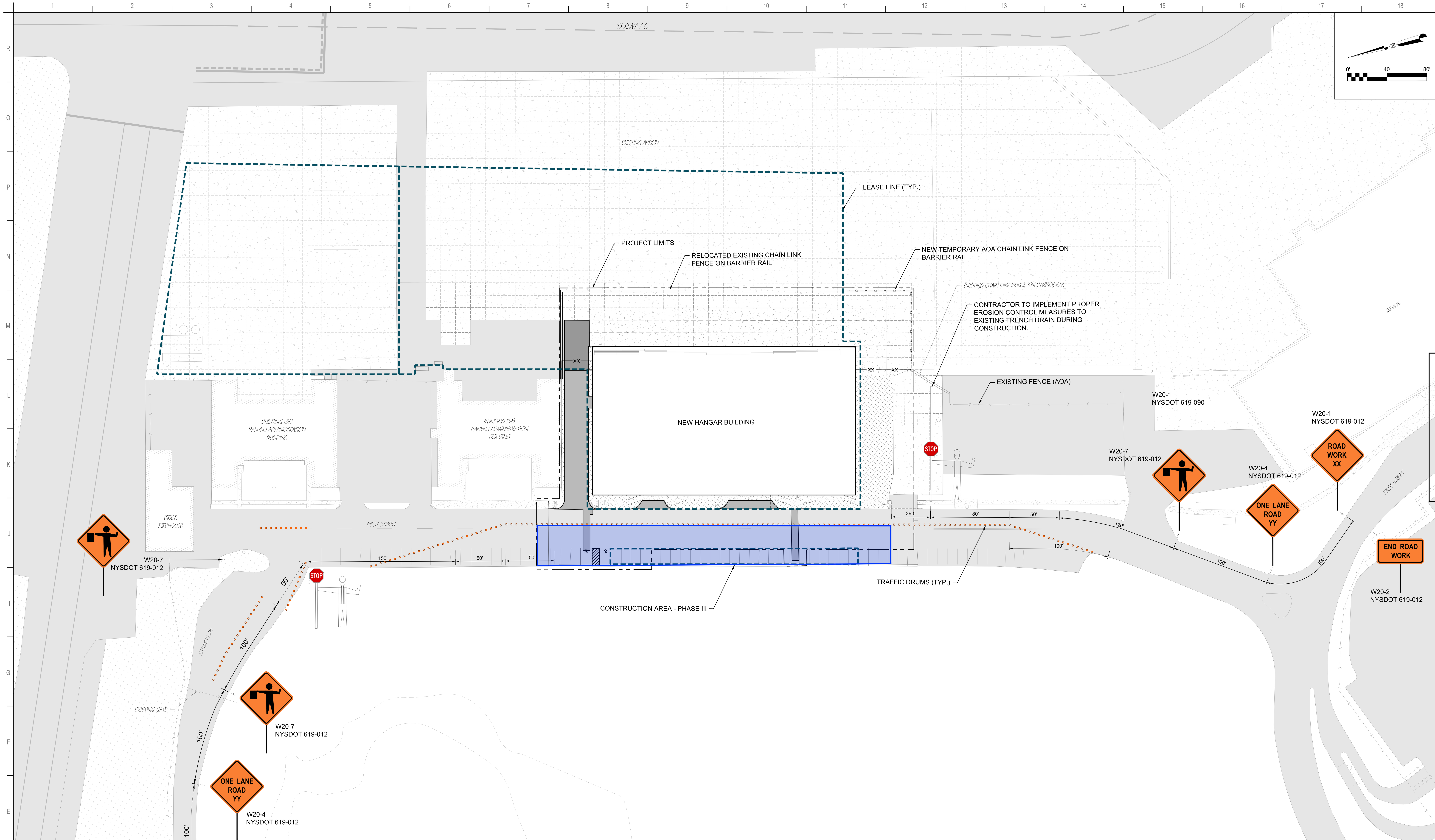
Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

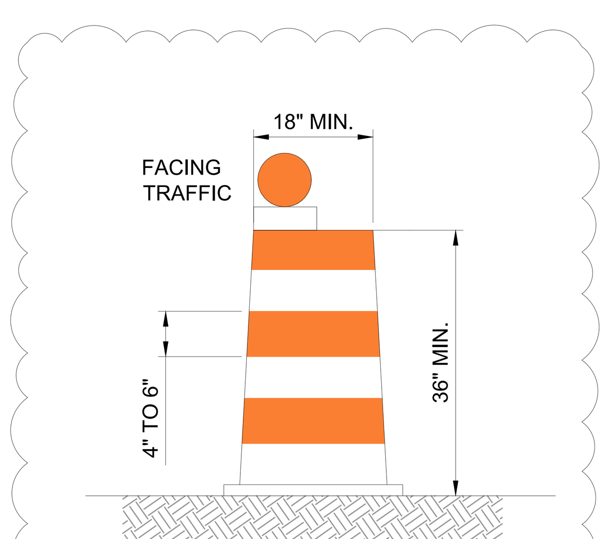
MAINTENANCE OF TRAFFIC PLAN - PHASE II

C031

100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION





DRUM

N.T.S.

NOTES:

1. ALL OPEN TRENCHES SHALL BE COVERED WITH TEMPORARY ROADWAY PLATES IF EXCAVATION IS NOT CLOSED DURING WORK HOURS. ALL OPEN TRENCHES WITHIN PEDESTRIAN WALKWAYS AND CROSSWALKS TO BE OPENED TO TRAFFIC SHALL BE COVERED WITH THE APPROPRIATE PROTECTION.
2. TEMPORARY ROADWAY PLATES SHALL BE STEEL, SIZED TO COVER ROADWAY EXCAVATIONS WITH THICKNESS AND EDGE SUPPORT ADEQUATE TO ACCOMODATE HS-20-44 LOADING PER SECTION 3.7.6 IN THE AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES".

LEGEND

- PROJECT LIMITS
- EXISTING BUILDING
- EXISTING PAVEMENT
- EXISTING CONCRETE
- EXISTING TREE AND WETLAND AREA
- EXISTING CHAIN LINK FENCE (AOA)
- EXISTING CHAIN LINK FENCE
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- XX — XX NEW GALVANIZED STEEL CHAIN LINK FENCE

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REVISIONS

MARK	DESCRIPTION	DATE
1.	PERMIT COMMENTS.	06/28/24

TERMINAL AND HANGAR

AT: STEWART INTERNATIONAL AIRPORT (SWF)

SIGNATURE AVIATION

201 S. ORANGE AVE. SUITE 1100 S
ORLANDO, FL 32801

Issue Date: 06/28/2024
MDG Project No. HDG23005
Drawn By: YY
Checked By: MM

MAINTENANCE OF TRAFFIC PLAN - PHASE III

C032

100% PERMIT SET

NOT RELEASED FOR CONSTRUCTION

Geotechnical Report

ANS GEO

GEOTECHNICAL RECOMMENDATIONS REPORT

Van Cleef
ENGINEERING WITH FOCUS

Stewart International Airport (Rev.01)
Signature Flight Terminal and Hangars

New Windsor, Orange County, New York

April 15, 2024

STATE OF NEW YORK
THILEEPAN RAJAH
EXCELSIOR
106305
LICENSED PROFESSIONAL ENGINEER

Thileepan Rajah, PE
New York PE No. 106305

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Appendix G – ASCE7 Seismic Hazard Tool Report

1 Executive Summary

ANS Geo, Inc. (NJ) and ANS Consultants, Inc. (NY) (collectively, "ANS") are pleased to present this Geotechnical Recommendations Report to Van Cleef Engineering (Client) in support of the design and construction of the proposed Signature Hangar, Hangar 1 and Signature FBO Terminal located within Stewart International Airport in New Windsor, Orange County, New York. The contents of this report summarize the data gathered from our subsurface investigation program performed September 26th to October 24th, 2023, and foundation recommendations for the proposed improvements. This geotechnical report is being submitted as a revised version of the originally submitted report dated October 20, 2023.

The listing below summarizes the findings described throughout this report:

1. ANS completed 12 soil borings within the proposed Signature Hangar, Hangar 1 and Signature FBO Terminal locations at Stewart International Airport in New Windsor, Orange County, New York.

2. Ten (10) asphalt cores were collected, logged, and inspected during our geotechnical investigation to record the thickness and condition of the current pavement. These pavement cores range between 2- and 23-inches thick and vary between reinforced concrete and asphalt layers. Core times also varied considerably with pavement penetration being observed between 9 minutes and 2 hours.

3. The overburden material was primarily comprised of Glacial Till that ranged between granular and cohesive. Therefore, we noted "**Glacial Till I**" and "**Glacial Till II**" to represent the granular and cohesive material respectively.

4. Based on encountered conditions on site, the Seismic Site Classification for this project site is **Site Class C.**

5. A bearing capacity and settlement analysis considering the proposed square footage of the project and the encountered subsurface conditions was performed. The analysis explored the potential for slab-on-grade, strip (wall footing), square (column footing) and mat slab foundations in support of the proposed structures. **The Allowable Bearing Capacities ranged from 500 to 2,500 pounds per square feet (psf).** The results of our analysis are summarized within Table 9 through Table 11 in **Section 8.1**.

6. Our recommendations also looked at the preparation of the subgrade material before the foundation element is constructed. As a result, from our settlement analysis, ANS recommends that all load foundation elements are to be found at a minimum of 40 inches (3.3 feet) below ground surface (BGS). Additionally, we recommend over-excavating 18-inches below frost depth and bring back to the desired grade by using compacted structural fill as mentioned in Table 11.

7. Pavement considerations of both the airside and the roadside of the project site are included in **Section 9**. This one refers to the Port Authority's (PANYNJ) "Civil – design Criteria & Special Requirements" that addresses the design criteria for pavement in both vehicular and aircraft usage. Additionally, the design of flexible and rigid airfield and vehicular pavements shall comply with the Federal Aviation Administration (FAA) and AASHTO, respectively.

2 Project Understanding

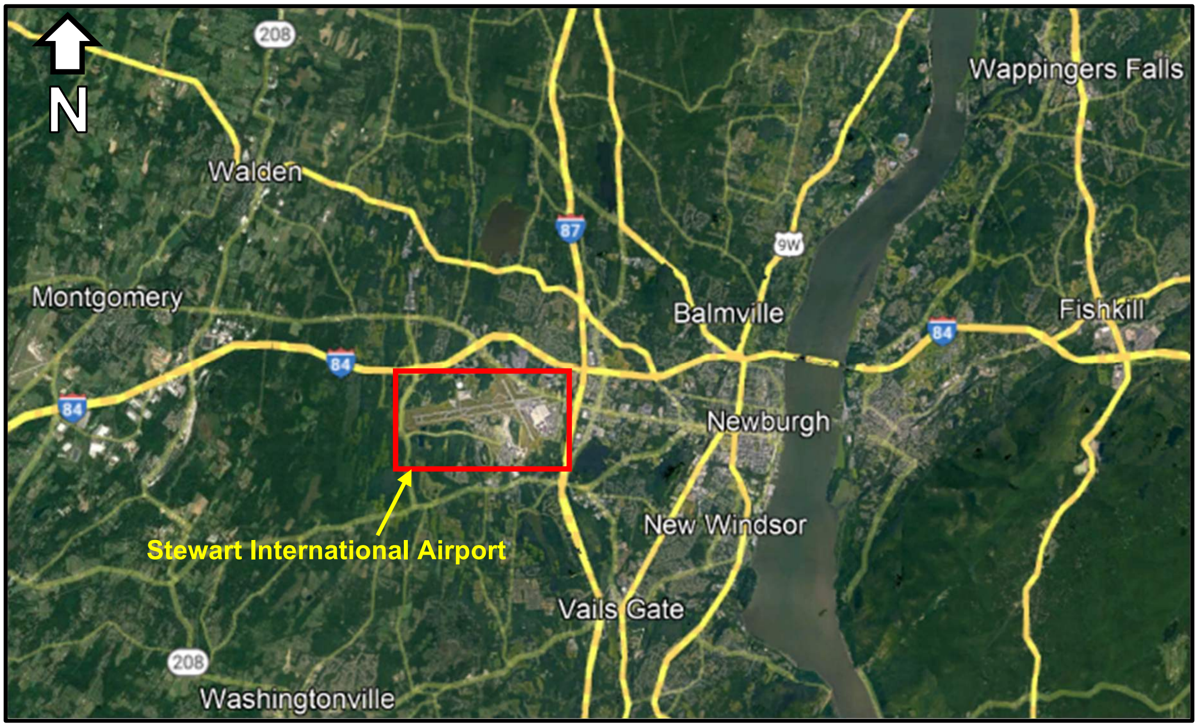
ANS was retained by Van Cleef Engineering to perform geotechnical investigations and provide geotechnical engineering in support of new hangars and terminal project at Stewart International Airport in New Windsor, Orange County, New York. Our geotechnical investigation program was based on Option 11 conceptual plan of the proposed Terminal and Hangars project, which consists of the following:

- **Hangar 1 (270 feet by 150 feet)**
  - Hangar's Footprint = 40,500 square feet
  - Hangar Floor = 36,800 square feet
  - 40 feet high Hangar Door with approx. 225 feet door opening
  - Rolling Hangar Doors with 10 panels (22.5 feet wide each)
  - Fire Pump & Boiler Room (30 feet by 40 feet) = 1,200 square feet
  - Two Floor of Offices & Shops
    - 1st Floor = 2,900 square feet
    - 2nd Floor = 4,000 square feet
- **Signature Hangar (210 feet by 150 feet)**
  - Hangar's Footprint = 31,500 square feet
  - 30 feet high Hangar Door
  - Fire Pump Room
  - One Floor of Offices & Shops = 2,500 square feet
  - Ground Support Equipment (GSE) Building ~ 1,640 square feet
- **Signature FBO Terminal (2-Story)**
  - Terminal's Footprint = 6,000 square feet

Other improvements include a new Air Operations Area (AOA) Vehicle Gate, new AOA fence, Pick-Up/Drop-Off area, and approximately 77 parking spaces. Our geotechnical investigation program consisted of test borings at 12 locations to a proposed depth of 10 and 20 feet BGS. As-drilled boring locations are shown in the Boring Location Plan Provided **Appendix A.**

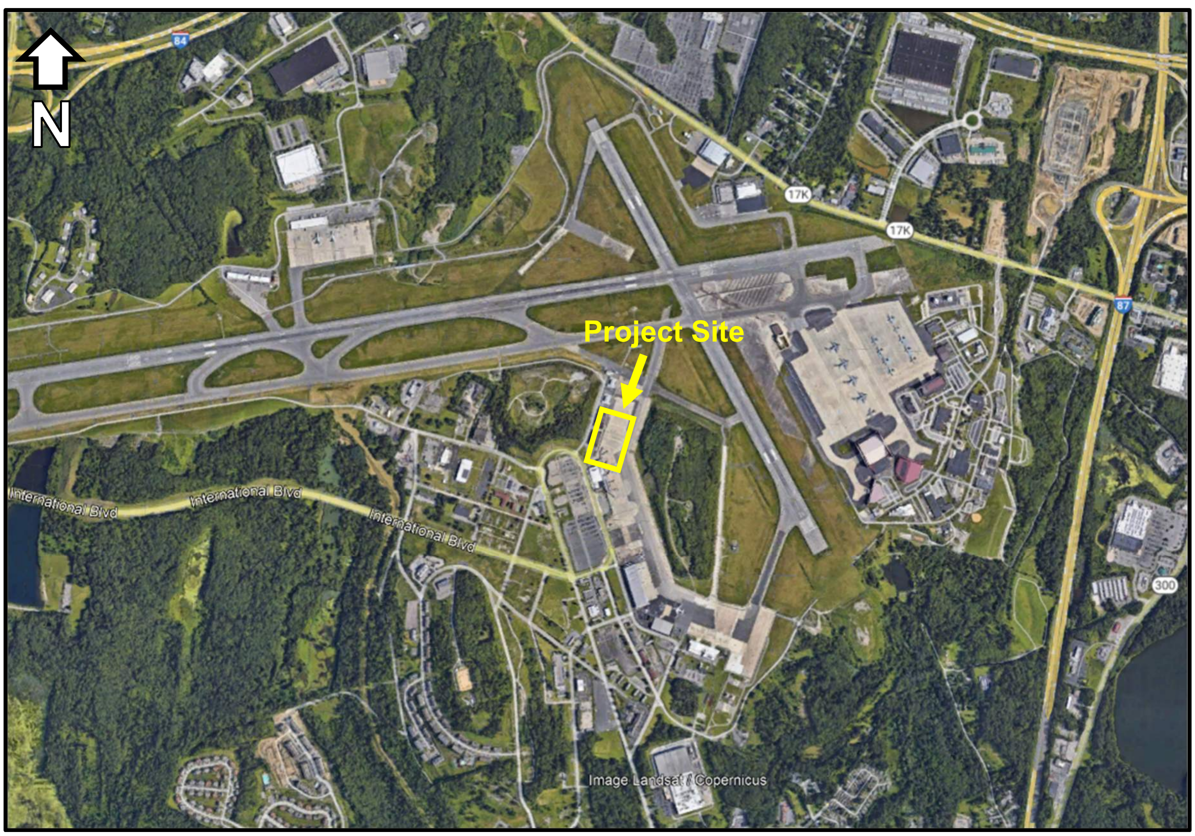
As part of our foundation analysis, ANS used historic borings from geotechnical report produced by Kevin L. Patton, PE from 36 Patton Road, Newburgh, New York, dated September 9th, 2018. The previously completed geotechnical investigation program consisted of five (5) test borings within the footprint of Hangar 1. The historic boring logs are provided in **Appendix B**.

Figure 1: Stewart International Airport Vicinity Map



(Source: Google Earth accessed on September 20, 2023)

Figure 2: Project Site Map



(Source: Google Earth accessed on September 20, 2023)

3 Methodology

3.1 Test Borings

ANS advanced 12 borings (T-01 to T-12) at the project area between September 26th and October 4th, 2023. Prior to drilling each boring, ANS completed Ground Penetrating Radar (GPR) survey of the boring locations. GPR scan was completed for 10 feet by 10 feet area within the boring locations to identify any existing un-marked underground utilities and obstructions. The GPR survey crew marked encountered underground utilities and obstructions using both spray paint and utility flag to indicate their approximate location. Photos of the GPR scan areas are included in **Appendix C**.

A Diedrich D-25 trailer mounted drill rig was used to collect soil samples using the Standard Penetration Test (SPT) Method in accordance with ASTM Standard D1586 – Standard Test Method for SPT and Split-Barrel Sampling of soils. Soil samples were generally collected continuously within the upper 10 feet of each boring location, then in five-foot intervals thereafter to the termination depth or split spoon refusal. Each split-spoon was driven using 140 pounds of hammer force with a free fall of 30 inches. Blow counts were recorded at 6-inch intervals over a total driven depth of 24 inches for each SPT sample. The N-Value is defined as the number blows required to drive the split-spoon sampler through a 12-inch interval after the initial 6 inches of split-spoon penetration. SPT split-spoon refusal is when 50 blows per foot (bpf) over a 6-inch interval is encountered during split-spoon penetration. Borehole was terminated when three consecutive SPT split-spoon refusal or roller bit refusal, whichever occurred first. A summary of ANS test borings and historic borings are provided in Table 1 below. Typed soil borings of our investigations are included within **Appendix B**.

Table 1: Summary of Test Borings

Soil Borings/SPT Test (ASTM Standard D1586)			
Boring ID	**Coordinates (Lat., Long.)**	**Proposed Depth (feet) BGS**	**Terminated Depth (feet) BGS**
ANS Completed Borings 2023			
T-01	41.50151213, -74.09984574	20	12.58
T-02	41.50130955, -74.09993730	20	5.75
T-03	41.50136830, -74.09970042	10	7.75
T-04	41.50118197, -74.09990402	10	7.5
T-05	41.50086648, -74.09992883	10	9.92
T-06	41.50057982, -74.10013206	10	5.7
T-07	41.50091200, -74.10035100	20	9.5
T-08	41.50204766, -74.09966421	10	3.5
T-09	41.50184901, -74.09972498	20	13.83
T-10	41.50200767, -74.10016704	20	9.25
T-11	41.50140904, -74.10038197	20	9.92
T-12	41.50084500, -74.10085600	10	9.2
Historic Borings Completed in 2018 by Others			
B-1	N/A	N/A	15.75
B-2	N/A	N/A	17.0

B-3	N/A	N/A	25.42
B-4	N/A	N/A	12.0
B-5	N/A	N/A	17.0

Additionally, due to the test boring locations being within the landing strip on the airside, Maintenance and Protection of Traffic (MPT) was needed to close off the work area during our geotechnical investigations. Before mobilization, it was communicated by Signature Flight to air-traffic control our schedule of test borings on the airside. Therefore, traffic cones, “Roadwork Ahead” signs, and an airport flag attached to our drill rig’s mast were all included as part of the MPT plan.

4 Geology and Subsurface Conditions

ANS performed a desktop review of surficial and bedrock geology maps made available by the United States Geological Survey (USGS), the New York State Department of Environmental Conservation and the Federal Emergency Management Agency (FEMA) prior to conducting our field investigations. The surficial mapping indicates the project site is underlain by a Pleistocene aged glacial till sediments primarily made up of Silt. Bedrock geological mapping indicates that the Normanskill Formation underlines the project site. This middle Ordovician is primarily comprised primarily of sedimentary units such mudstone and shale and has minor components of Siltstone and Argillite. Surficial geologic mapping was found to be consistent with the classified soils within our investigations.

ANS additionally reviewed overburden soil information made available by the USDA’s Natural Resources Conservation Service (NRCS). The NRCS classifies the native upper six (6) feet of soil primarily as material of the Mardin gravelly silt loam unit. The project area that has previously been developed is primarily underlain by Urban land. The Mardin gravelly silt loam unit is described as a moderately well drained silty till commonly used as farmland. The full NRCS report has been included within **Appendix D**.

4.1 Generalized Subsurface Profile

ANS has provided the generalized subsurface conditions below based upon the observations made during our geotechnical investigation in support of both new hangars and the new Signature flight terminal. A summary of the encountered soil stratums has been included within Table 2 below. ANS notes that this profile is highly generalized and that soil boring logs, provided as **Appendix B**, should be reviewed for location-specific subsurface conditions.

Table 2: Generalized Subsurface Profile

Depth (ft)	Soil Type	Average Density	Description
0 – 2	Pavement/ Topsoil	-	Surficial pavement was encountered within ten (10) of the twelve test borings. The pavement layers were classified as either concrete or asphalt material extending between 7 and 24 inches thick. Core times ranged between 9 minutes to over 2 hours. Topsoil was additionally encountered within the two (2) test boring locations. This layer extended roughly 3 to 4 inches from grade and was located within the front grassed area of the existing Port Authority and Signature Flight buildings.
2 – 6	Glacial Till I (Sand/Gravel)	Dense/ Very Dense	A glacial till stratum was recovered generally from below the pavement or topsoil to roughly 6 feet below ground surface (BGS). The soil composition varied with granular and cohesive soils observed within the recoveries. N values generally remained above 50 blows per foot of soil (bpf).

6 +	Glacial Till II (Silt/Clay)	Hard	A different type of glacial till was recovered within the lower stratums of our explorations. This soil material had a heavier content of cohesive material with clay and silt being the main components within these depths. N values ranged between 44 and over 50 bpf.

It should be noted that groundwater was not observed during our geotechnical investigation. ANS generated three soil profiles based on test boring completed by ANS. The three soil profile drawings are provided in **Appendix E**.

4.2 Frost Depth Considerations

The frost line is the depth where the ground is expected to freeze during colder temperatures. Any footings or utilities constructed above frost line can experience frost heaving when the ground freezes and thaws. The frost depth for Orange County is 40 inches BGS; therefore, ANS recommends any utilities, without frost protection, installed below the frost depth of 40 inches BGS.

5 Laboratory Results

5.1 Soil Index Testing

Representative soil samples were collected during our investigation and submitted to ANS accredited materials testing laboratory. The collected index samples were tested for Grain Size (Sieve) Analysis (ASTM D6913), Moisture Content (ASTM D2166) and Atterberg Limits (ASTM D4318). A summary of the index laboratory test results is provided Table 3 and Table 4. Laboratory results are included within **Appendix F**.

Table 3: Soil Index Testing Summary (Sieve Analysis)

Sieve Analysis (ASTM D6913)						
Boring ID	**Sample ID**	**Depth (feet)**	**% Gravel**	**% Sand**	**% Fines**	**% Moisture**
T-2	S-2	4 – 6	43.7	46.3	10	7.5
T-6	S-1	1 – 3	41.4	48.9	9.7	8.3
T-8	S-1	1 – 3	69.4	23.3	7.3	6.2
T-10	S-3	4 – 6	11	36.8	52.2	8.9
T-12	S-1	1 – 3	25.1	45.8	29.1	9.1

Table 4: Soil Index Testing Summary (Atterberg Limits)

Atterberg Limits Determination (ASTM D4318)							
Location ID	**Sample ID**	**Depth (feet)**	**Liquid Limit**	**Plastic Limit**	**Plasticity Index**	**% Moisture**	**USCS Symbol**
T-1	S-2	4 – 6	25	20	5	11.6	CL-ML
T-3	S-2	4 – 6	24	17	7	10.0	CL-ML
T-4	S-2	6 – 8	22	17	5	10.1	CL-ML
T-5	S-4	8 – 10	22	16	6	12.2	CL-ML
T-7	S-3	5 – 7	23	19	4	8.3	CL-ML
T-9	S-3	5 – 7	24	18	6	12.7	CL-ML
T-11	S-2	2 – 4	22	16	6	8.4	CL-ML

Atterberg Limits Determination (ASTM D4318)							
Location ID	Sample ID	Depth (feet)	Liquid Limit	Plastic Limit	Plasticity Index	% Moisture	USCS Symbol
T-12	S-1	1 – 3	21	16	5	9.1	CL-ML

5.2 California Bearing Ratio

ANS collected an additional sample from grade to 1-feet below grade at one (1) location for testing of California Bearing Ratio (CBR) in accordance with ASTM D1883 at approximately 95 percent of its Modified Proctor Density (ASTM D1557-12 Method B). The results of the testing will be summarized within Table 5 and detailed within **Appendix E**.

Table 5: California Bearing Ratio Summary

California Bearing Ratio (CBR) (ASTM D1883)				
Location ID	Density (pcf)	Percent of Maximum Density (%)	CBR Ratio (0.10 in), %	CBR Ratio (0.20in), %
T-11	123.7	96.2	22.8	21.5
T-11	113.3	88.4	4.6	4.4

6 Seismic Site Classification

Based on the results from the subsurface investigation program and utilizing the N-Value method in accordance with AASHTO, NYSDOT, and as prescribed in Chapter 20 of ASCE 7-16, **Seismic Site Class C (very dense soil and soft rock)** can be assumed as the average condition across the project site.

The seismic ground motion values for this this were obtained from the USGS Seismic Hazard Maps, referenced in ASCE 7-16 Standard, and provided as **Appendix G**, and are as follows:

- 0.2 second spectral response acceleration, S_S= 0.23 g
- 1 second spectral response acceleration, S_1= 0.049 g
- Maximum spectral acceleration for short periods, S_{MS}= 0.23 g
- Maximum spectral acceleration for a 1-second period, S_{M1}= 0.063
- 5% damped design spectral acceleration at short periods, S_{DS}= 0.16g
- 5% damped design spectral acceleration at 1-second period, S_{D1}= 0.042

Liquefaction is caused by a fast increase of pore water pressures in loose and soft soils. Seismic activity on this project site is low risk, and the site predominantly consisted of medium to very dense granular material over a predominantly hard cohesive Glacial Till. Therefore, soil liquefaction induced by significant seismic activity is a low risk and not a concern at this project site.

7 Recommended Geotechnical Design Parameters

Based on our interpretation of the subsurface conditions observed within our subsurface investigation program, ANS recommends that the geotechnical design parameters, as depicted in Table 6 through Table 8, be considered for this project site.

Table 6: Geotechnical Parameters for Signature Hangar

Depth (feet)	Material	Total Unit Weight (lb/ft^3)	Effective Unit Weight (lb/ft^3)	Internal Friction Angle	Cohesion (lb/ft^2)	Modulus of Vertical Subgrade (k) (lb/in^3)	K_0 (At-rest earth pressure coefficient)	K_a (Active earth pressure coefficient)	K_p * (Passive earth pressure coefficient)
2 – 4	Glacial Till I	130	67.6	33	--	125	0.5	0.3	1.7
4 +	Glacial Till II	135	72.6	--	1,200	130	1	1	0.5

**A factor of safety of two has been applied to the passive earth pressure coefficient, Kp, since walls will be unable to accommodate substantial lateral displacement or deflection.*

Table 7: Geotechnical Parameters for Hangar 1

Depth (feet)	Material	Total Unit Weight (lb/ft^3)	Effective Unit Weight (lb/ft^3)	Internal Friction Angle	Cohesion (lb/ft^2)	Modulus of Vertical Subgrade (k) (lb/in^3)	K_0 (At-rest earth pressure coefficient)	K_a (Active earth pressure coefficient)	K_p * (Passive earth pressure coefficient)
1 – 4	Glacial Till I	115	52.6	30	--	90	0.5	0.3	1.5
4 +	Glacial Till II	135	72.6	--	1,200	130	1	1	0.5

**A factor of safety of two has been applied to the passive earth pressure coefficient, Kp, since walls will be unable to accommodate substantial lateral displacement or deflection*

Table 8: Geotechnical Parameters for Signature FBO Terminal

Depth (feet)	Material	Total Unit Weight (lb/ft^3)	Effective Unit Weight (lb/ft^3)	Internal Friction Angle	Cohesion (lb/ft^2)	Modulus of Vertical Subgrade (k) (lb/in^3)	K_0 (At-rest earth pressure coefficient)	K_a (Active earth pressure coefficient)	K_p * (Passive earth pressure coefficient)
1 – 6	Glacial Till I	125	62.6	30	--	110	0.5	0.3	1.5
6 +	Glacial Till II	135	72.6	--	1,200	130	1	1	0.5

**A factor of safety of two has been applied to the passive earth pressure coefficient, Kp, since walls will be unable to accommodate substantial lateral displacement or deflection.*

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8 Foundation Recommendations

ANS determined bearing capacities and settlements for typical foundation sizes based on the encountered subsurface conditions and "*SWF Terminal & Hangars Site Plan – Option 11*" conceptual drawing dated November 21st, 2022. Additionally, the historical geotechnical report produced by Kevin L. Patton, PE, was also considered during our analysis of the potential foundation elements for this project. Given the observed soil conditions, shallow foundations were considered the most feasible foundation elements in support of the new hangar structures, and the Signature FBO Terminal. For our analysis, we included strip (wall footing), square (column footing), slab on grade, and mat foundation options in support of the new hangars and terminal buildings.

8.1 Shallow Foundations

ANS recommends over-excavating minimum 18-inches of existing native material and backfill with compacted ¾ – inch sized crushed stone or recommended structural fill as per Table 12 in Section 10.3. ANS recommend using the Allowable Bearing Capacities for all interior and exterior footings based on Table 9 through 11 below.

Table 9: Recommended Bearing Capacities for Signature Hangar

Footing Type	Footing Size (Maximum)	Ultimate Bearing Capacity (psf)	Allowable Bearing Capacity (psf)
Strip (Wall)	1.5 feet wide	5,000	2,000
	3 feet wide	2,500	1,000
Square (Column)	3 feet by 3 feet	5,500	2,500
	4 feet by 4 feet	5,000	2,000
Slab-on-Grade	10 feet by 10 feet	1,250	500
Mat Foundation	210 feet by 150 feet	3,250	1,500

Table 10: Recommended Bearing Capacities for Hangar 1

Footing Type	Footing Size (Maximum)	Ultimate Bearing Capacity (psf)	Allowable Bearing Capacity (psf)
Strip (Wall)	1.5 feet wide	5,000	2,000
	3 feet wide	2,500	1,000
Square (Column)	3 feet by 3 feet	5,500	2,500
	4 feet by 4 feet	5,000	2,000
Slab-on-Grade	10 feet by 10 feet	1,250	500
Mat Foundation	210 feet by 150 feet	3,250	1,500

Table 11: Recommended Bearing Capacities for FBO Signature Terminal

Footing Type	Footing Size (Maximum)	Ultimate Bearing Capacity (psf)	Allowable Bearing Capacity (psf)
Strip	1.5 feet wide	5,000	2,000
	3 feet wide	2,250	1,000
Square (Column)	3 feet by 3 feet	5,500	2,500
	4 feet by 4 feet	3,250	1,500
Slab-on-Grade	10 feet by 10 feet	2,250	1,000

The recommended Allowable Bearing Capacity for each footing type is based on tolerable limit of one (1) inch of total settlement, one-half inch of differential settlement. For mat foundation, the recommended Allowable Bearing Capacity is based on tolerable limit of two (2) inches of total settlement bearing on 18 inches of compacted structural fill or ¾-inch crushed stone.

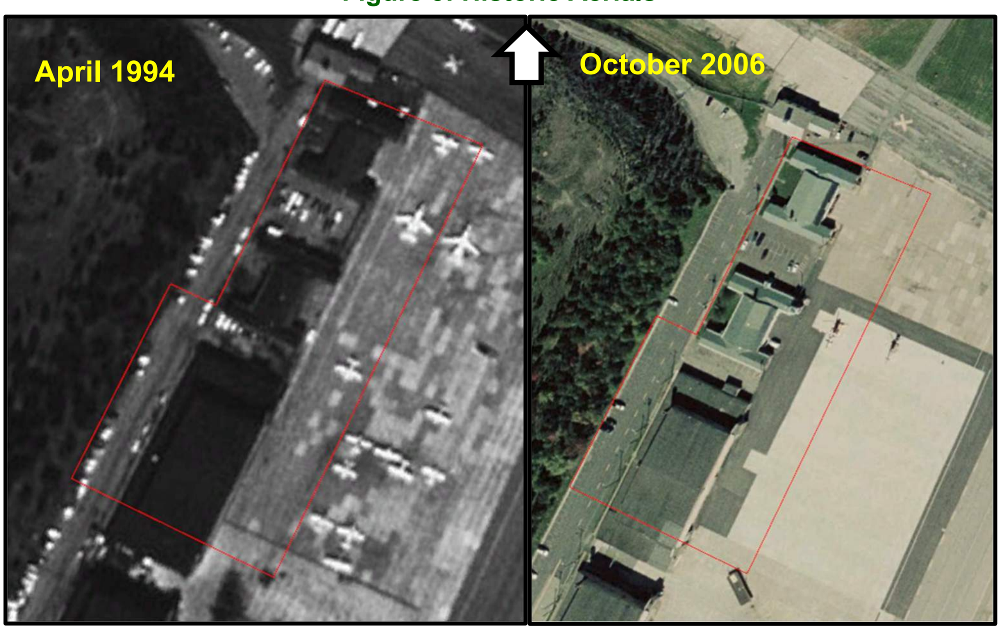
The calculated Allowable Bearing Capacities for strip, square and mat foundation provided above assumes foundations will bear at frost depth (40 inches), 18-inch over-excavation, and subgrade prepared as described in Section 10.3. The calculated Allowable Bearing Capacities for slab-on-grade footings assumes the slab will bear on existing grade with minimum of six (6) inches of ¾-inch size crushed stone or recommended structural fill as per Table 12 in Section 10.3. Remove any uncontrolled fill or deleterious materials and backfill with compacted structural fill as described in as per Table 12 in Section 10.3.

9 Pavement Considerations

ANS performed pavement coring at 10 of the 12 test boring locations before performing SPT sampling. The core samples were logged and collected to confirm the existing pavement thickness across the project site. The core samples collected were measured between 2 and 23 inches thick with core times ranging between 9 minutes to over 2 hours. The samples collected yielded both flexible (asphalt) and rigid (concrete) pavement cores across the test locations. It is our understanding that service vehicles, fuel vehicles, and aircraft vehicles will circulate frequently within the footprint of the hangars during its service life. Meanwhile, it is also anticipated that 1st street, the access road from the main airport terminal, will be rehabilitated along with the new facilities.

Our team additionally, reviewed historical aerials of the project site dating back to 1994 where the pavement configuration was different than the current conditions. The aerial imagery reveals the pavement material across the runway was uniform and resembled the material found at the surface in locations T-08 & T-09. Between 2004 and 2006 the runway appears to have been re-paved and changed to its current condition. Figure 3 below show the way the runway has changed historically from 1994 to 2006.

Figure 3: Historic Aerials



(Source: Google Earth accessed on October 10, 2023)

9.1 Pavement Considerations (Airside)

Eight (8) out of the 10 collected pavement cores were located airside and were classified as either reinforced concrete or asphalt ranging between 7 and 23 inches thick. The collected material was classified as asphalt within four (4) locations and as concrete within the other four (4) locations. The existing pavement at the proposed Signature Hangar and Hangar 1 locations yielded different coring times and were visually different. Given ANS field observations, it is understood that the rehabilitation of the airside pavement is to be considered as part of the site improvements within the project site. According to the observed existing pavement conditions on the airside, it is our opinion that pavement specifications for airside shall consist of minimum 18 to 24 inches of concrete pavement underlain by 6 to 12 inches subbase material.

According to Porth Authority's (PANYNJ) "Civil – design Criteria & Special Requirements" The design of flexible and rigid airfield pavements shall comply with FAA AC 150/5320-6F (or more recent if available) entitled "Airport Pavement Design and Evaluation" (hereafter AC). This AC fully implements the FAA's design procedure which is performed using the FAA Rigid and Flexible Interactive Elastic Layer Design (FAARFIELD) computer program. The AC requires a 20-year structural life for pavements (i.e., flexible and rigid). The PANYNJ utilizes a 40-year structural life for a rigid pavement. Perform all airfield pavement designs or structural capacity evaluations using FAARFIELD. ANS notes that these design requirements are highly generalized from our investigations and are not meant to serve as design parameters. ANS recommends the aircraft pavement design is to be designed by Professional Engineer licensed in the State of New York with pavement design experience. Pavement design shall be in accordance with the specifications established in the FAA AC 150/5320-6F and should be submitted for PANYNJ review and approval.

9.2 Pavement Considerations (Roadway)

One (1) test boring was performed within the surface of 1st Street, the access road, and one (1) within the proposed airside entrance to support with the roadway pavement assessment. The thickness of existing asphalt was approximately 12 inches in boring T-12. It is ANS understanding that the repaving of 1st Street is to be included along with the new hangars and terminal project that will also provide 77 parking spaces.

According to the Port Authority's (PANYNJ) "Civil – design Criteria & Special Requirements", there are two main design methods for the design of flexible and rigid vehicular pavements. One of these is labeled as the "Empirical Methods" and are outlined in: Empirical Methods – Outlined in the following publications: 1. 1993 "AASHTO Guide for Design of Pavement Structures" and based on the AASHTO Road Tests performed between 1958 - 1961. 2. "1998 Supplement to the AASHTO Guide for Design of Pavement Structures, Part II, - Rigid Pavement Design & Rigid Pavement Joint Design." The second method listed is the Mechanistic Method outlined within the "National Cooperative Highway Research Program 1-37A, "Mechanistic-Empirical Pavement Design Guide"."

The PANYNJ allows for either method to be used in the support of rigid and flexible pavement design for vehicular usage. ANS recommends that any vehicular pavement design is to be designed in accordance with the specifications established by the PANYNJ by Professional Engineer licensed in the State of New York, and should be submitted for PANYNJ review and approval.

10 Construction Recommendations

10.1 Excavation

Depending on proposed foundation configurations and degree of earthworks, excavation will extend deeper than four feet below grade. Excavations deeper than four feet should be shored or sloped and benched, in accordance with OSHA regulations, for safe working conditions within excavations. Given the irregular nature of the encountered Glacial Till material encountered during our investigations, ANS recommends any sloped excavations should be no steeper than 1 ½H:1V (horizontal to vertical) given OSHA's Soil Classification Outline for granular Type C Soils. All OSHA soil classifications should be field determined by the contractor's "competent person" prior to excavation. Any proposed shoring systems should be designed by the contractor's "competent person", be certified by a Professional Engineer licensed in the State of New York and should be submitted for review.

10.2 Dewatering

Groundwater was not explicitly observed within our soil boring explorations. The Contractor should be prepared to manage groundwater, perched water, and/or infiltrated stormwater as needed using localized sump-and-pump or similar techniques to allow for concrete foundation construction in-the-dry. Water discharge should be managed in compliance with applicable state and local regulations. The Contractor should be prepared to grade the surface as necessary to divert stormwater away from any open excavation to the extent possible.

10.3 Subgrade Preparation and Compaction

ANS recommends over-excavating the subgrade by at least 18-inches, lining the exposed material with a geotextile separation fabric, and bringing the subgrade back up to the design foundation elevation with ¾ - crushed stone or compacted structural fill as specified within Table 12 for all shallow foundations at the project site.

Table 12: Recommended Gradation of Structural Fill

Sieve Size	Percent Passing
3-inch	100
1 ½-inch	60 – 100
No. 4	30 – 60
No. 200	0 – 10

Native material beneath the separation fabric should be inspected by a Geotechnical Engineer licensed in the state of New York, for unsatisfactory conditions such as standing water, frozen soil, organics, protruding cobbles or boulders, or deleterious materials. Should any unsatisfactory conditions exist within the native subgrade, the excavation should be undercut an additional six (6) inches below the encountered unsatisfactory condition prior to placement of the geotextile fabric. Structural fill as specified within Table 12 should be placed in loose lifts not exceeding eight (8) inches in height and be compacted to at least 95 percent of its Modified Proctor Density in accordance with ASTM D1557.

10.4 Backfilling and Re-use of Native Soils

ANS notes that native soils have greater than 10 percent of fine-grained soils (clays and silts) on site. The native soil cannot be used as structural fill underneath any under or above foundations and load-bearing structures. This soil may be re-used across the project area for fill in landscaped areas, and above any proposed underground utilities.

ANS recommends importing a clean granular material with less than 15 percent fine-grained content for use as general backfill. General backfill material should be screened of any cobbles, boulders, and any particles larger than 3 inches in diameter, and should not be used beneath any load-bearing structures. General backfill should be placed in loose lift thicknesses not exceeding 12 inches and be compacted to at least 90 percent of its Standard Proctor Density (ASTM D1557). Soil used as backfill should not be handled when frozen and should be free of excessive moisture, organic, and deleterious material.

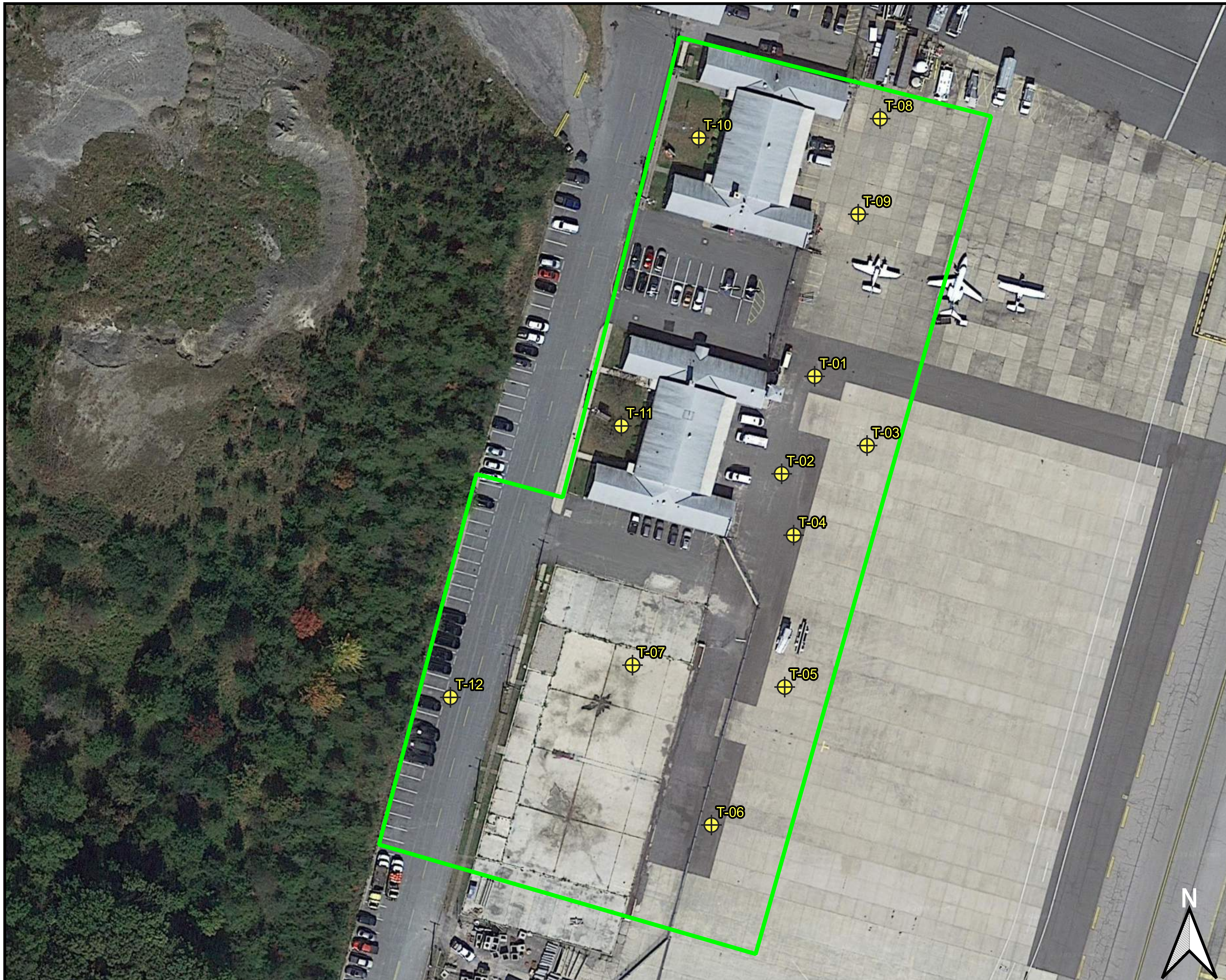
11 Limitations

ANS notes that the findings and recommendations presented within this Geotechnical Recommendations Report are based on our subsurface investigation program conducted in September and October of 2023 and our engineering judgment. Should the scope of the project change, or more investigation area become available, ANS should be given the opportunity to review the applicability of the collected information and modify our recommendations, as needed.

We sincerely appreciate the opportunity to support this project, and please feel free to contact us should you have any questions regarding the findings of this Report.

Appendix A

Investigation Location Plan



ANS GEO

Client:

Van Cleef
ENGINEERING WITH FOCUS

INVESTIGATION LOCATION PLAN

VAN CLEEF ENGINEERING
STEWART INTERNATIONAL
AIRPORT TERMINAL & HANGARS
- OPTION 11
NEW WINDSOR, NEW YORK

Legend

Soil Boring Locations

Investigation Area Boundary

0 75 150 ft

Absolute Scale: 1 inch = 75 feet
Scale at 11" x 17" AS SHOWN

Prepared by: Grant Libby
Date: October 5, 2023
Drawing Number: Stewart Airport ILP Rev.0

Appendix B

Test Boring Logs

BORING LOG LEGEND

Client: Van Cleef Engineering **Project Name:** SWF - Hangar Option 11 **Project Location:** New Windsor, NY

Soil Description Symbology

FILL: Historic/Man-Made

Glacial Till

Topsoil

Rock Description Symbology

N/E = Not Encountered

Density (Cohesionless Soils)

SPT N-Value (Blows/foot)	Apparent Density
0 - 5	Very Loose
5 - 10	Loose
10 - 30	Medium Dense
30 - 50	Dense
Over 50	Very Dense

Consistency (Cohesive Soils)

SPT N-Value (Blows/foot)	Consistency
0 - 2	Very Soft
2 - 4	Soft
4 - 8	Medium Stiff
8 - 15	Stiff
15 - 30	Very Stiff
Over 30	Hard

Minor Components Description

Description	Criteria
Clayey, Silty, Sandy, Gravelly	30 - 50%
Some	20 - 30%
Little	10 - 20%
Trace	1 - 10%

Moisture Description

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp nut no visible water
Wet	Visible free water, usually soil is below water table

= ATD Water Level (At Time of Drilling)

= AD Water Level (After Drilling - Short Term)

= EOD Water Level (End of Drilling - Long Term)

Toughness: Low (L), Medium (M), High (H)

Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)

PP = Pocket Penetrometer, measured in tons per square ft.

TV = Torvane (Shear Vane), measured in tons per square ft.

RQD = Rock Quality Designation

REC = Rock Core Recovery

UNIFIED SOIL CLASSIFICATION SYSTEM AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)

Gravels More than 50% of coarse fraction larger than N.4 sieve size	Clean Gravels (Less than 5% fines)	
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (more than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
Sands More than 50% of coarse fraction larger than N.4 sieve size	Clean Sands (Less than 5% fines)	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly-graded sands, gravelly sands, little or no fines
	Sands with fines (Less than 5% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS (more than 50% of material is smaller than No. 200 sieve size.)

SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fats clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

Determine percentages of sand and Gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent .... GW, GP, SW, SP
More than 12 percent .... GM, GC, SM, SC
5 to 12 percent .... Borderline cases requiring dual symbols

Additional Notes:

Groundwater not encountered within any completed borings at time of investigation.

Additional Classifications:

Asphalt

Concrete

Soil Boring Log

T-01

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.50151213, -74.09984574
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	9/28/2023 12:45:00 PM	**Elevation:**	Grade
Inspector:	Grant Libby	**Boring End:**	9/28/2023 2:55:00 PM	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
	R-1	24					24"- ASPHALT						
	S-1	7	24 50/5	> 50			Very dense, gray Silty medium to fine SAND, little coarse to fine Gravel, trace Clay, moist (TILL).	-		-	-	>>	
5	S-2	9	11 20 25 33	45			Hard, gray to dark gray Silty CLAY, little fine Sand, trace coarse to fine Gravel, moist (TILL).	H	M	>4.5	0.45		Tested soil classification via Atterberg limit testing.
	S-3	2	39 50/5	> 50			Hard, dark gray Sandy CLAY, little Silt, trace fine Gravel, moist (TILL).	M	M	2.0	0.475	>>	
	S-4	3	43 50/2	> 50			Hard, dark gray Clayey SILT, little fine Sand, trace coarse to fine Gravel, moist (TILL).	L	M	-	-	>>	
10	S-5	11	12 40 52 50/3	92			Hard, dark gray Silty CLAY, little fine Sand, trace coarse to fine Gravel, moist (TILL).	M	M	>4.5	0.3	>>	
	S-6	6	50 50/1	> 50			Hard, dark gray, Silty CLAY, little fine Sand, trace fine Gravel, moist (TILL).	H	M	>4.5	0.45	>>	
							End of boring due to Split Spoon refusal at 12.58 feet BGS. Borehole was filled with cement mix and topped with a 6-inch concrete patch.						
15													
20													

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

▼ = Water Level (if observed)
BGS = Below Ground Surface
No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-02

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.50130955, -74.0999373
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	9/28/2023 8:40:00 AM	**Elevation:**	Grade
Inspector:	Grant Libby	**Boring End:**	9/28/2023 12:40:00 PM	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
	R-1	11					17"- ASPHALT						
	S-1	6	50 50/3	> 50			Very dense, brown to light gray medium to fine SAND, some coarse to fine Gravel, some Silt, trace Clay, moist (TILL).	-		-	-	>>	Contains fill material mixed with asphalt fragments.
5	S-2	7	24 29 50/1	> 50			Very dense, gray Gravelly coarse to fine SAND, trace Silt, trace Clay, moist (TILL).	-		-	-	>>	Contains fill material. Tested soil classification via Sieve analysis.
							End of boring at 5.75 feet BGS due to roller bit refusal. Borehole filled with cement mix and plugged with 6-inch concrete patch.						
10													
15													
20													

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

= Water Level (if observed)

BGS = Below Ground Surface

No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-03

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.5013683, -74.09970042
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	10/2/2023	**Elevation:**	Grade
Inspector:	Diego Meglar	**Boring End:**	10/2/2023	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
							15"- CONCRETE						
	R-1	21											
							6"- ASPHALT						
	S-1	11	35 41 50/4	> 50			Very dense, dark gray coarse to fine GRAVEL, some fine Sand, moist (FILL).	-		-	-	>>	
5	S-2	11	24 50/5	> 50			Hard, dark gray Silty CLAY, trace fine Sand, moist (TILL).	-		-	-	>>	Tested soil classification via Atterberg limit testing.
	S-3	5	21 50/3	> 50			Hard, dark gray Gravelly SILT, trace fine Sand, moist (TILL).	-		-	-	>>	
							End of boring at 7.75 feet BGS due to 3 consecutive split spoon refusals. Boring filled with cement mix and topped with 6-inch concrete patch.						
10													
15													
20													

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

▼ = Water Level (if observed)
BGS = Below Ground Surface
No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-04

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.50118197, -74.09990402
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	9/27/2023 2:00:00 PM	**Elevation:**	Grade
Inspector:	Grant Libby	**Boring End:**	9/27/2023 4:30:00 PM	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
	R-1	10				18"- ASPHALT						
	S-1	2	50/2	> 50		Very dense, dark gray Silty medium to fine SAND, trace coarse to fine Gravel, moist (FILL).	-		-	-	>>	
	S-2	9	41 43 50/4	> 50		Hard, dark gray Clayey SILT, little fine Gravel, trace fine Sand, moist (TILL).	H	L	-	-	>>	Tested soil classification via Atterberg limit testing.
5												
	S-3	11	33 37 50/3	> 50		Hard, dark gray Clayey SILT, trace fine Gravel, trace fine Sand, moist (TILL).	H	L	-	-	>>	
						End of boring at 7.5 feet BGS due to roller bit refusal. Borehole was filled with cement mix and topped with 6-inch concrete patch.						
10												
15												
20												

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

▼ = Water Level (if observed)
BGS = Below Ground Surface
No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-05

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.50086648, -74.09992883
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	9/26/2023 4:00:00 PM	**Elevation:**	Grade
Inspector:	Grant Libby	**Boring End:**	9/27/2023 1:50:00 PM	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value 10 20 30 40	Drilling & Strata Notes
	R-1	22					15"- CONCRETE 9"- ASPHALT						
	S-1	13	50 53 56 58	109			Hard, brown to gray SILT, some fine Sand, trace coarse to fine Gravel, trace Clay, moist (FILL). Hard, brown to gray SILT, some fine Sand, trace coarse to fine Gravel, trace Clay, moist (TILL).	H	L	-	-	>>	5 inches Fill beneath Asphalt.
5	S-2	4	51 50/5	> 50			Very dense, gray Silty medium to fine SAND, little coarse to fine Gravel, trace Clay, wet (TILL).	-		-	-	>>	
	S-3	10	16 31 24 25	55			Hard, dark gray Silty CLAY, little fine Sand, trace fine Gravel, moist (TILL).	H	M	>4.5	0.7	>>	
	S-4	12	20 36 52 50/5	88			Hard, dark gray Silty CLAY, little coarse to fine Gravel, little fine Sand, moist (TILL).	H	M	>4.5	0.5	>>	Tested soil classification via Atterberg limit testing.
10							End of boring at 9.92 feet BGS due to split spoon refusal. Borehole was backfilled with cement mix and topped with 6-inch concrete patch.						
15													
20													

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

▼ = Water Level (if observed)
BGS = Below Ground Surface
No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-06

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.50057982, -74.10013206
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	9/26/2023 2:00:00 PM	**Elevation:**	Grade
Inspector:	Grant Libby	**Boring End:**	9/26/2023 3:45:00 PM	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
	R-1	15					14"- ASPHALT						
	S-1	6	56 50/4	> 50			Top: Very dense, gray coarse to fine GRAVEL, some Sand, moist (FILL). Bottom: Very dense, gray Gravelly coarse to fine SAND, trace Silt, trace Clay, moist (TILL).	-		-	-	>>	Till, with intermixed fill material in top half of sample. Tested soil classification via Sieve analysis.
	S-2	4	50/4	> 50			Very dense, brown to gray Silty coarse to fine SAND, little coarse to fine Gravel, trace Clay, moist (TILL).	-		-	-	>>	
5	S-3	2	38 50/1	> 50			Hard, gray Clayey SILT, little fine Sand, trace coarse to fine Gravel, moist (TILL).	H	L	-	-	>>	
							End of boring at 5.7 feet BGS due to roller bit refusal. Borehole filled with cement mix and topped with 6-inch concrete patch.						
10													
15													
20													

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

▼ = Water Level (if observed)
BGS = Below Ground Surface
No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-07

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.500912, -74.100351
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	10/4/2023 9:02:00 AM	**Elevation:**	Grade
Inspector:	Sergio Motta	**Boring End:**	10/4/2023 11:17:00 AM	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
	R-1	7					12"- CONCRETE						
	S-1	13	22 20 34 46	54			Hard, dark brown Sandy SILT, little coarse to fine Gravel, moist (TILL).	L	NP	1.0	0.05	>>	
	S-2	24	15 52 56 60	108			Hard, brown Sandy SILT, little coarse to fine Gravel, trace Clay, moist (TILL).	L	L	0.5	0.1	>>	Schist Fragments/crushed stone encountered.
5	S-3	12	25 45 50/0	> 50			Hard, light gray Gravelly CLAY, little Silt, trace fine Sand, wet (TILL).	H	L	3.0	0.2	>>	Auger to 7 feet BGS. Rough drilling.
	S-4	12	20 55 50/0	> 50			Very dense, light gray Silty coarse to fine GRAVEL, little clay, trace fine Sand, wet (TILL).	-		-	-	>>	Tough drilling. Very dense/Hard Till Zone after 7.5 feet BGS.
10	S-5	1	50/1	> 50			Hard, light gray Clayey Silt, little coarse to fine Gravel, trace fine Sand, wet (TILL).	H	L	>4.5	0.2	>>	Rough drilling.

End of boring due to auger refusal encountered at 9.5 feet BGS.
Borehole backfilled with soil cuttings/ concrete mix and topped with a concrete Patch.

15

20

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

▼ = Water Level (if observed)
BGS = Below Ground Surface
No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-08

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.50204766, -74.09966421
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	10/2/2023 9:15:00 AM	**Elevation:**	Grade
Inspector:	Diego Meglar	**Boring End:**	10/2/2023 11:17:00 AM	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
	R-1	7					7"- CONCRETE						
	S-1	10	26 45 50/2	> 50			Very dense, dark gray coarse to fine GRAVEL, little fine Sand, moist (TILL).	-		-	-	>>	Tested soil classification via Sieve analysis.
	S-2	0	50/5	> 50			No recovery; assumed same as above.	-		-	-	>>	
							End of boring at 3.5 feet BGS due to roller bit refusal. Borehole filled with cement mix and topped with 6-inch concrete plug.						
5												5	
10												10	
15												15	
20												20	

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

▼ = Water Level (if observed)
BGS = Below Ground Surface
No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-09

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.50184901, -74.09972498
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	9/28/2023 3:00:00 PM	**Elevation:**	Grade
Inspector:	Grant Libby	**Boring End:**	9/28/2023 5:15:00 PM	**Vert. Datum:**	N/A
Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
	R-1	8					12"- CONCRETE						
	S-1	14	21 39 55 50/4	94			Hard, brown to gray SILT, some coarse to fine Sand, little Clay, little coarse to fine Gravel, moist (TILL).	M	L	-	-	>>	Upper 3 inches brown Fill. Lower 11 inches gray Till. Sand composition decreases with depth.
	S-2	13	32 43 39 50	82			Hard, gray Clayey SILT, little fine Sand, little coarse to fine Gravel, moist (TILL).	H	L	-	-	>>	
5	S-3	10	47 53 50 50/2	103			Hard, gray Silty CLAY, little fine Sand, trace fine Gravel, moist (TILL).	H	L	>4.5	.575	>>	Tested soil classification via Atterberg limit testing.
	S-4	16	20 25 31 36	56			Very dense, gray Sandy SILT, little coarse to fine Gravel, little Clay, moist (TILL).	L	L	-	-	>>	
10	S-5	6	47 50/4	> 50			Very dense, gray Silty CLAY, little fine Sand, trace fine Gravel, moist (TILL).	H	L	>4.5	.275	>>	
	S-6	17	31 48 50 50/3	98			Very dense, gray Silty CLAY, little fine Sand, trace fine Gravel, moist (TILL).	H	L	>4.5	.55	>>	
	S-7	6	34 50/4	> 50			Very dense, gray Silty CLAY, little fine Sand, trace fine Gravel, moist (TILL).	H	L	>4.5	.4	>>	
							End of boring at 13.83 feet BGS due to 3 consecutive split spoon refusals. Borehole was filled with cement mix and topped with 6-inch concrete patch.						
15													
20													

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

▼ = Water Level (if observed)
BGS = Below Ground Surface
No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

ANS GEO

Soil Boring Log

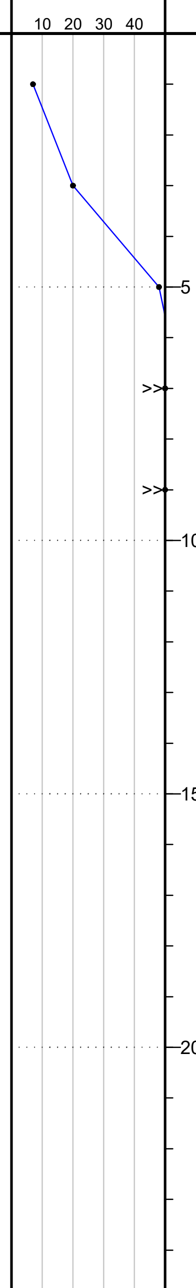
T-10

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.50200767, -74.10016704
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	10/2/2023 11:25:00 AM	**Elevation:**	Grade
Inspector:	Diego Meglar	**Boring End:**	10/2/2023 12:41:00 PM	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	Drilling & Strata Notes
							3"- TOPSOIL					
	S-1	10	3 6 1 38	7			Medium stiff, brown SILT, little coarse to fine Gravel, moist (TILL).	-		-	-	
	S-2	17	9 10 10 17	20			Medium dense, gray Silty coarse to fine GRAVEL, trace fine Sand, moist (TILL).	-		-	-	
5	S-3	14	22 24 24 38	48			Hard, dark gray SILT, some coarse to fine Sand, little coarse to fine Gravel, moist (TILL).	-		-	-	Tested soil classification via Atterberg limit testing.
	S-4	8	21 50/3	> 50			Hard, gray SILT, trace fine Gravel, moist (TILL).	-		-	-	
	S-5	12	24 33 50/3	> 50			Hard, gray SILT, trace fine Gravel, moist (TILL).	-		-	-	
10												
							Split spoon refusal at 9.25 feet. End of boring at 11 feet BGS due to roller bit refusal. Borehole filled with cement mix and topped with 6-inch concrete patch.					
15												
20												

N-Value



In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

= Water Level (if observed)

BGS = Below Ground Surface

No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-11

Client: Van Cleef Engineering
Project: Stewart Int. Airport- SFS Hangar Option 11
Location: New Windsor, NY
Inspector: Grant Libby

Drilling Firm: Diamond Drilling
Drill Crew: Tony Martin / Edward Rodriguez
Boring Start: 9/26/2023 9:50:00 AM
Boring End: 9/26/2023 12:40:00 PM

Coordinates: 41.50140904, -74.10038197
Horiz. Datum: WGS 84
Elevation: Grade
Vert. Datum: N/A

Rig Model: Diedrich D-25
Rig Type: Trailer
Drill Method: Mud Rotary
Hammer Type: Safety
Drilling Fluid: EZ mud

Sampler Type: Split Spoon
Sampler Length: 24 inches
Sampler I.D.: 1.375 inches
Hammer Wt.: 140 pounds
Hammer Fall: 30 inches

Casing Type: Steel
Casing Length: 5 feet
Casing I.D.: 4 inches
Hammer Wt.: 140 pounds
Hammer Fall: 30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
							8"- TOPSOIL						
	S-1	15	2 4 18 54	22			Very stiff, brown to gray Clayey SILT, little coarse to fine Gravel, little coarse to fine Sand, moist (TILL).	M	L	-	-		
	S-2	15	29 63 50/4	> 50			Hard, gray Clayey SILT, little coarse to fine Gravel, little fine Sand, moist (TILL).	H	L	-	-	>>	Tested soil classification via Atterberg limit testing.
5	S-3	9	39 50/4	> 50			Hard, gray to dark gray Clayey SILT, little fine Sand, trace coarse to fine Gravel, moist (TILL).	H	L	-	-	>>	
	S-4	3	50/3	> 50			Hard, gray Clayey SILT, little coarse to fine Gravel, little fine Sand, moist (TILL).	H	L	-	-	>>	
	S-5	19	41 43 56 50/5	99			Hard, gray SILT, some fine Sand, some Clay, trace coarse to fine Gravel, moist (TILL).	H	L	-	-	>>	
10							End of boring at 9.92 feet BGS due to 3 consecutive Split Spoon refusals. Borehole filled with cement mix and topped with 6-inch concrete patch.						
15													
20													

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

= Water Level (if observed)
BGS = Below Ground Surface
No Groundwater encountered.

Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Soil Boring Log

T-12

ANS GEO

Client:	Van Cleef Engineering	**Drilling Firm:**	Diamond Drilling	**Coordinates:**	41.500845, -74.100856
Project:	Stewart Int. Airport- SFS Hangar Option 11	**Drill Crew:**	Tony Martin / Edward Rodriguez	**Horiz. Datum:**	WGS 84
Location:	New Windsor, NY	**Boring Start:**	10/4/2023 12:00:00 PM	**Elevation:**	Grade
Inspector:	Sergio Motta	**Boring End:**	10/4/2023 1:09:00 PM	**Vert. Datum:**	N/A

Rig Model:	Diedrich D-25	**Sampler Type:**	Split Spoon	**Casing Type:**	Steel
Rig Type:	Trailer	**Sampler Length:**	24 inches	**Casing Length:**	5 feet
Drill Method:	Mud Rotary	**Sampler I.D.:**	1.375 inches	**Casing I.D.:**	4 inches
Hammer Type:	Safety	**Hammer Wt.:**	140 pounds	**Hammer Wt.:**	140 pounds
Drilling Fluid:	EZ mud	**Hammer Fall:**	30 inches	**Hammer Fall:**	30 inches

Depth (ft)	Sample No.	Rec. (in)	Blows per 6"	N-Value	USCS Symbol	Graphic Log	Visual Classification	Toughness	Plasticity	PP (tsf)	TV (tsf)	N-Value (10 20 30 40)	Drilling & Strata Notes
	R-1	2					12"- ASPHALT						
	S-1	22	15 20 30 45	50			Hard, gray Clayey SILT, little coarse to fine Gravel, trace fine Sand, moist (TILL).	H	L	1.25	0.15		Tested soil classification via Atterberg limit testing.
	S-2	16	20 24 39 50	63			Hard, gray Gravelly SILT, trace fine Sand, moist (TILL).	H	NP	>4.5	0.2	>>	Tough drilling.
5	S-3	17	40 42 46 50	88			Hard, gray Gravelly SILT, trace fine Sand, moist (TILL).	H	NP	>4.5	-	>>	Cobble fragments encountered.
	S-4	19	32 50 58 80	108			Hard, gray SILT, some coarse to fine Gravel, little fine Sand, trace Clay, moist (TILL).	H	M	>4.5	0.3	>>	Cobble fragments encountered. Very dense/Hard Till Zone after 8.5 feet BGS.
10	S-5	2	50/2	> 50			Very dense, dark gray coarse to fine GRAVEL, little Silt, trace fine Sand, wet (TILL). End of boring due to splitspoon refusal encountered at 9.2 feet BGS. Borehole backfilled with soil cuttings/ concrete mix and topped with a concrete Patch.	-		-	-	>>	Rough drilling
15													
20													

In-Borehole Water Levels

Date / Time	Casing Tip (ft)	Bot. of Hole (ft)	Water Lvl (ft)

General Notes

▼ = Water Level (if observed)

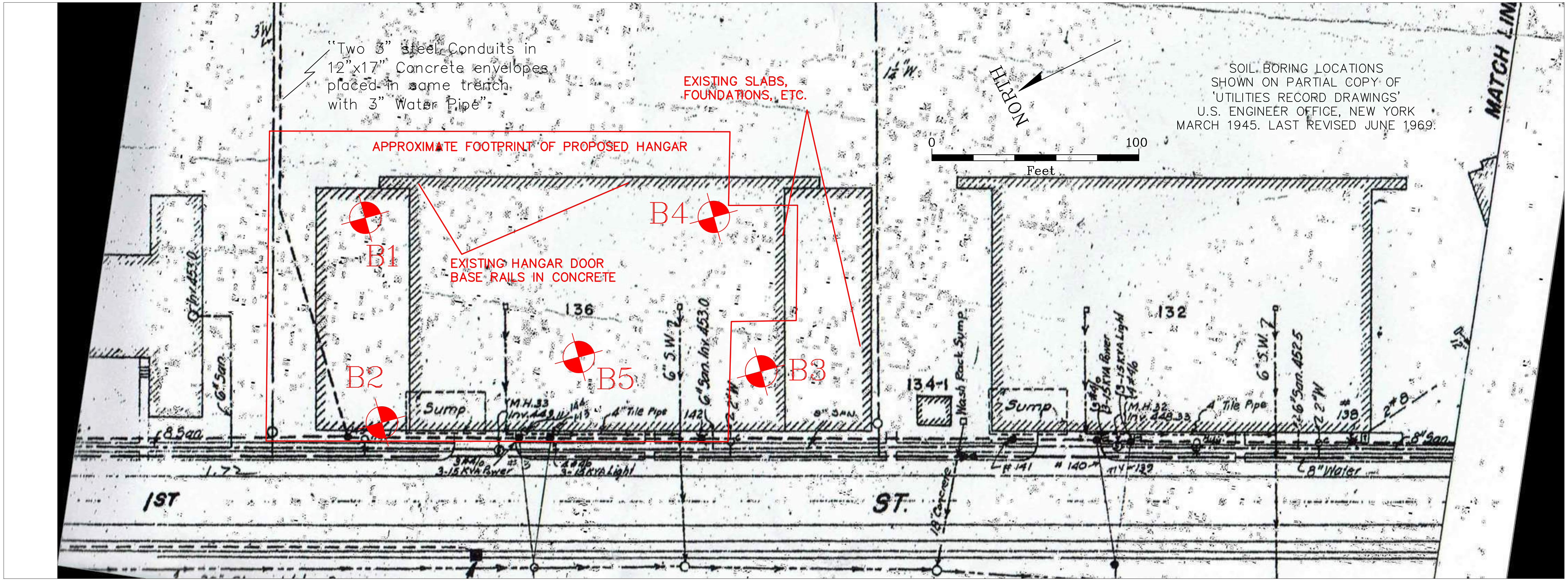
BGS = Below Ground Surface

No Groundwater encountered.

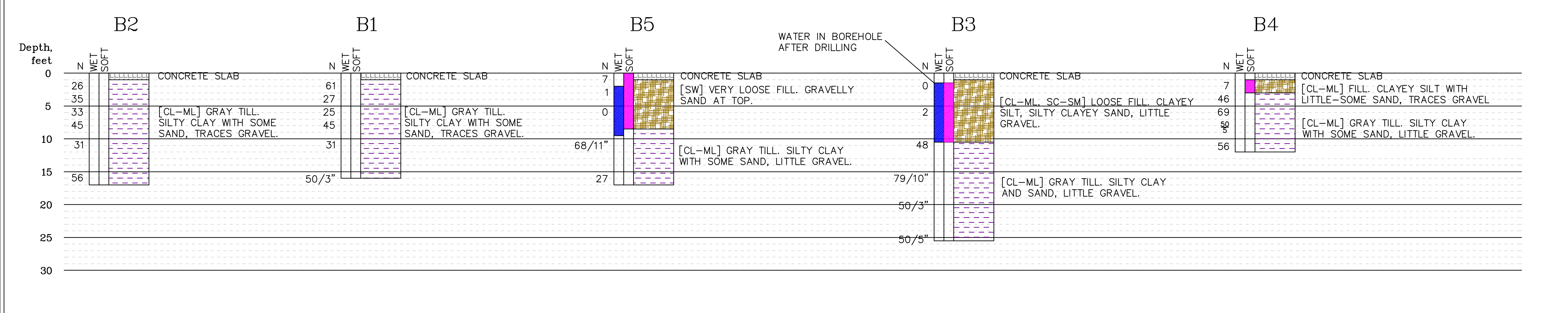
Toughness: Low (L), Medium (M), High (H)
Plasticity: Non-Plastic (NP), Low (L), Medium (M), High (H)
PP = Pocket Penetrometer, measured in tons per square ft.
TV = Torvane (Shear Vane), measured in tons per square ft.

Historic Test Borings

By Kevin L. Patton, PE
Dated 9/9/2018



GENERALIZED SUBSURFACE PROFILE



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PATTONGEOTECH.COM

SIGNATURE FLIGHT SUPPORT
HANGAR DD, STEWART AIRPORT, NEW WINDSOR, N.Y.
BORING LOCATIONS AND SUBSURFACE PROFILE

REV.	DATE	BY
0	9/9/2018	KLP

KEVIN L. PATTON, P.E.	CLIENT:	American Infrastructure Development, Inc.		
36 PATTON ROAD	PROJECT:	Stewart Airport Hangar DD		
NEWBURGH, NY 12550	DATE:	8/10/2018	Project No.:	18306
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Cloudy, 75-85°F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Northeast corner	BORING NO.	B-1
DRILLER AND HELPER:	John Wyant				
HAMMER TYPE:	Automatic Hammer	ELEVATION:	Top of slab		
INSPECTOR:	Wyeth Patton	WATER DEPTH:			

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
1-3	S1	SS	12	CL-ML	22	**33**	**28**	21	Moist	Gray till. Silt with some sand, trace gravel	
3-5	S2	SS	20	CL-ML	11	**13**	**14**	13	Moist	Gray till. Silty clay with some sand, little gravel	PEN= 15ksf
5											
5-7	S3	SS	12	CL-ML	9	**13**	**12**	11	Moist	Gray Till. Silty clay with some sand, little gravel	PEN= 12ksf
7-9	S4	SS	21	CL-ML	27	**25**	**20**	26	Moist	Gray Till. Silty clay, some sand, traces gravel	PEN= 15ksf
10											
10-12	S5	SS	20	CL-ML	9	**15**	**16**	19	Moist	Gray Till. Silty clay, some sand, traces gravel	
15											
15-17	S6	SS	9	CL-ML	14	**50/3**			Moist	Gray Till. Silty clay, some sand, little gravel	
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE: SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS
PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

KEVIN L. PATTON, P.E. 36 PATTON ROAD NEWBURGH, NY 12550 PATTONGEOTECH.COM 845 275-7732	CLIENT:	American Infrastructure Development, Inc.		
	PROJECT:	Stewart Airport Hangar DD		
	DATE:	8/10/2018	Project No.:	18306
	WEATHER:	Cloudy, 75-85°F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Northwest Corner	BORING NO.	B-2
DRILLER AND HELPER:	John Wyant				
HAMMER TYPE:	Automatic Hammer	ELEVATION:	Top of slab		
INSPECTOR:	Wyeth Patton	WATER DEPTH:			

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
1-3	S1	SS	14	CL-ML	6	**13**	**13**	9	Moist	Gray Till. Silty clay, some sand, little gravel	
3-5	S2	SS	8	CL-ML	17	**18**	**17**	17	Moist	Gray Till. Silty clay, some sand, little gravel	
5											
5-7	S3	SS	19	CL-ML	9	**16**	**17**	25	Moist	Gray Till. Silty clay, some sand, little gravel	
7-9	S4	SS	18	CL-ML	11	**23**	**22**	23	Moist	Gray Till. Silty clay, some sand, traces gravel	
10											
10-12	S5	SS	11	CL-ML	9	**11**	**20**	20	Moist	Gray Till. Silty clay, some sand, little gravel	
15											
15-17	S6	SS	8	CL-ML	22	**38**	**18**	23	Moist	Gray Till. Silty clay, some sand, little gravel	PEN= 15ksf
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

KEVIN L. PATTON, P.E.	CLIENT:	American Infrastructure Development, Inc.		
36 PATTON ROAD	PROJECT:	Stewart Airport Hangar DD		
NEWBURGH, NY 12550	DATE:	8/13/2018	Project No.:	18306
PATTONGEOTECH.COM 845 275-7732	WEATHER:	Rain, 70-75°F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Southwest corner	BORING NO.	B-3
DRILLER AND HELPER:	John Wyant				
HAMMER TYPE:	Automatic Hammer	ELEVATION:	Top of slab		
INSPECTOR:	Wyeth Patton	WATER DEPTH:	-1 foot		

Feet	SAMPLE #	Type	Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
1-3	S0	SS	0		1/24"				---	Loose material at 1 to 5 feet depth.	Void under concrete
										No sample recovered.	Possible drain.
5											
5-7	S1	SS	6	CL-ML	1	**1**	**1**	2	Wet	Gray till fill. Clayey silt with some sand,	
										little gravel. Soft.	
10											
10-12	S2	SS	18	SC-SM	3	**22**	**26**	28	Wet	Soft loose gray and brown sand with some	
				CL-ML					Moist	clayey silt, little gravel. Changes to:	PEN= 15ksf
										Gray till. Clayey till with some sand and little gravel	(Gray till)
15											
15-17	S3	SS	16	CL-ML	9	**29**	**50/4**		Moist	Gray Till. Clayey silt and sand, little gravel	
20											
20-22	S4	SS	3	SC-SM	50/3				Very moist	Gray Till. Sand and clayey silt, little gravel	
25											
25-27	S5	SS	2	CL-ML	50/5					Gray Till. Clayey silt and sand, little gravel	
										Small sample.	
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD: HSA - Hollow-Stem Auger MR - Mud-Rotary MEASUREMENTS IN FEET AND INCHES

SAMPLE/TEST TYPE: SS - SPLIT SPOON C - CORE T - UNDISTURBED TUBE AUG - AUGER CUTTINGS PEN - HAND PENETROMETER TOR - TORVANE V - VANE SHEAR

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CLIENT:	American Infrastructure Development, Inc.		
PROJECT:	Stewart Airport Hangar DD		
DATE:	8/13/2018	Project No.:	18306
WEATHER:	Rain, 70-75°F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Southeast corner	**BORING NO.**	**B-4**
DRILLER AND HELPER:	John Wyant				
HAMMER TYPE:	Automatic Hammer	ELEVATION:	Top of slab		
INSPECTOR:	Wyeth Patton	WATER DEPTH:			

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
										Brown Sand with little gravel, traces silt, over	
1-3	S1	SS	7	SM	3	**4**	**3**	8	Moist	Gray and brown till. Clayey silt with little to	PEN= 4ksf (till)
				CL-ML					Very moist	some sand, traces gravel	
3-5	S2	SS	16	CL-ML	16	**21**	**25**	18	Moist	Gray till. Silty clay with some sand, little gravel	
5											
5-7	S3	SS	12	CL-ML	19	**40**	**29**	24	Moist	Gray till. Silty clay with some sand, little gravel	
7-9	S4	SS	6	CL-ML	20	**50/5**			Very moist	Gray till. Silty clay with some sand, little gravel	
10											
10-12	S5	SS	20	CL-ML	22	**18**	**38**	21	Moist	Gray till. Silty clay with some sand, little gravel	
15											
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

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CLIENT:	American Infrastructure Development, Inc.		
PROJECT:	Stewart Airport Hangar DD		
DATE:	8/13/2018	Project No.:	18306
WEATHER:	Rain, 70-75°F		

SOIL BORING LOG

DRILLING COMPANY:	General Borings	LOCATION:	Middle	**BORING NO.**	**B-5**
DRILLER AND HELPER:	John Wyant				
HAMMER TYPE:	Automatic Hammer	ELEVATION:	Top of slab		
INSPECTOR:	Wyeth Patton	WATER DEPTH:			

Feet	SAMPLE #	SAMPLE Type	SAMPLE Rec.	USCS SOIL CLASS	SPT TEST, BLOWS/6" 0-6	6-12	12-18	18-24	MOISTURE	DESCRIPTION	NOTES
0-2	S1	SS	10	SW	5	**4**	**3**	4	Moist	Brown sand with little gravel, trace silt.	
										Bank-run sand and gravel.	Loose Fill
2-4	S2	SS	2	SW	2	**1**	**1/12"**		Wet	Same. Loose.	
5											
5-7	S3	SS	0	---	WOR				---	No recovery. Very loose and soft to	
										approx. 8.5 feet.	
10											Undisturbed Soil
10-12	S4	SS	15	CL-ML	9	**18**	**50/5**		Moist-	Gray till. Clayey silt with some sand, little gravel	
									Very moist		
15											
15-17	S5	SS	24	CL-ML	6	**12**	**15**	15	Moist	Gray till. Clayey silt with some sand, little gravel	WOR
										PEN = 12 ksf	
20											
25											
30											
35											
40											
45											

COMMENTS:

DRILLING METHOD:	HSA - Hollow-Stem Auger	MR - Mud-Rotary		MEASUREMENTS IN FEET AND INCHES
SAMPLE/TEST TYPE	SS - SPLIT SPOON	C - CORE	T - UNDISTURBED TUBE	AUG - AUGER CUTTINGS
	PEN - HAND PENETROMETER		TOR - TORVANE	V - VANE SHEAR

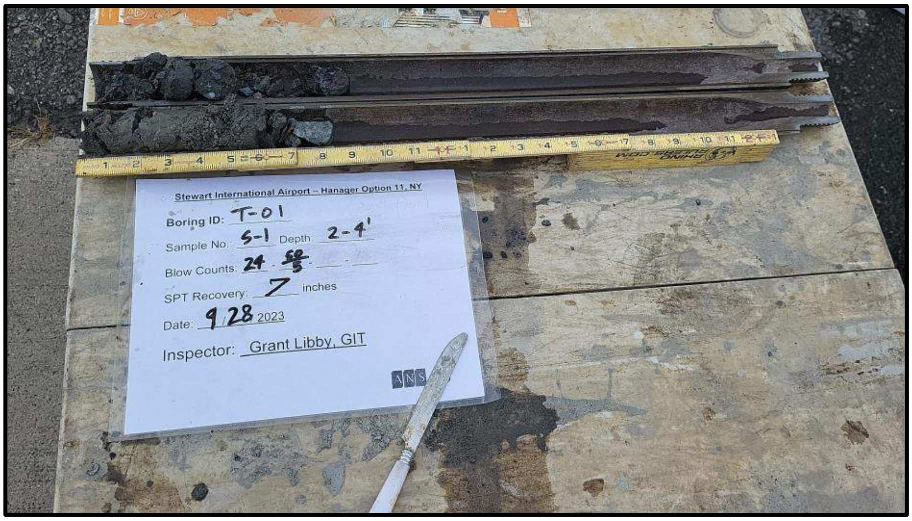
Appendix C

Photo Logs

SPT Photo Log

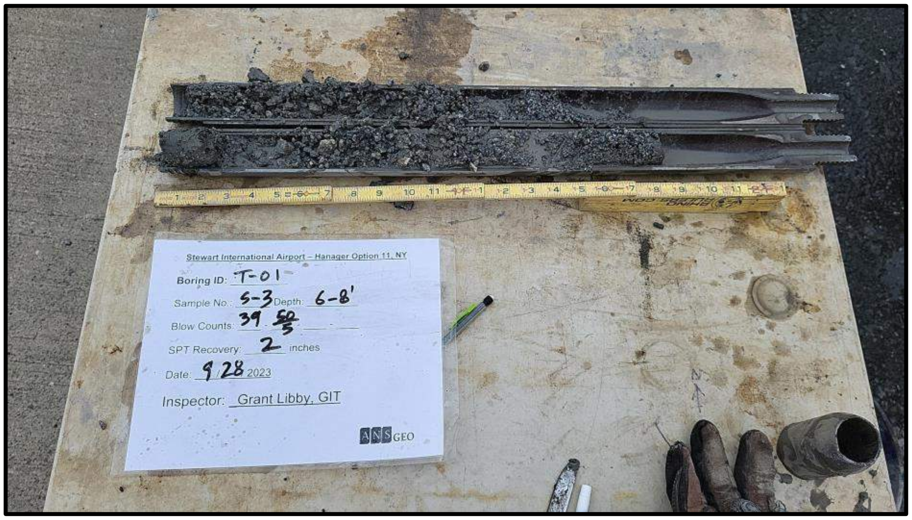
SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Boring ID: T-01 **Sample: S- 1 (2'- 4')** **Recovery: 7 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Boring ID: T-01 **Sample: S- 3 (6'- 8')** **Recovery: 2 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Boring ID: T-01

Sample: S- 4 (8'- 10')

Recovery: 3 inches

SPT PHOTO LOG	
Project Name: Stewart International Airport, New Windor, NY **Date:** 09/28/2023 **Inspector:** Grant Libby	
Boring ID: T-01 **Sample: S- 5 (10'- 12')** **Recovery: 11 inches**	

SPT PHOTO LOG

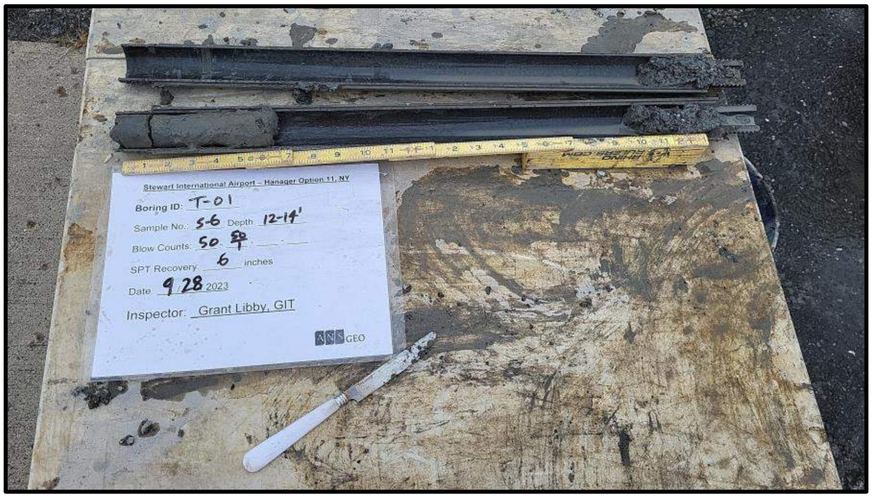
Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

ANS GEO

Boring ID: T-01

Sample: S-6 (12'- 14')

Recovery: 6 inches



SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Boring ID: T-02 **Sample: S-1 (1.6'- 3.6')** **Recovery: 6 inches**	

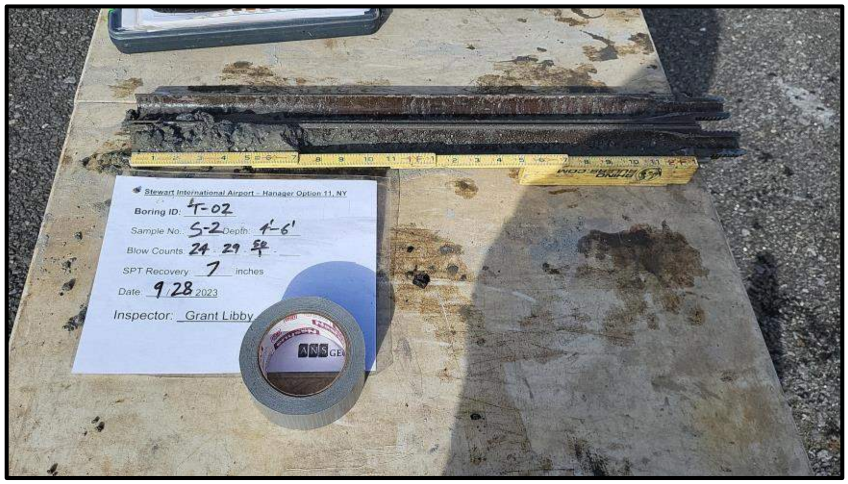
SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Boring ID: T-02

Sample: S-2 (4'- 6')

Recovery: 7 inches



SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/27/2023
Inspector: Grant Libby

Boring ID: T-04 **Sample: S-1 (1.5'- 3.5')** **Recovery: 2 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/27/2023
Inspector: Grant Libby

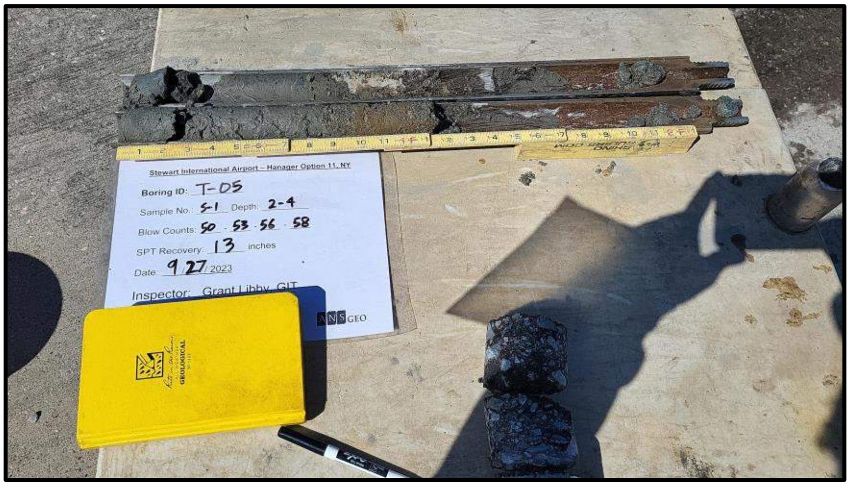
Boring ID: T-04 **Sample: S-2 (3.5'- 5.5')** **Recovery: 9 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/27/2023
Inspector: Grant Libby

Boring ID: T-04 **Sample: S-3 (5.5'- 7.5')** **Recovery: 11 inches**	

SPT PHOTO LOG	
Project Name: Stewart International Airport, New Windor, NY **Date:** 09/27/2023 **Inspector:** Grant Libby	ANS GEO

Boring ID: T-05 **Sample: S-1 (2'- 4')** **Recovery: 13 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/27/2023
Inspector: Grant Libby

Boring ID: T-05 **Sample: S-2 (4'- 6')** **Recovery: 4 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/27/2023
Inspector: Grant Libby

Boring ID: T-05

Sample: S-3 (6'- 8')

Recovery: 10 inches

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/27/2023
Inspector: Grant Libby

Boring ID: T-05 **Sample: S-4 (8'- 10')** **Recovery: 12 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/26/2023
Inspector: Grant Libby

Boring ID: T-06 **Sample: S-1 (1'- 3')** **Recovery: 6 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/26/2023
Inspector: Grant Libby

Boring ID: T-06 **Sample: S-2 (3'- 5')** **Recovery: 4 inches**	

SPT PHOTO LOG

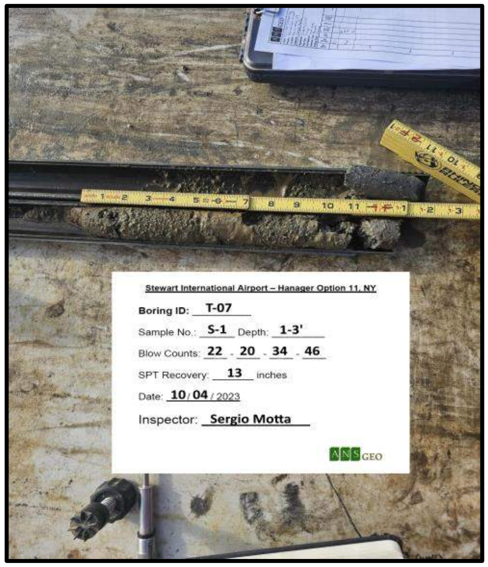
Project Name: Stewart International Airport, New Windor, NY
Date: 09/26/2023
Inspector: Grant Libby

Boring ID: T-06

Sample: S-3 (5'- 7')

Recovery: 2 inches

SPT PHOTO LOG
Project Name: Stewart International Airport, New Windor, NY **Date:** 10/04/2023 **Inspector:** Sergio Motta

Boring ID: T-07 **Sample: S-1 (1'- 3')** **Recovery: 13 inches**	

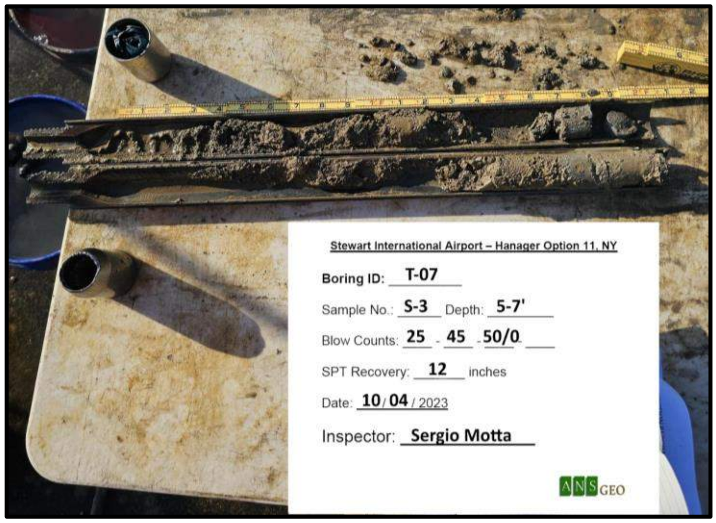
SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

Boring ID: T-07 **Sample: S-2 (3'- 5')** **Recovery: 24 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

Boring ID: T-07 **Sample: S-3 (5'- 7')** **Recovery: 12 inches**	

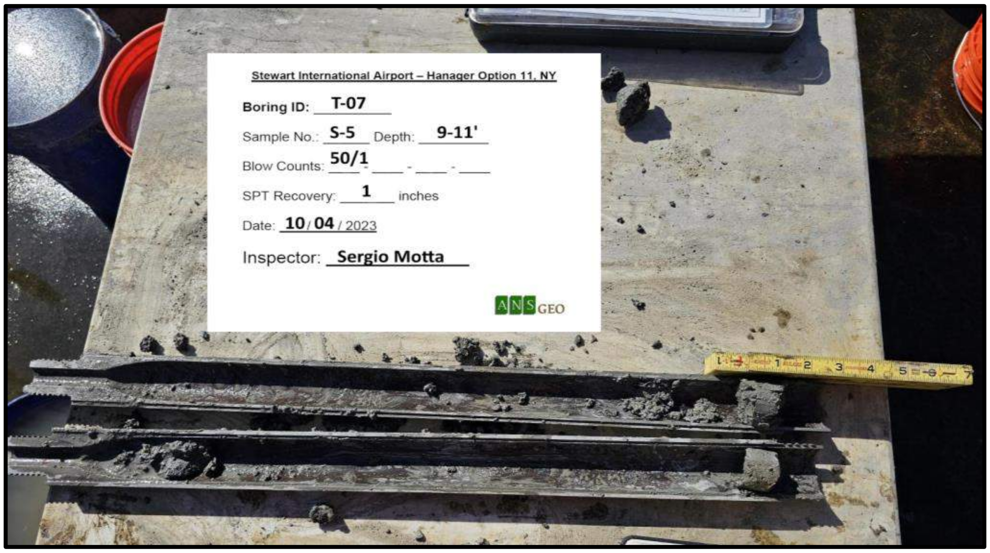
SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

Boring ID: T-07 **Sample: S-4 (7'- 9')** **Recovery: 12 inches**	

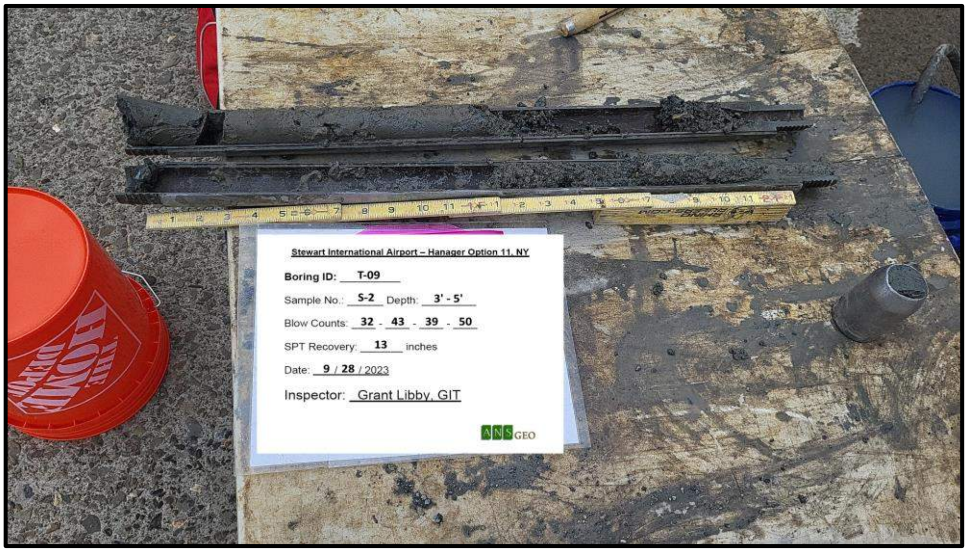
SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

Boring ID: T-07 **Sample: S-5 (9’- 11’)** **Recovery: 1 inch**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Boring ID: T-09 **Sample: S- 2 (3'- 5')** **Recovery: 13 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Boring ID: T-09

Sample: S-3 (5'- 7')

Recovery: 10 inches

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Boring ID: T-09 **Sample: S-4 (7'- 9')** **Recovery: 16 inches**	

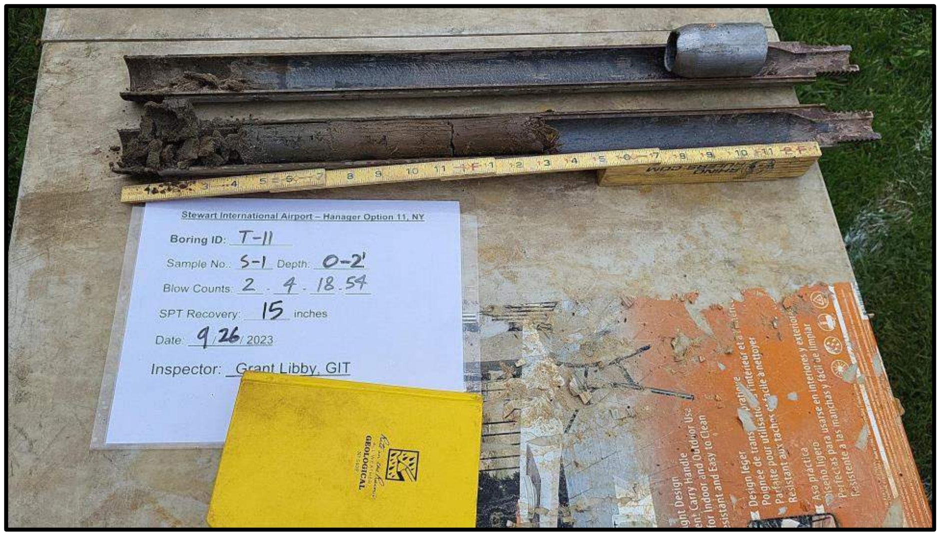
SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/26/2023
Inspector: Grant Libby

Boring ID: T-11

Sample: S-1 (0'- 2')

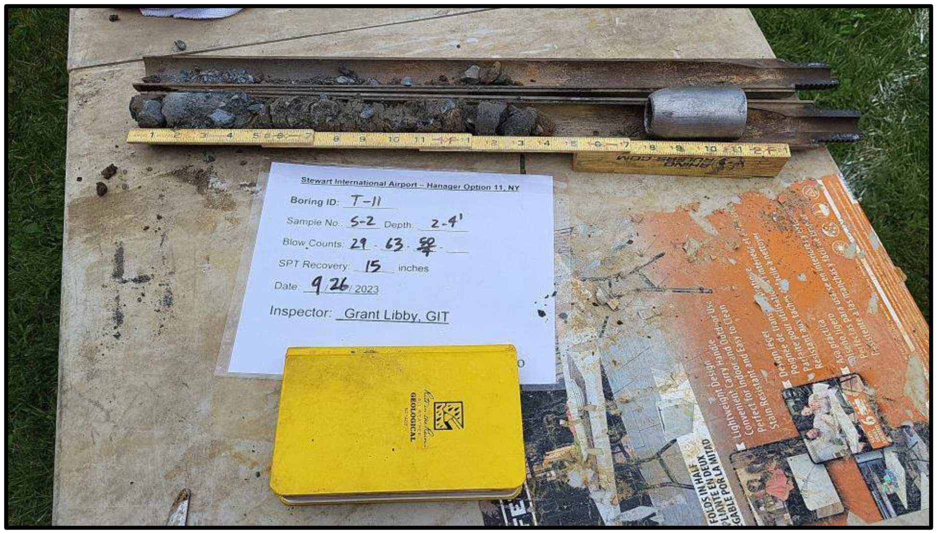
Recovery: 15 inches



SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/26/2023
Inspector: Grant Libby

ANS GEO

Boring ID: T-11 **Sample: S-2 (2'- 4')** **Recovery: 15 inches**	

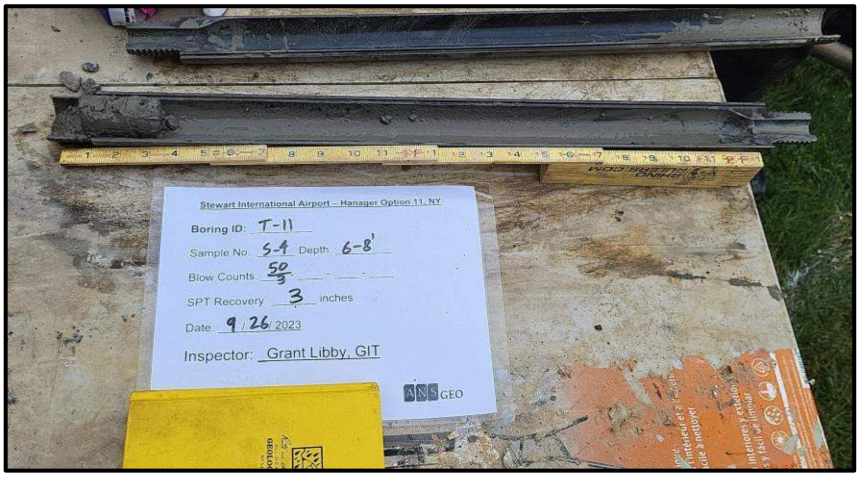
SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/26/2023
Inspector: Grant Libby

Boring ID: T-11 **Sample: S-3 (4'- 6')** **Recovery: 9 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/26/2023
Inspector: Grant Libby

Boring ID: T-11 **Sample: S-4 (6'- 8')** **Recovery: 3 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 09/26/2023
Inspector: Grant Libby

Boring ID: T-11

Sample: S-5 (8'- 10')

Recovery: 19 inches

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

Boring ID: T-12

Sample: S-1 (1'- 3')

Recovery: 22 inches

SPT PHOTO LOG

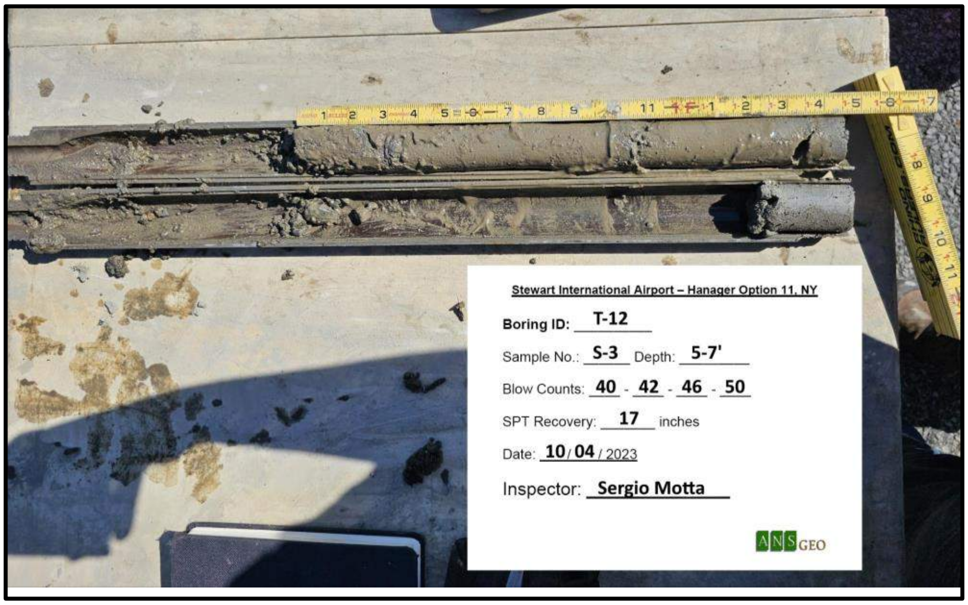
Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

ANS GEO

Boring ID: T-12 **Sample: S-2 (3'- 5')** **Recovery: 16 inches**	

SPT PHOTO LOG

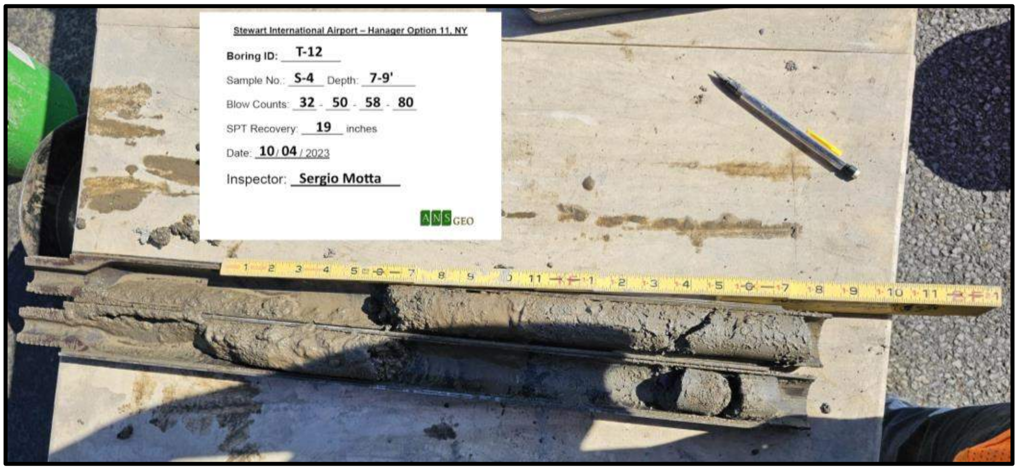
Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

Boring ID: T-12 **Sample: S-3 (5'- 7')** **Recovery: 17 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

ANS GEO

Boring ID: T-12 **Sample: S-4 (7'- 9')** **Recovery: 19 inches**	

SPT PHOTO LOG

Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

Boring ID: T-12

Sample: S-5 (9'- 11')

Recovery: 2 inches

Pavement Core Samples

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

ANS GEO

Core ID: T-01

Asphalt Pavement Core

Recovery: 24 inches

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Core ID: T-02

Asphalt Pavement Core

Recovery: 11 inches

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 10/02/2023
Inspector: Grant Libby

Core ID: T-03 **Concrete/Asphalt Pavement Core** **Recovery: 21 inches**	

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 09/27/2023
Inspector: Grant Libby

Core ID: T-04 **Asphalt Pavement Core** **Recovery: 10 inches**	

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 09/27/2023
Inspector: Grant Libby

Core ID: T-05 **Concrete/Asphalt Pavement Core** **Recovery: 22 inches**	

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 09/26/2023
Inspector: Grant Libby

ANS GEO

Core ID: T-06

Asphalt Pavement Core

Recovery: 15 inches

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 10/04/2023
Inspector: Sergio Motta

Core ID: T-07 **Concrete Pavement Core** **Recovery: 7 inches**	

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 10/02/2023
Inspector: Grant Libby

ANS GEO

Core ID: T-08

Concrete Pavement Core

Recovery: 7 inches

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 09/28/2023
Inspector: Grant Libby

Core ID: T-09

Concrete Pavement Core

Recovery: 8 inches

PAVEMENT CORE SAMPLES

Project Name: Stewart International Airport, New Windor, NY
Date: 10/02/2023
Inspector: Sergio Motta

Core ID: T-12 **Asphalt Pavement Core** **Recovery: 2 inches**	

GPR Survey Scan Photos

[redacted]

Picture 1: MALA Pro Widerange HDR

Weather:

Lat/Lng:
Bearing:
Date Taken: 09/19/2023

Taken By: Grant Libby
Tags: GPR

[redacted]

Picture 2: T-01 GPR

Weather:

Lat/Lng:
Bearing: N
Date Taken: 09/19/2023

Taken By: Grant Libby
Tags: GPR

[redacted]

Picture 3: T-02 GPR

Weather:

Lat/Lng:
Bearing: N
Date Taken: 09/19/2023

Taken By: Grant Libby
Tags: GPR

[redacted]

Picture 4: T-03 GPR

Weather:

Lat/Lng:
Bearing: N
Date Taken: 09/19/2023

Taken By: Grant Libby
Tags: GPR

ANS GEO

Project Name: Stewart International Airport - Hangar Option 11	
Project Location: 1188 1st St, New Windsor, NY 12553, USA	
Client: Van Cleef Engineering	Project Code:
Preparer: Grant Libby	Reviewer: Diego Melgar
Report Date: 10/17/2023	

[redacted]

Picture 5: T-04 GPR

Weather:	
Lat/Lng: Bearing: N Date Taken: 09/19/2023	Taken By: Grant Libby Tags: GPR

[redacted]

Picture 6: T-05 GPR

Weather:	
Lat/Lng: Bearing: N Date Taken: 09/19/2023	Taken By: Grant Libby Tags: GPR

[redacted]

Picture 7: T-06 GPR

Weather:	
Lat/Lng: Bearing: N Date Taken: 09/19/2023	Taken By: Grant Libby Tags: GPR

[redacted]

Picture 8: T-07 GPR

Weather: Sunny	
Lat/Lng: 41.5020,-74.1000 Bearing: Date Taken: 10/16/2023	Taken By: Diego Melgar Tags:

ANS GEO

Project Name: Stewart International Airport - Hangar Option 11	
Project Location: 1188 1st St, New Windsor, NY 12553, USA	
Client: Van Cleef Engineering	Project Code:
Preparer: Grant Libby	Reviewer: Diego Melgar
Report Date: 10/17/2023	Page Number: 2 of 23

Picture 9: T-08 GPR

Weather:

Lat/Lng: 41.5020,-74.1000
Bearing:
Date Taken: 09/27/2023

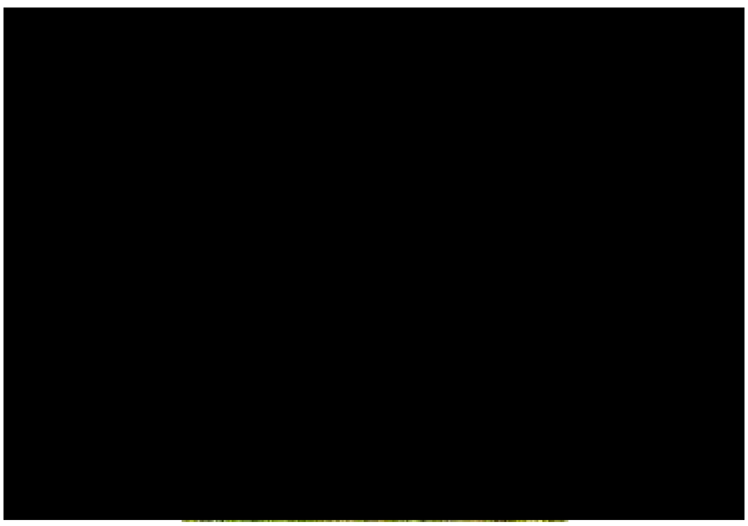
Taken By: Diego Melgar
Tags:

Picture 10: T-09 GPR

Weather:

Lat/Lng: 41.5020,-74.1000
Bearing:
Date Taken: 09/27/2023

Taken By: Diego Melgar
Tags:



Picture 11: T-10 GPR

Weather:

Lat/Lng: 41.5020,-74.1000
Bearing:
Date Taken: 09/27/2023

Taken By: Diego Melgar
Tags:

Picture 12: T-11 GPR

Weather:

Lat/Lng: 41.5020,-74.1000
Bearing:
Date Taken: 09/19/2023

Taken By: Grant Libby
Tags:

ANS GEO

Project Name: Stewart International Airport - Hangar Option 11	
Project Location: 1188 1st St, New Windsor, NY 12553, USA	
Client: Van Cleef Engineering	Project Code:
Preparer: Grant Libby	Reviewer: Diego Melgar
Report Date: 10/17/2023	Page Number: 3 of 23

Appendix D

NRCS Web Soil Survey Report

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Orange County, New York

September 20, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:1,470 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County, New York
Survey Area Data: Version 23, Sep 10, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 31, 2022—Oct 27, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
MdB	Mardin gravelly silt loam, 3 to 8 percent slopes	0.7	12.1%
MdC	Mardin gravelly silt loam, 8 to 15 percent slopes	1.2	20.5%
UH	Udorthents, smoothed	0.0	0.8%
Ur	Urban land	4.0	66.7%
Totals for Area of Interest		**6.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Orange County, New York

MdB—Mardin gravelly silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2v30j
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mardin and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mardin

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till

Typical profile

Ap - 0 to 8 inches: gravelly silt loam
Bw - 8 to 15 inches: gravelly silt loam
E - 15 to 20 inches: gravelly silt loam
Bx - 20 to 72 inches: gravelly silt loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 14 to 26 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: D
Ecological site: F144AY008CT - Moist Till Uplands
Hydric soil rating: No

Minor Components

Lordstown

Percent of map unit: 5 percent

Landform: Mountains, hills
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Mountaintop, interfluve, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Volusia

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Bath

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

MdC—Mardin gravelly silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2v30l
Elevation: 330 to 2,460 feet
Mean annual precipitation: 31 to 70 inches
Mean annual air temperature: 39 to 52 degrees F
Frost-free period: 105 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mardin and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mardin

Setting

Landform: Mountains, hills
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

Ap - 0 to 8 inches: gravelly silt loam
Bw - 8 to 15 inches: gravelly silt loam
E - 15 to 20 inches: gravelly silt loam
Bx - 20 to 72 inches: gravelly silt loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: 14 to 26 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 13 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D
Ecological site: F144AY008CT - Moist Till Uplands
Hydric soil rating: No

Minor Components

Lordstown

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Volusia

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope, side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Bath

Percent of map unit: 5 percent
Landform: Mountains, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

UH—Udorthents, smoothed

Map Unit Setting

National map unit symbol: 9vxc
Elevation: 0 to 1,260 feet
Mean annual precipitation: 42 to 52 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 75 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Typical profile

H1 - 0 to 4 inches: channery loam
H2 - 4 to 70 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 5.95 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Alden

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Ur—Urban land

Map Unit Setting

National map unit symbol: 9vxg
Mean annual precipitation: 42 to 52 inches
Mean annual air temperature: 46 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 75 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H1 - 0 to 6 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Canandaigua

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Building Site Development

Building site development interpretations are designed to be used as tools for evaluating soil suitability and identifying soil limitations for various construction purposes. As part of the interpretation process, the rating applies to each soil in its described condition and does not consider present land use. Example interpretations can include corrosion of concrete and steel, shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping.

Corrosion of Concrete

ENG

Engineering

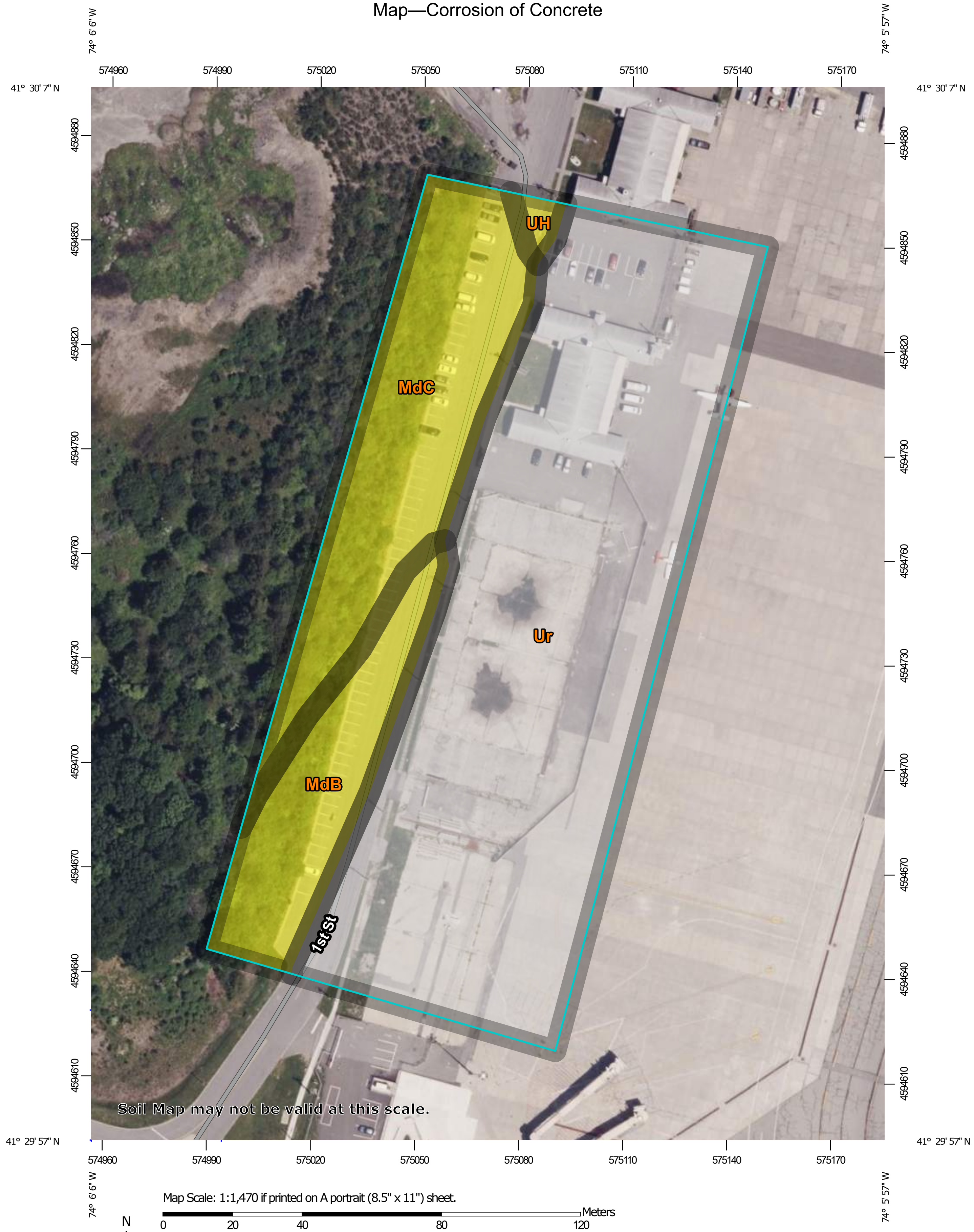
AGR

Agronomy

"Risk of corrosion" pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens concrete. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the concrete in installations that are entirely within one kind of soil or within one soil layer.

The risk of corrosion is expressed as "low," "moderate," or "high."

Map—Corrosion of Concrete



Map Scale: 1:1,470 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

High

Moderate

Low

Not rated or not available

Soil Rating Lines

High

Moderate

Low

Not rated or not available

Soil Rating Points

High

Moderate

Low

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County, New York
Survey Area Data: Version 23, Sep 10, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 31, 2022—Oct 27, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Corrosion of Concrete

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
MdB	Mardin gravelly silt loam, 3 to 8 percent slopes	Moderate	0.7	12.1%
MdC	Mardin gravelly silt loam, 8 to 15 percent slopes	Moderate	1.2	20.5%
UH	Udorthents, smoothed	Moderate	0.0	0.8%
Ur	Urban land		4.0	66.7%
Totals for Area of Interest			**6.0**	**100.0%**

Rating Options—Corrosion of Concrete

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Corrosion of Steel

ENG

Engineering

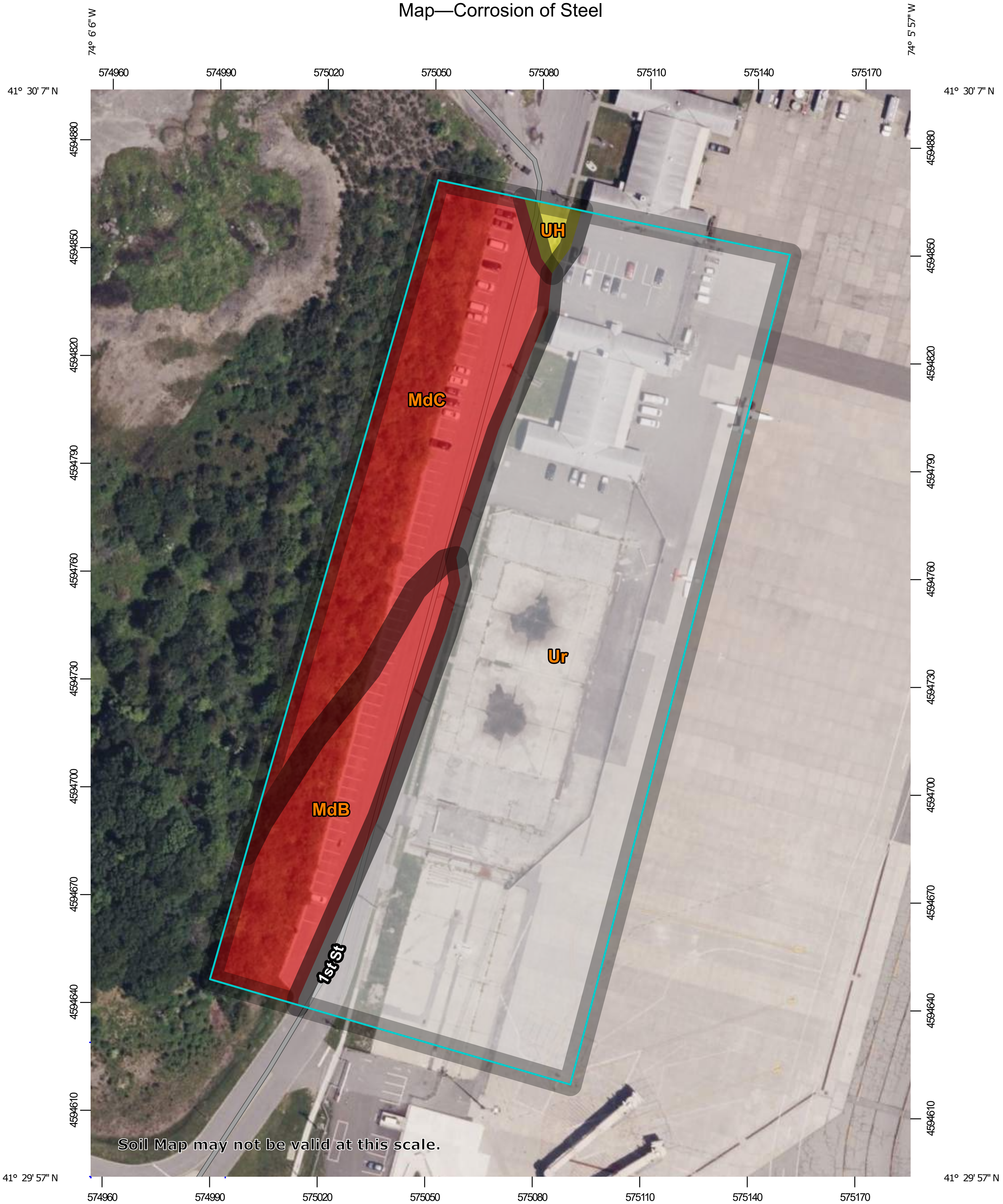
AGR

Agronomy

"Risk of corrosion" pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel in installations that are entirely within one kind of soil or within one soil layer.

The risk of corrosion is expressed as "low," "moderate," or "high."

Map—Corrosion of Steel



Map Scale: 1:1,470 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- High
- Moderate
- Low
- Not rated or not available

Soil Rating Lines

- High
- Moderate
- Low
- Not rated or not available

Soil Rating Points

- High
- Moderate
- Low
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County, New York
Survey Area Data: Version 23, Sep 10, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 31, 2022—Oct 27, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Corrosion of Steel

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
MdB	Mardin gravelly silt loam, 3 to 8 percent slopes	High	0.7	12.1%
MdC	Mardin gravelly silt loam, 8 to 15 percent slopes	High	1.2	20.5%
UH	Udorthents, smoothed	Moderate	0.0	0.8%
Ur	Urban land		4.0	66.7%
Totals for Area of Interest			**6.0**	**100.0%**

Rating Options—Corrosion of Steel

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Land Management

Land management interpretations are tools designed to guide the user in evaluating existing conditions in planning and predicting the soil response to various land management practices, for a variety of land uses, including cropland, forestland, hayland, pastureland, horticulture, and rangeland. Example interpretations include suitability for a variety of irrigation practices, log landings, haul roads and major skid trails, equipment operability, site preparation, suitability for hand and mechanical planting, potential erosion hazard associated with various practices, and ratings for fencing and waterline installation.

Erosion Hazard (Off-Road, Off-Trail)

FOR - Forestry

As of 9/30/2022, this rating is not working as intended. All components appear as not rated. This rating will be fixed on 10/01/2023.

The ratings in this interpretation indicate the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope, soil erosion factor K, and an index of rainfall erosivity (R). The soil loss is caused by sheet or rill erosion in off-road or off-trail areas where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance.

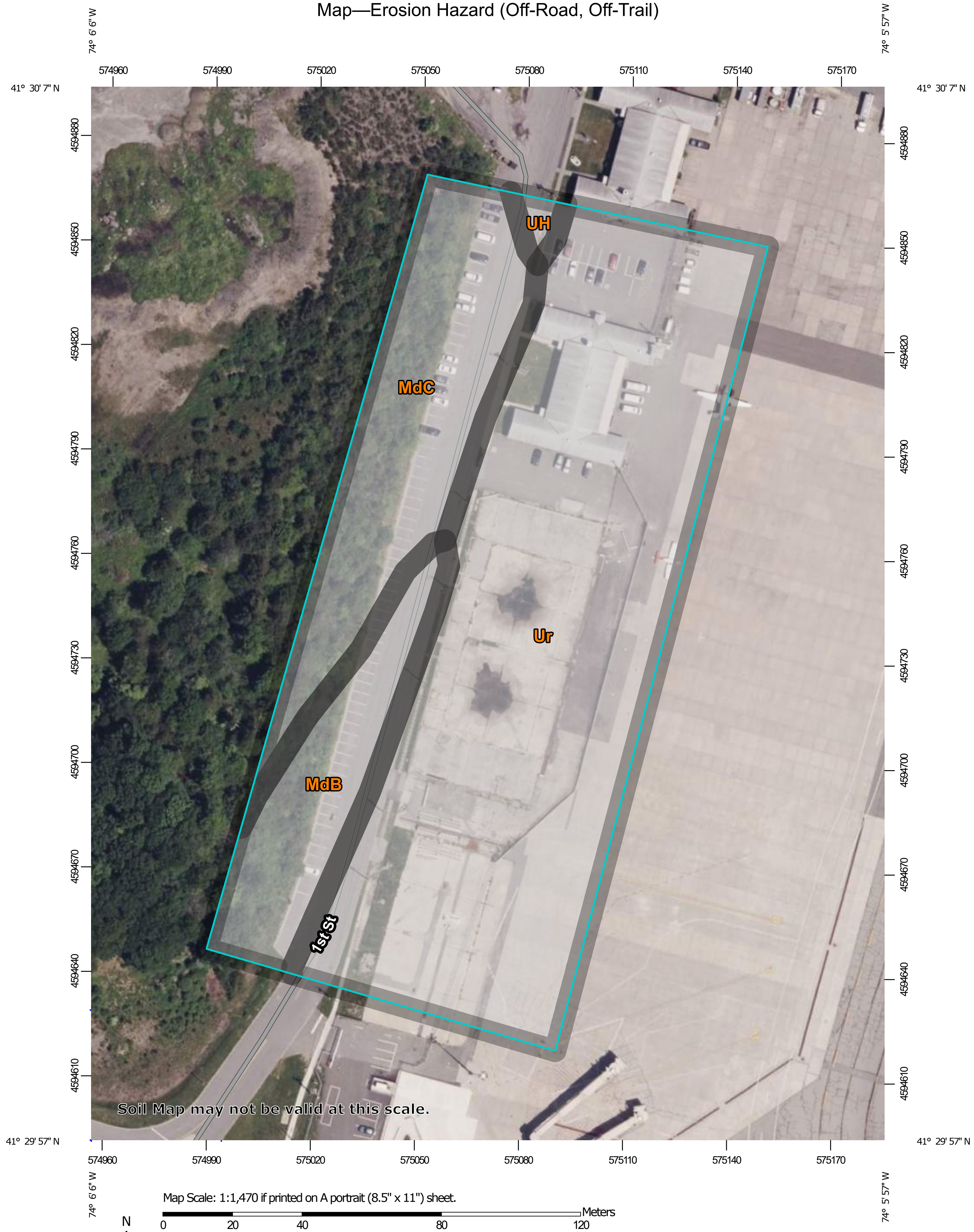
The ratings are both verbal and numerical. The hazard is described as "slight," "moderate," "severe," or "very severe." A rating of "slight" indicates that erosion is unlikely under ordinary climatic conditions; "moderate" indicates that some erosion is likely and that erosion-control measures may be needed; "severe" indicates that erosion is very likely and that erosion-control measures, including revegetation of bare areas, are advised; and "very severe" indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the specified aspect of forestland management (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map—Erosion Hazard (Off-Road, Off-Trail)



Map Scale: 1:1,470 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very severe
- Severe
- Moderate
- Slight
- Not rated or not available

Soil Rating Lines
- Very severe
- Severe
- Moderate
- Slight
- Not rated or not available

Soil Rating Points
- Very severe
- Severe
- Moderate
- Slight
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Orange County, New York
Survey Area Data: Version 23, Sep 10, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 31, 2022—Oct 27, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Tables—Erosion Hazard (Off-Road, Off-Trail)

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
MdB	Mardin gravelly silt loam, 3 to 8 percent slopes	Not rated	Mardin (85%)		0.7	12.1%
			Lordstown (5%)			
			Volusia (5%)			
			Bath (5%)			
MdC	Mardin gravelly silt loam, 8 to 15 percent slopes	Not rated	Mardin (85%)		1.2	20.5%
			Lordstown (5%)			
			Volusia (5%)			
			Bath (5%)			
UH	Udorthents, smoothed	Not rated	Udorthents (75%)		0.0	0.8%
			Alden (5%)			
Ur	Urban land	Not rated	Urban land (75%)		4.0	66.7%
			Canandaigua (5%)			
Totals for Area of Interest					**6.0**	**100.0%**

Rating	Acres in AOI	Percent of AOI
Null or Not Rated	6.0	100.0%
Totals for Area of Interest	**6.0**	**100.0%**

Rating Options—Erosion Hazard (Off-Road, Off-Trail)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

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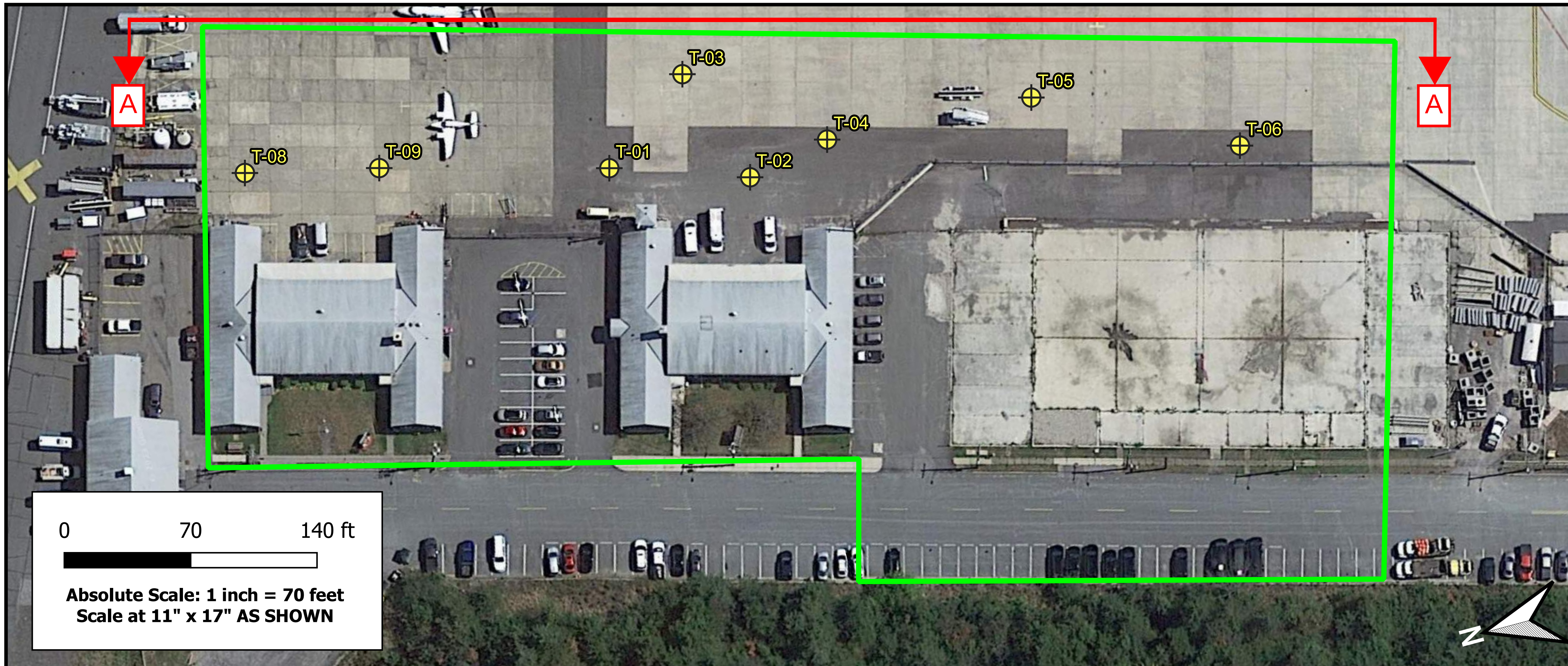
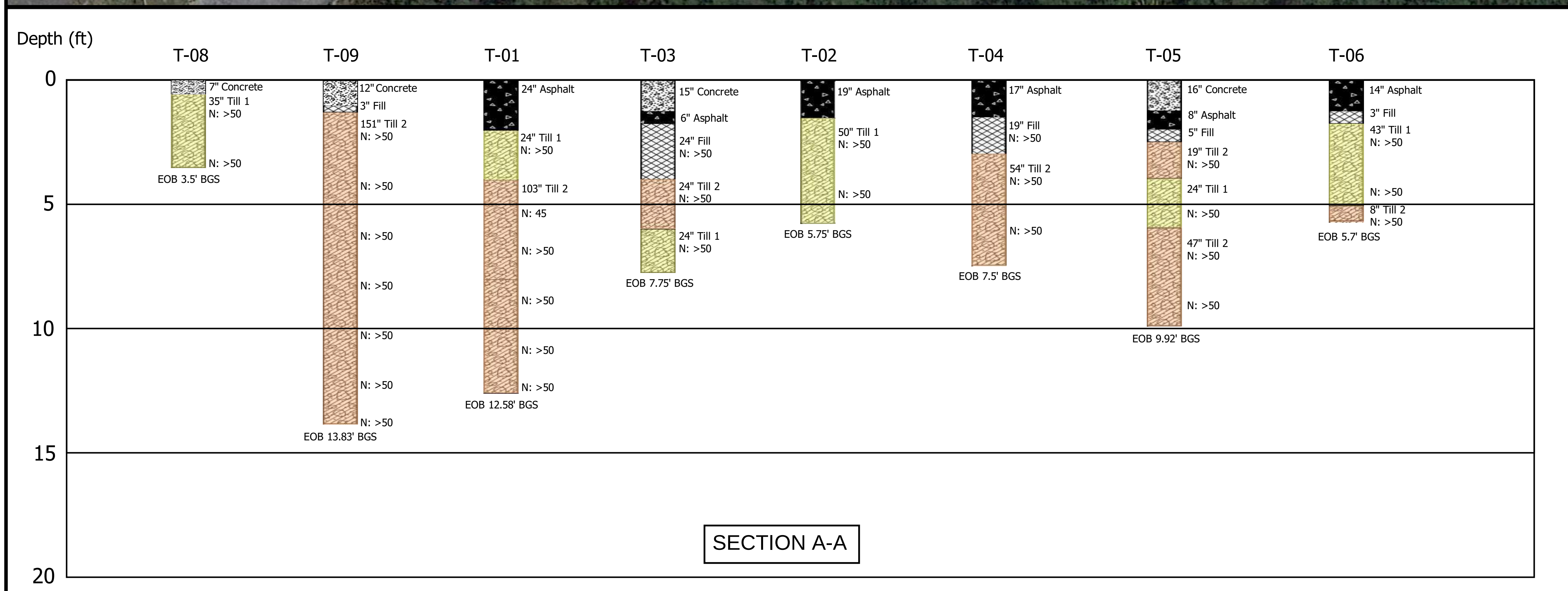
Appendix E

Soil Profiles





ANS GEO

Client:

Van Cleef
ENGINEERING WITH FOCUS

SOIL BORING PROFILE 1

VAN CLEEF ENGINEERING
STEWART INTERNATIONAL AIRPORT TERMINAL & HANGARS - OPTION 11
NEW WINDSOR, NY

Legend

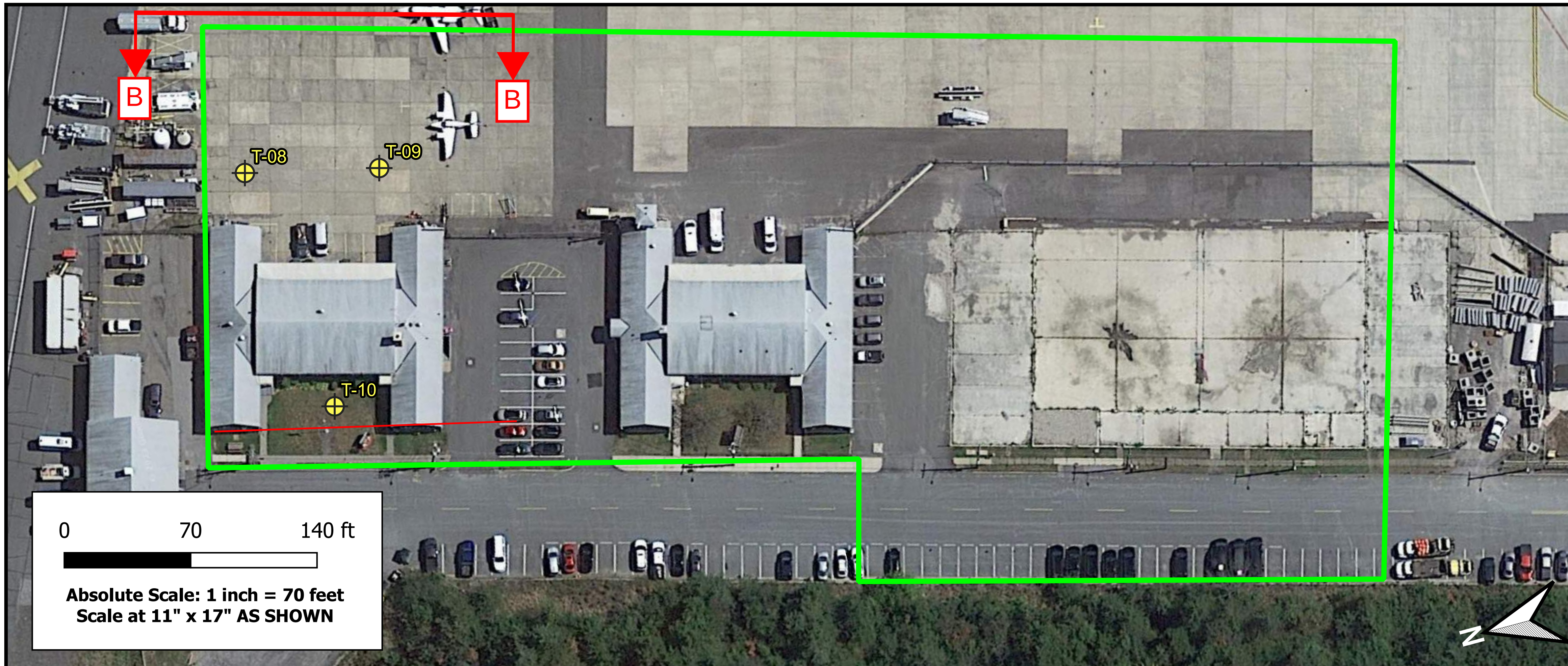
Map Units

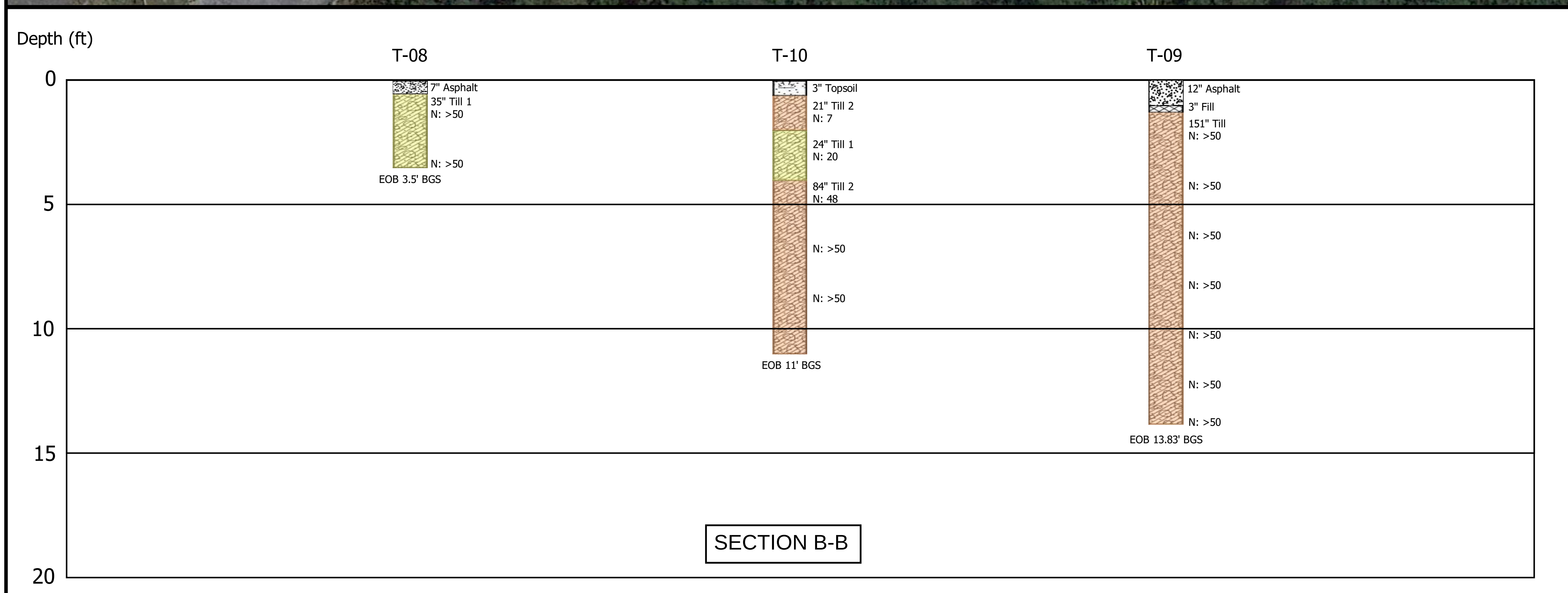
- Soil Boring Locations
- Investigation Area Boundary

Profile Units

- Asphalt
- Concrete
- Fill
- Till 1 (Sand/Gravel)
- Till 2 (Silt/Clay)

Prepared by: Grant Libby
Date: October 16, 2023
Drawing Number: SBP-001





ANS GEO

Client:

Van Cleef ENGINEERING WITH FOCUS

SOIL BORING PROFILE 2

VAN CLEEF ENGINEERING
STEWART INTERNATIONAL AIRPORT TERMINAL & HANGARS - OPTION 11
NEW WINDSOR, NY

Legend

Map Units

Soil Boring Locations

Investigation Area Boundary

Profile Units

Topsoil

Asphalt

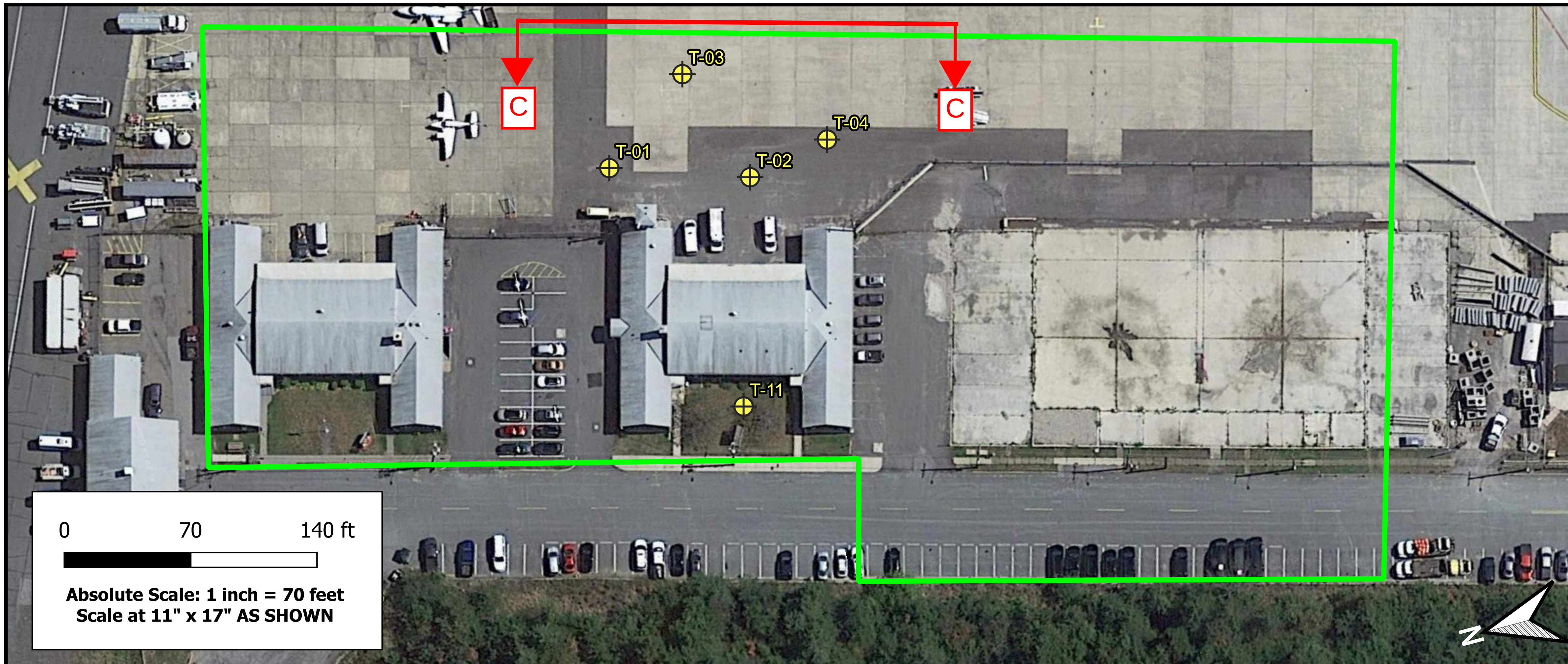
Concrete

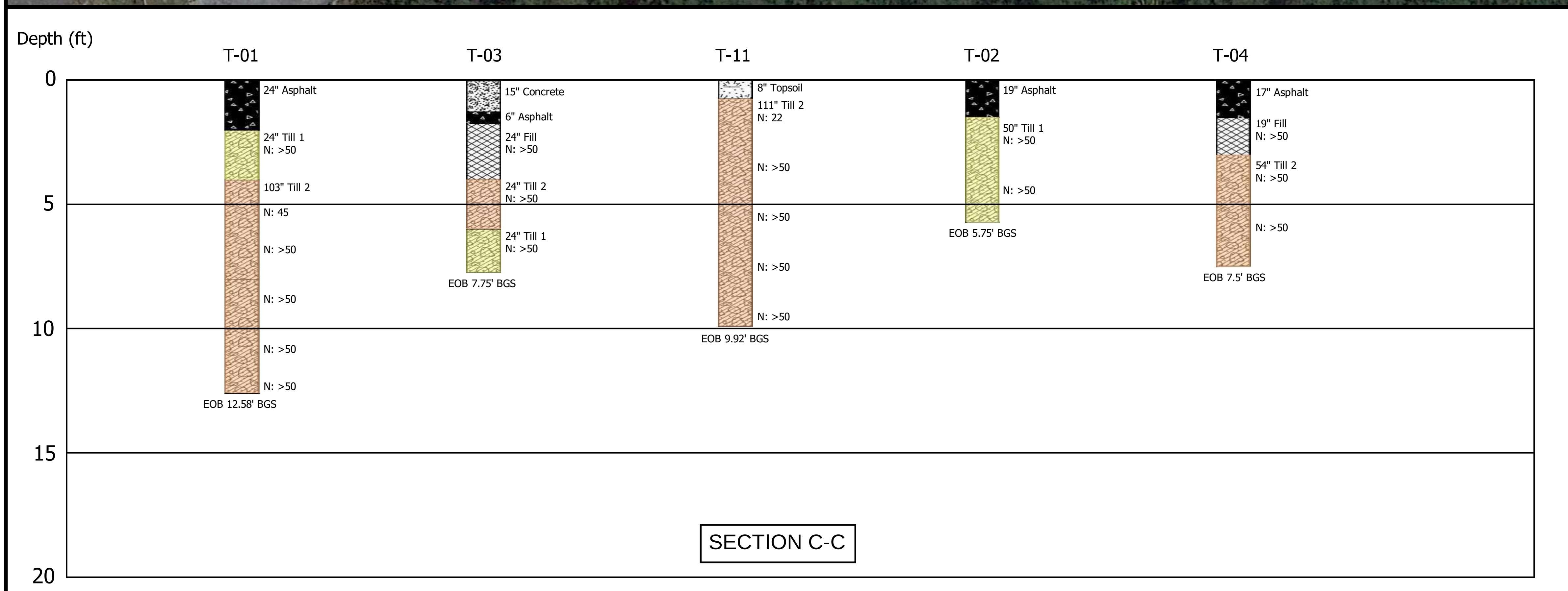
Fill

Till 1 (Sand/Gravel)

Till 2 (Silt/Clay)

Prepared by: Grant Libby
Date: October 17, 2023
Drawing Number: SBP-002





ANS GEO

Client:

Van Cleef
ENGINEERING WITH FOCUS

SOIL BORING PROFILE 3

VAN CLEEF ENGINEERING
STEWART INTERNATIONAL AIRPORT TERMINAL & HANGARS - OPTION 11
NEW WINDSOR, NY

Legend

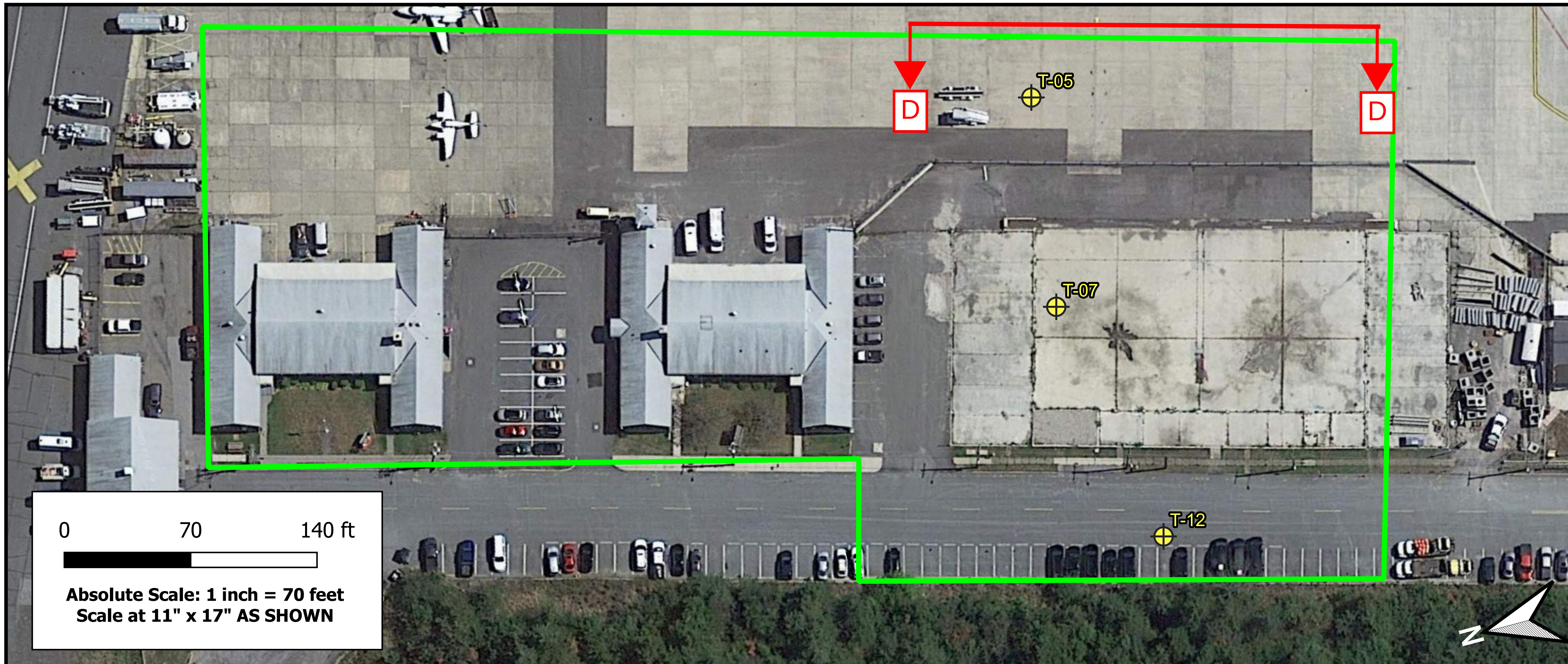
Map Units

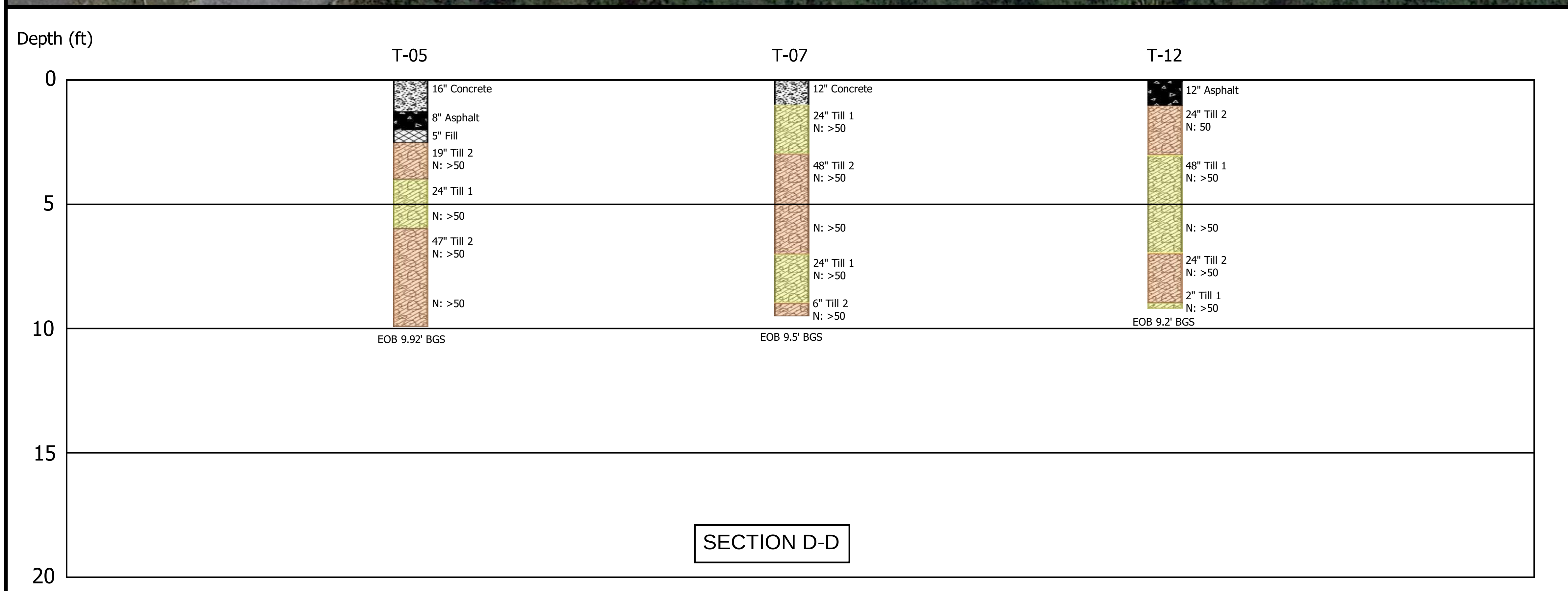
Soil Boring Locations
Investigation Area Boundary

Profile Units

Topsoil
Asphalt
Concrete
Fill
Till 1 (Sand/Gravel)
Till 2 (Silt/Clay)

Prepared by: Grant Libby
Date: October 16, 2023
Drawing Number: SBP-003





ANS GEO

Client:

Van Cleef
ENGINEERING WITH FOCUS

SOIL BORING PROFILE 4

VAN CLEEF ENGINEERING
STEWART INTERNATIONAL AIRPORT TERMINAL & HANGARS - OPTION 11
NEW WINDSOR, NY

Legend

Map Units

- Soil Boring Locations
- Investigation Area Boundary

Profile Units

- Asphalt
- Concrete
- Fill
- Till 1 (Sand/Gravel)
- Till 2 (Silt/Clay)

Prepared by: Grant Libby
Date: October 17, 2023
Drawing Number: SBP-004

Appendix F

Laboratory Results

ANS CONSULTANTS, INC.
4405 South Clinton Avenue
South Plainfield, NJ 07080
Tel: (800) 585-ATUL
(908) 754-8383
Fax: (908) 754-8633
NJ EDA Approved Testing Laboratory • MBE/DBE Certified • NJ DEP Certified
www.ANSConsultants.net

Laboratory Determination of Water (Moisture) Content of Soil and Rock (ASTM D2216)

Client Name: Van Cleef Engineering Associates, LLC | LAB IRN: 23-130

Project Name: Stewart International Airport | Date: 10/11/2023

Sample ID	T-1, S-2	T-2, S-1	T-3, S-2	T-4, S-2	T-5, S-4
Depth	4'-6'	2'-4'	4'-6'	6'-8'	8'-10'
Wet soil + Tare (g)	211.3	586.0	146.9	193.5	306.5
Dry soil + Tare (g)	190.7	558.4	134.7	177.1	274.7
Wt. of Tare (g)	13.7	191.4	13.8	13.6	13.9
Moisture Content	**11.6%**	**7.5%**	**10.0%**	**10.1%**	**12.2%**

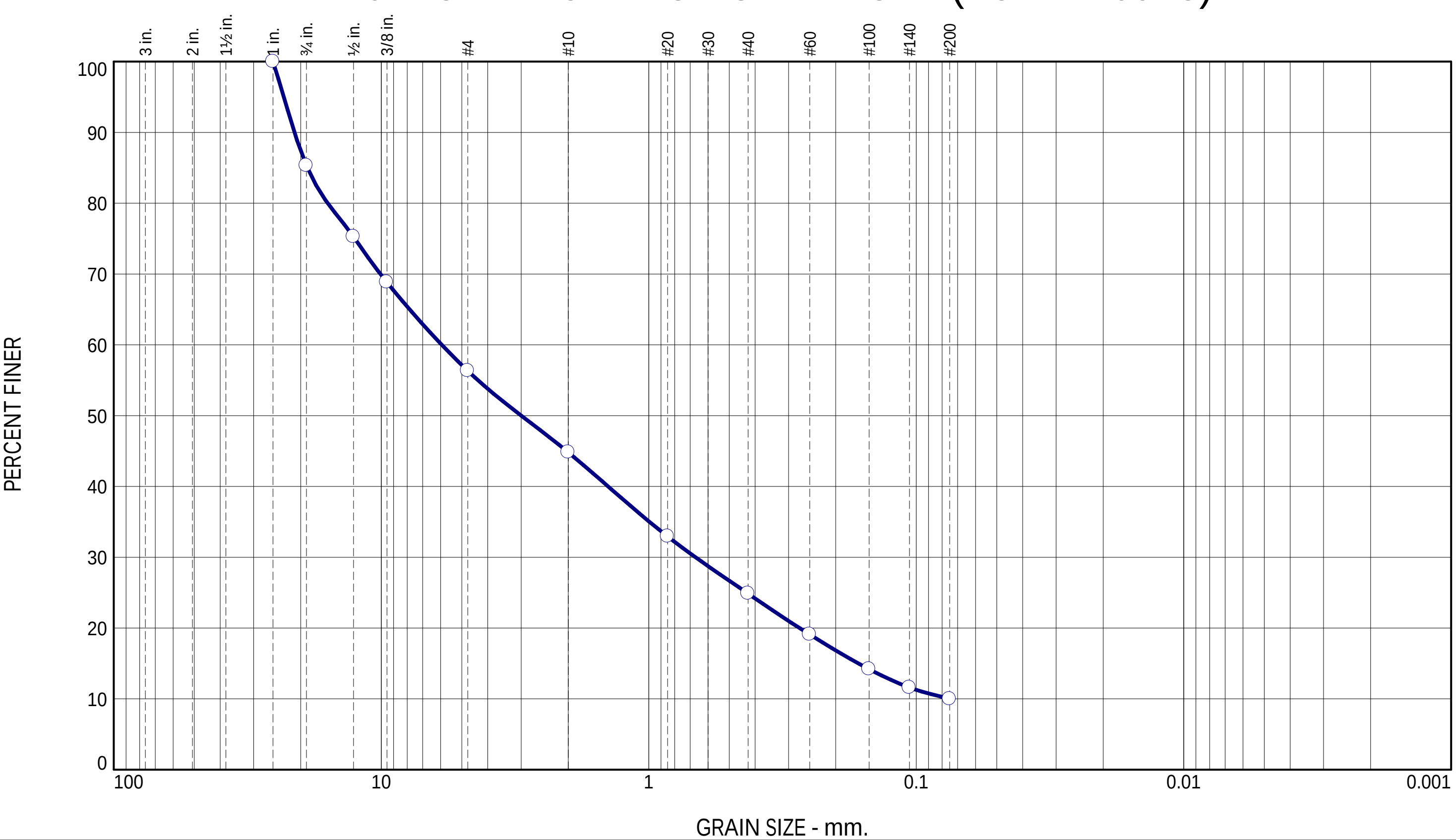
Sample ID	T-6, S-1	T-7, S-3	T-8, S-1	T-9, S-3	T-10, S-3
Depth	1'-3'	5'-7'	1'-3'	5'-7'	4'-6'
Wet soil + Tare (g)	619.4	314.6	457.9	220.9	595.8
Dry soil + Tare (g)	586.7	283.8	442.6	197.7	562.9
Wt. of Tare (g)	190.9	13.9	195.8	14.7	192.7
Moisture Content	**8.3%**	**11.4%**	**6.2%**	**12.7%**	**8.9%**

Sample ID	T-11, S-2	T-12, S-1
Depth	2'-4'	1'-3'
Wet soil + Tare (g)	231.1	655.9
Dry soil + Tare (g)	214.3	616.9
Wt. of Tare (g)	13.8	188.7
Moisture Content	**8.4%**	**9.1%**

Tested By: AG/NK

Checked By: ANS

PARTICLE SIZE DISTRIBUTION REPORT (ASTM D6913)



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.7	29.0	11.5	19.9	14.9	10.0	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	85.3		
1/2"	75.3		
3/8"	68.8		
#4	56.3		
#10	44.8		
#20	32.9		
#40	24.9		
#60	19.1		
#100	14.2		
#140	11.6		
#200	10.0		

* (no specification provided)

Soil Description

Grayish Brown well-graded sand with silt and gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 21.1086 D_{85}= 18.8871 D_{60}= 5.9400
D_{50}= 2.9961 D_{30}= 0.6684 D_{15}= 0.1645
D_{10}= 0.0752 C_u= 78.97 C_c= 1.00

Classification

USCS= SW-SM AASHTO= A-1-a

Remarks

Undersized specimen

Sample Number: T-2, S-1 Depth: 2'-4'

Date: 10/11/2023

ANS CONSULTANTS, INC.

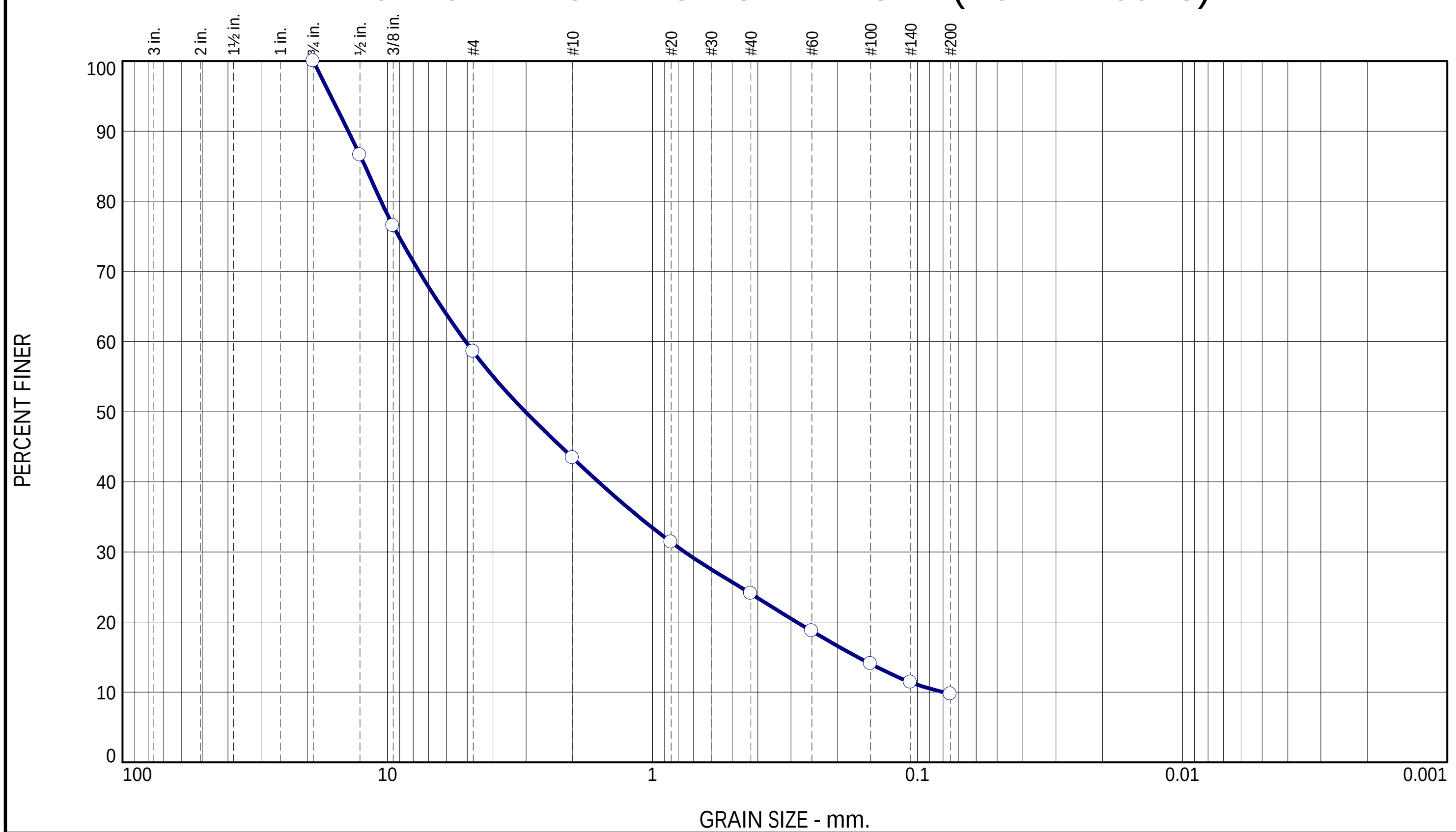
South Plainfield, New Jersey

Client: Van Cleef Engineering Associates, LLC
Project: Stewart International Airport, Orange County, NY

Project No: IRN 23-130 Figure

Tested By: NK/AG Checked By: ANS

PARTICLE SIZE DISTRIBUTION REPORT (ASTM D6913)



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	41.4	15.2	19.4	14.3	9.7	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	86.6		
3/8"	76.5		
#4	58.6		
#10	43.4		
#20	31.4		
#40	24.0		
#60	18.7		
#100	14.0		
#140	11.4		
#200	9.7		

* (no specification provided)

Soil Description

Grayish Brown well-graded sand with silt and gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 14.0646 D_{85}= 12.1433 D_{60}= 5.0707
D_{50}= 3.0179 D_{30}= 0.7558 D_{15}= 0.1679
D_{10}= 0.0799 C_u= 63.43 C_c= 1.41

Classification

USCS= SW-SM AASHTO= A-1-a

Remarks

Sample Number: T-6, S-1 Depth: 1'-3'

Date: 10/11/2023

ANS CONSULTANTS, INC.

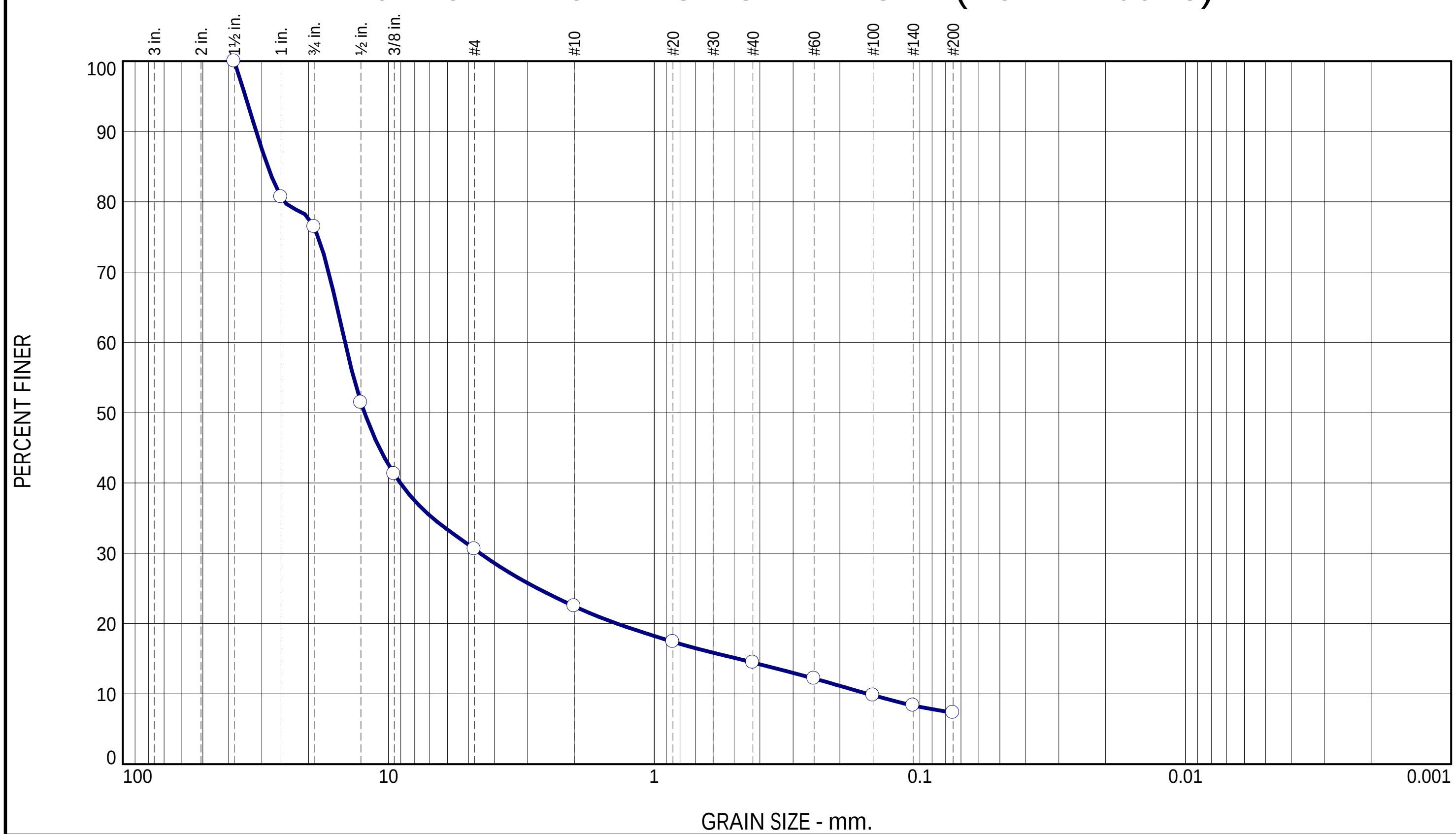
South Plainfield, New Jersey

Client: Van Cleef Engineering Associates, LLC
Project: Stewart International Airport, Orange County, NY

Project No: IRN 23-130 Figure

Tested By: NK/AG Checked By: ANS

PARTICLE SIZE DISTRIBUTION REPORT (ASTM D6913)



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	23.6	45.8	8.1	8.0	7.2	7.3	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5"	100.0		
1"	80.7		
3/4"	76.4		
1/2"	51.4		
3/8"	41.3		
#4	30.6		
#10	22.5		
#20	17.4		
#40	14.5		
#60	12.2		
#100	9.8		
#140	8.3		
#200	7.3		

* (no specification provided)

Soil Description

Dark Brown poorly graded gravel with silt and sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 31.4897 D_{85}= 28.4847 D_{60}= 14.5795
D_{50}= 12.3153 D_{30}= 4.5219 D_{15}= 0.4840
D_{10}= 0.1570 C_u= 92.87 C_c= 8.93

Classification

USCS= GP-GM AASHTO= A-1-a

Remarks

Undersized specimen

Sample Number: T-8, S-1 Depth: 1'-3'

Date: 10/11/2023

ANS CONSULTANTS, INC.

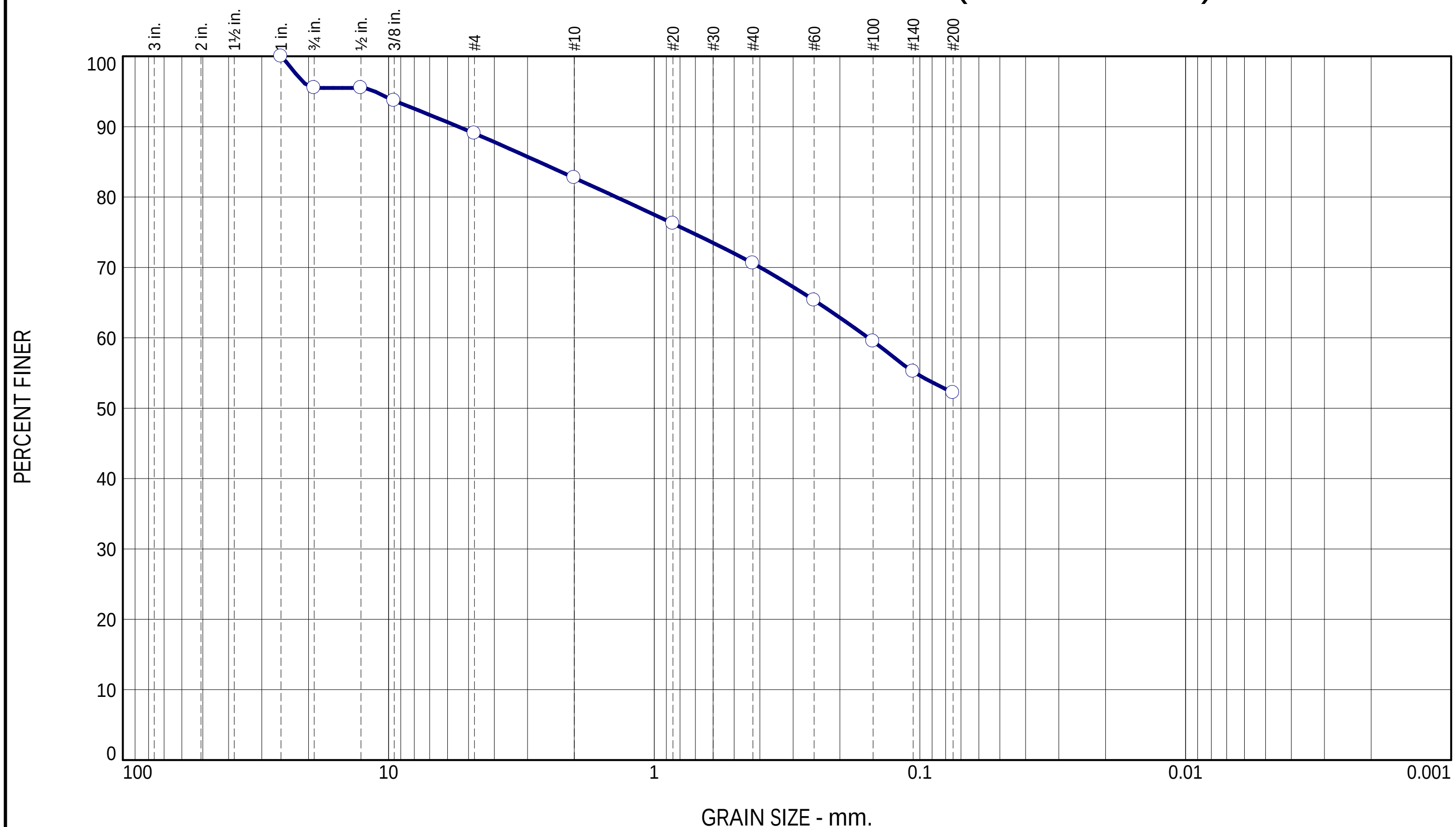
South Plainfield, New Jersey

Client: Van Cleef Engineering Associates, LLC
Project: Stewart International Airport, Orange County, NY

Project No: IRN 23-130 Figure

Tested By: NK/AG Checked By: ANS

PARTICLE SIZE DISTRIBUTION REPORT (ASTM D6913)



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.5	6.5	6.3	12.1	18.4	52.2	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100.0		
3/4"	95.5		
1/2"	95.5		
3/8"	93.7		
#4	89.0		
#10	82.7		
#20	76.2		
#40	70.6		
#60	65.3		
#100	59.5		
#140	55.2		
#200	52.2		

* (no specification provided)

Soil Description

Dark Gray

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.4555 D_{85}= 2.7170 D_{60}= 0.1563
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Sample Number: T-10, S-3 Depth: 4'-6'

Date: 10/11/2023

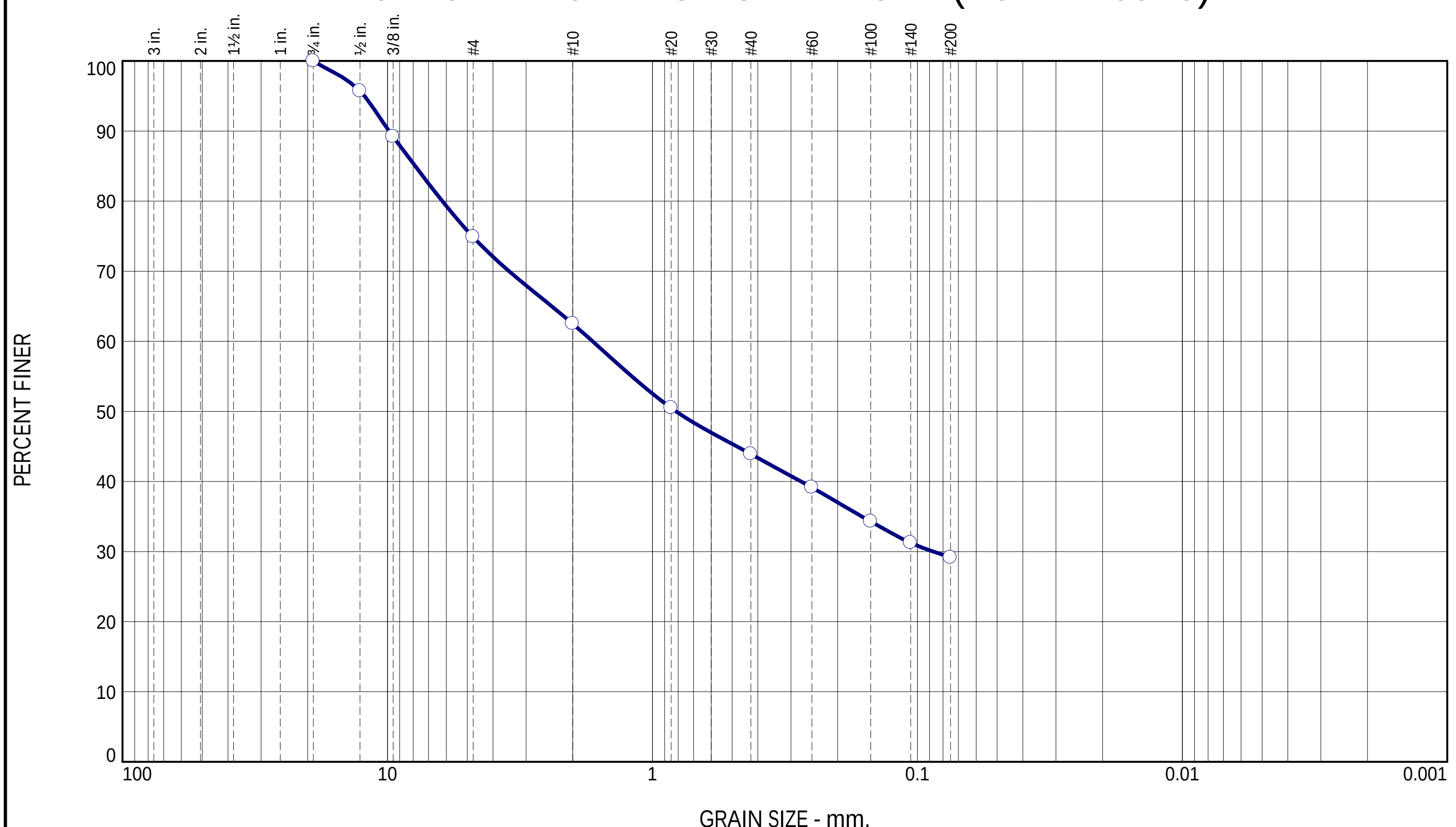
ANS CONSULTANTS, INC.

South Plainfield, New Jersey

Client: Van Cleef Engineering Associates, LLC
Project: Stewart International Airport, Orange County, NY
Project No: IRN 23-130 Figure

Tested By: NK/AG Checked By: ANS

PARTICLE SIZE DISTRIBUTION REPORT (ASTM D6913)



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	25.1	12.4	18.6	14.8	29.1	

SIEVE SIZE OR DIAMETER	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100.0		
1/2"	95.7		
3/8"	89.2		
#4	74.9		
#10	62.5		
#20	50.5		
#40	43.9		
#60	39.1		
#100	34.3		
#140	31.2		
#200	29.1		

* (no specification provided)

Soil Description

Dark Gray silty, clayey sand with gravel

Atterberg Limits

PL= 16 LL= 21 PI= 5

Coefficients

D_{90}= 9.8710 D_{85}= 7.8533 D_{60}= 1.6821
D_{50}= 0.8143 D_{30}= 0.0871 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-2-4(0)

Remarks

Sample Number: T-12, S-1 Depth: 1'-3'

Date: 10/11/2023

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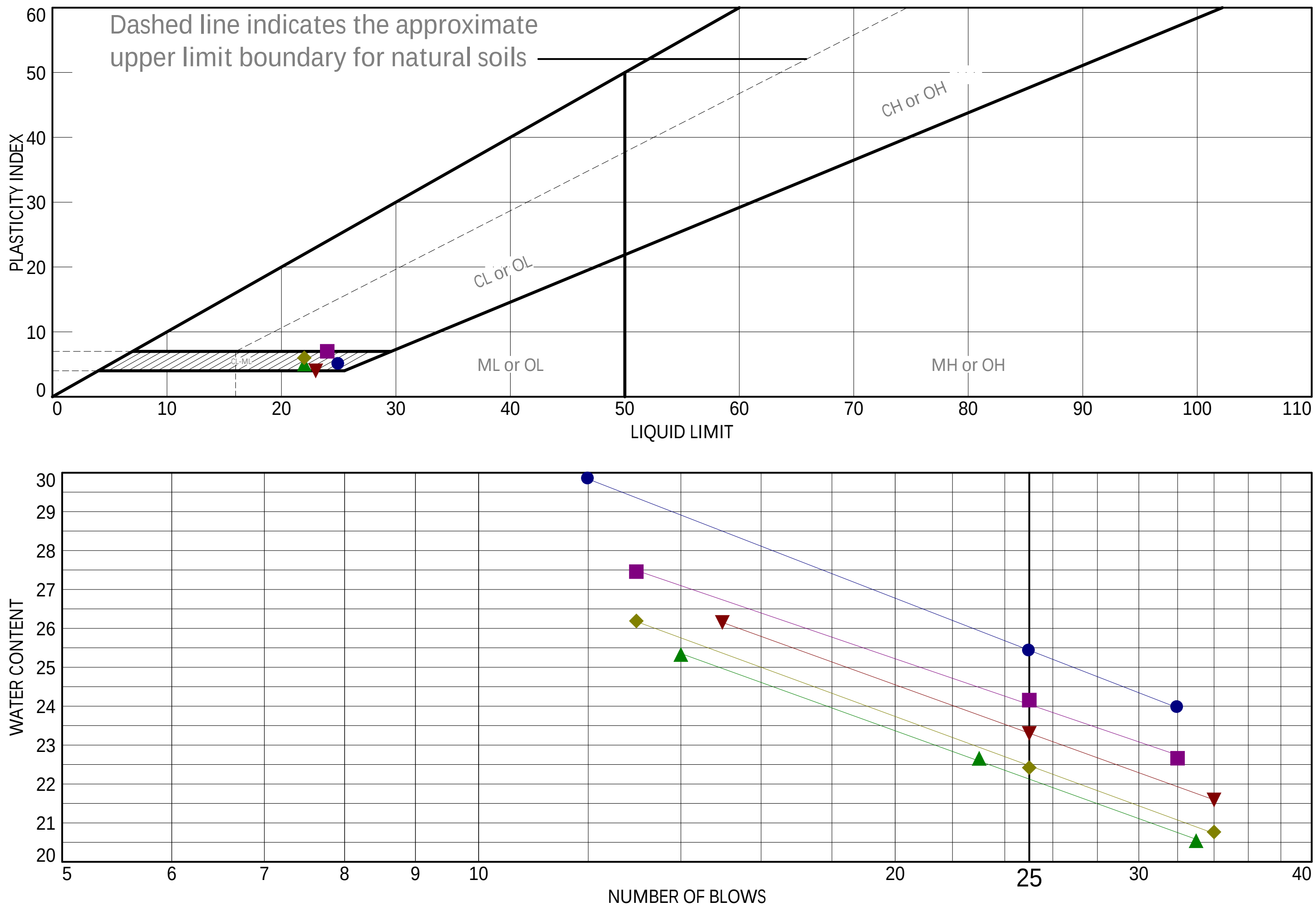
Client: Van Cleef Engineering Associates, LLC
Project: Stewart International Airport, Orange County, NY

Project No: IRN 23-130 Figure

Tested By: NK/AG Checked By: ANS

LIQUID AND PLASTIC LIMITS TEST REPORT (ASTM D4318)



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Silt & Clay, some cmf Sand (Visual)	25	20	5			
■	Dark Gray Silt & Clay, some cmf Sand, little mf Gravel (Visual)	24	17	7			
▲	Dark Gray Silt & Clay, little cmf Sand, trace mf Gravel (Visual)	22	17	5			
◆	Dark Gray Silt & Clay, little cmf Sand, trace mf Gravel (Visual)	22	16	6			
▼	Dark Gray Silt & Clay, some cmf Sand, little mf Gravel (Visual)	23	19	4			

Project No. IRN 23-130 Client: Van Cleef Engineering Associates, LLC

Project: Stewart International Airport, Orange County, NY

●Depth: 4'-6' Sample Number: T-1, S-2

■Depth: 4'-6' Sample Number: T-3, S-2

▲Depth: 6'-8' Sample Number: T-4, S-2

◆Depth: 8'-10' Sample Number: T-5, S-4

▼Depth: 5'-7' Sample Number: T-7, S-3

Remarks:

●ASTM D4318 - Sample Air-Dried, LL Device: Manual, PL Rolling Method: Hand-Rolled, Grooving Tool: Metal
10/11/2023

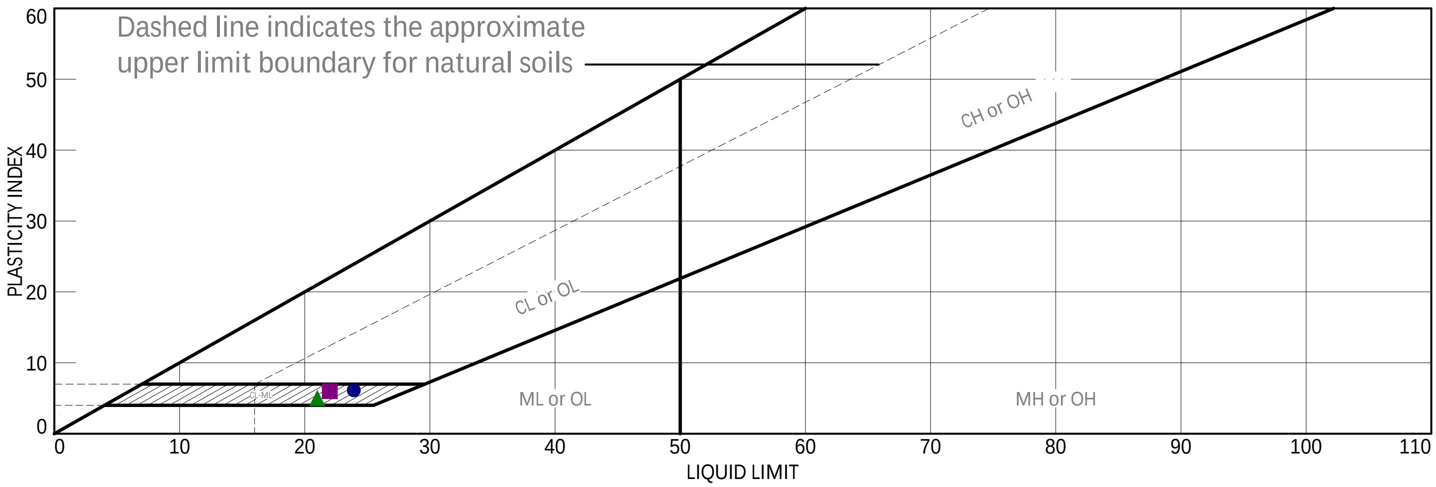
ANS CONSULTANTS, INC.

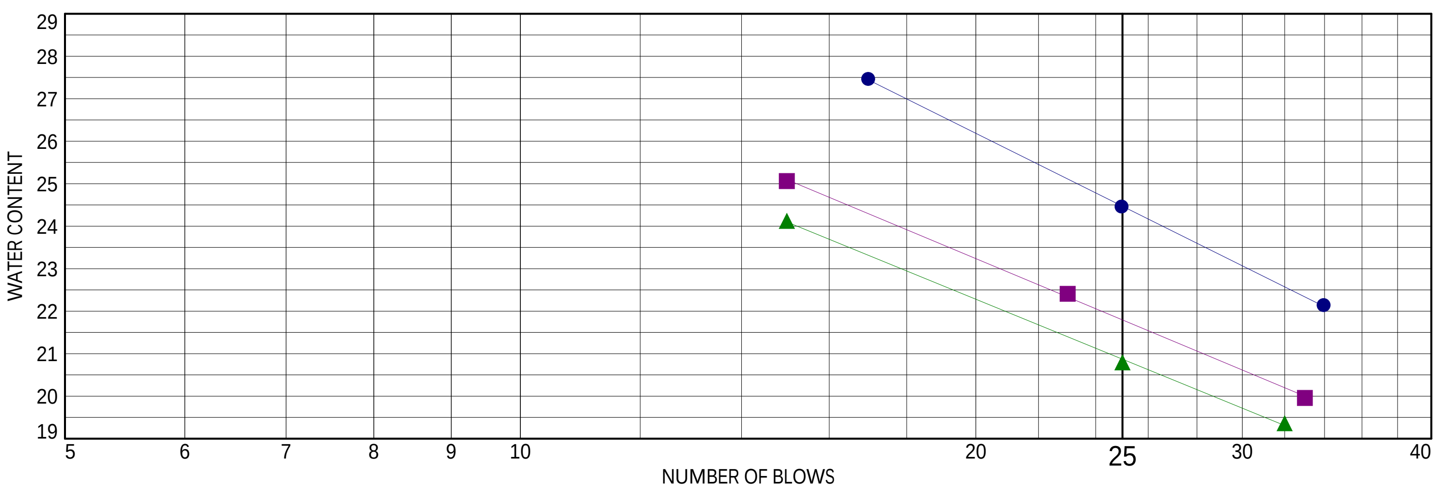
South Plainfield, New Jersey

Figure

Tested By: AG Checked By: ANS

LIQUID AND PLASTIC LIMITS TEST REPORT (ASTM D4318)





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark Gray Silt & Clay, some cmf Sand, little mf Gravel (Visual)	24	18	6			
■	Dark Gray Silt & Clay, little cmf Sand, trace mf Gravel (Visual)	22	16	6			
▲	Dark Gray silty, clayey sand with gravel	21	16	5	43.9	29.1	SC-SM

Project No. IRN 23-130 Client: Van Cleef Engineering Associates, LLC

Project: Stewart International Airport, Orange County, NY

●Depth: 5'-7' Sample Number: T-9, S-3

■Depth: 2'-4' Sample Number: T-11, S-2

▲Depth: 1'-3' Sample Number: T-12, S-1

Remarks:

●ASTM D4318 - Sample Air-Dried, LL Device: Manual, PL Rolling Method: Hand-Rolled, Grooving Tool: Metal 10/11/2023

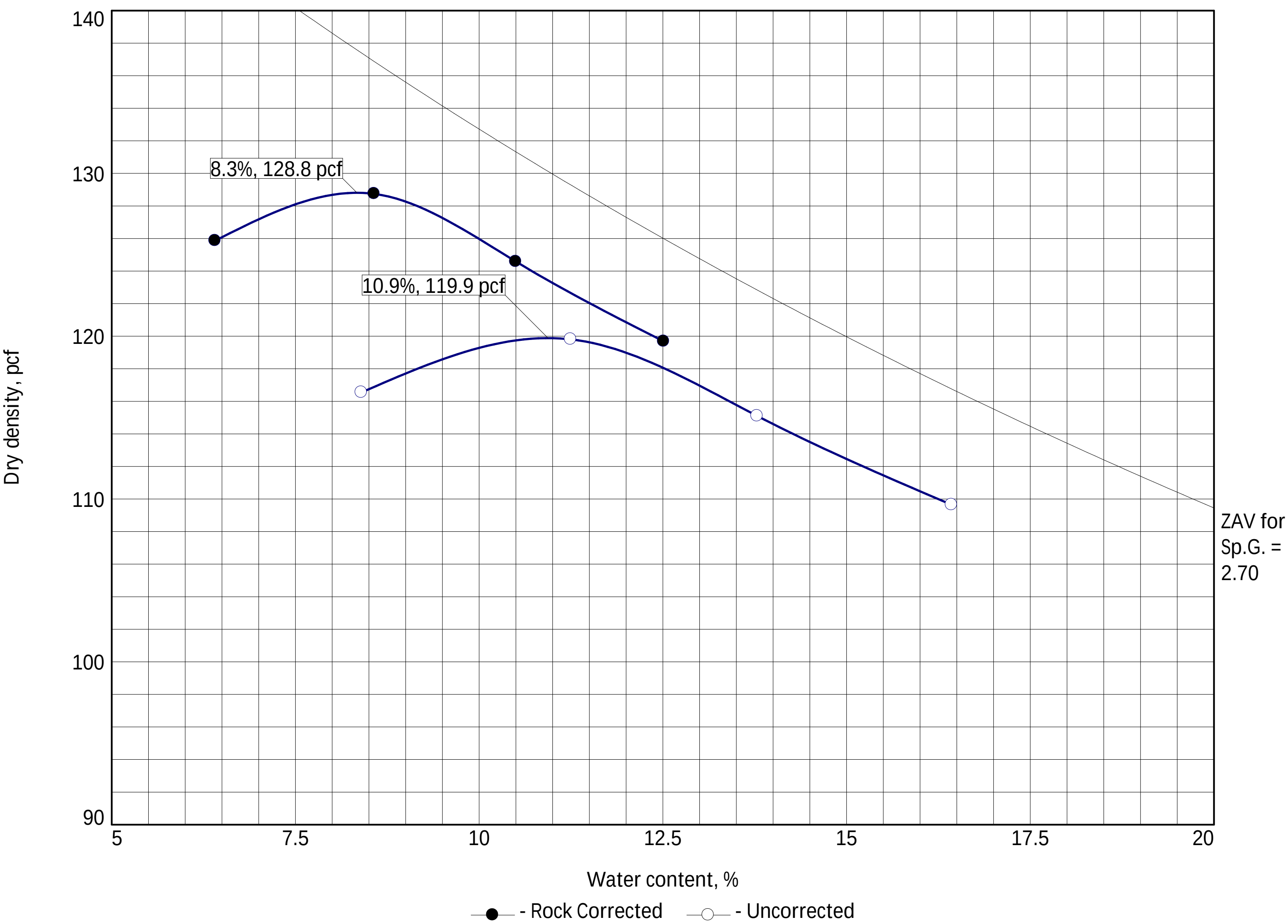
ANS CONSULTANTS, INC.

South Plainfield, New Jersey

Figure

Tested By: ○ AG □AG △Ag Checked By: ANS

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method B Modified
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
0'-1'				2.7			24	

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 128.8 pcf	119.9 pcf	Dark Brown Silt & Clay and, mf Gravel, little cmf Sand (Visual)
Optimum moisture = 8.3 %	10.9 %	

Project No. IRN 23-118 Client: Van Cleef Engineering Associates, LLC
Project: Stewart International Airport, Orange County, NY
Date: 10/5/2023
Sample Number: T-11, CBR-1

ANS CONSULTANTS, INC.

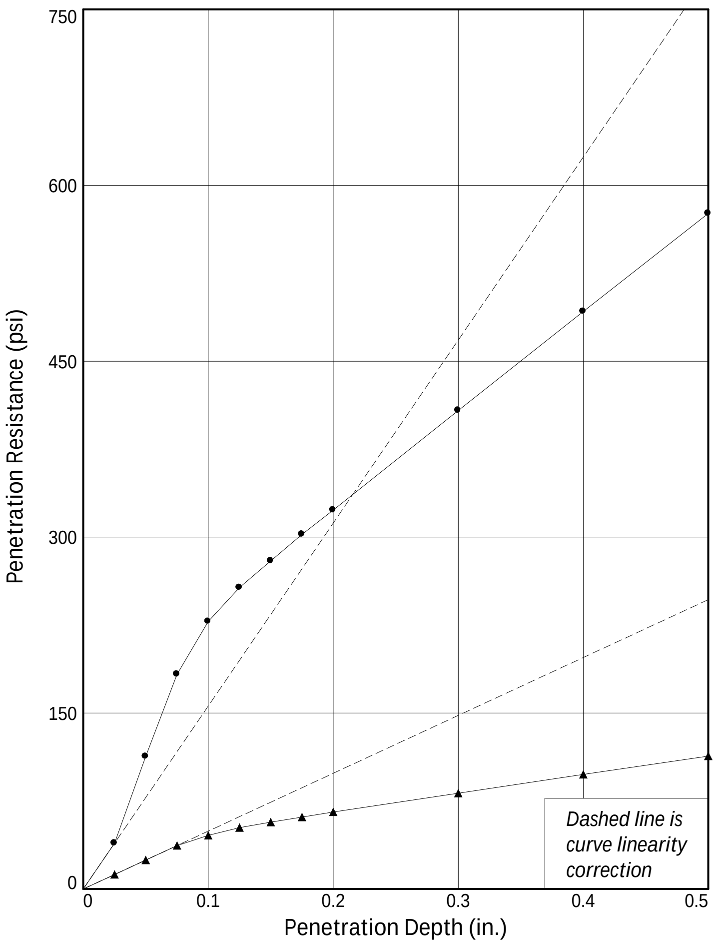
South Plainfield, New Jersey

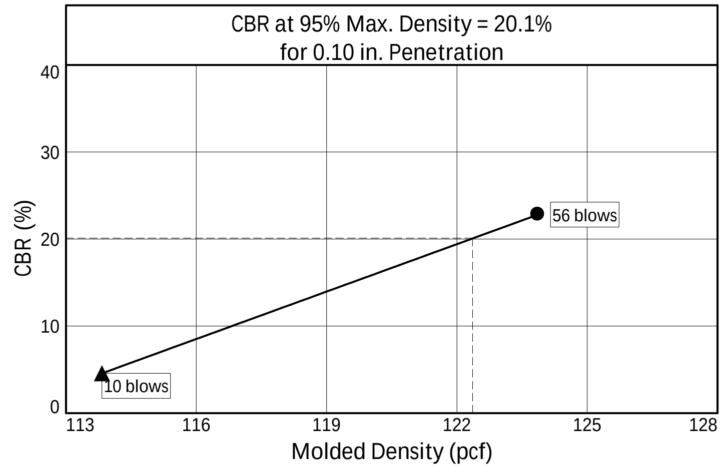
Remarks:
SG Assumed

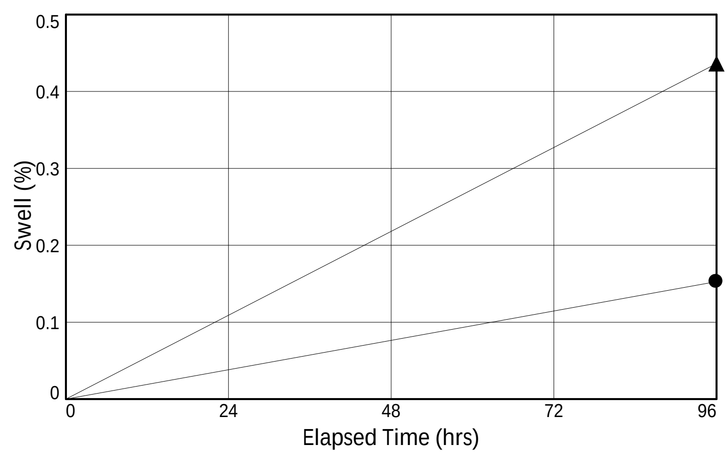
Figure

Tested By: MG Checked By: ANS

BEARING RATIO TEST REPORT
ASTM D1883-16







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ●	123.9	96.2	8.3	123.7	96	16.1	22.8	21.5	0.000	10	0.2
2 ▲	113.8	88.4	8.3	113.3	88	18.7	4.6	4.4	0.000	10	0.4
3 ■											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Dark Brown Silt & Clay and, mf Gravel, little cmf Sand (Visual)		128.8	8.3		

Project No: IRN 23-118

Project: Stewart International Airport, Orange County, NY

Sample Number: T-11, CBR-1   Depth: 0'-1'

Date: 10/5/2023

Test Remarks:

Saturation period: 96 Hours

BEARING RATIO TEST REPORT

ANS CONSULTANTS, INC.

Figure ________

Tested By: AS   Checked By: ANS

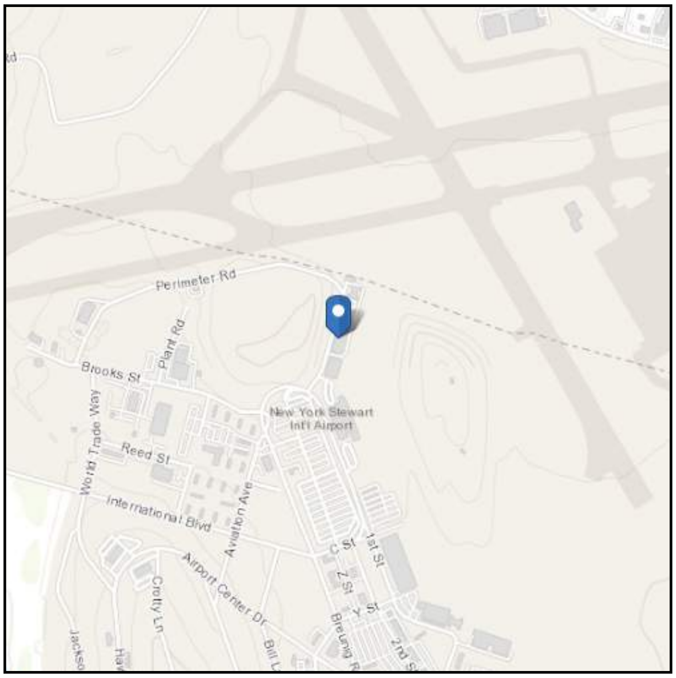
Appendix G

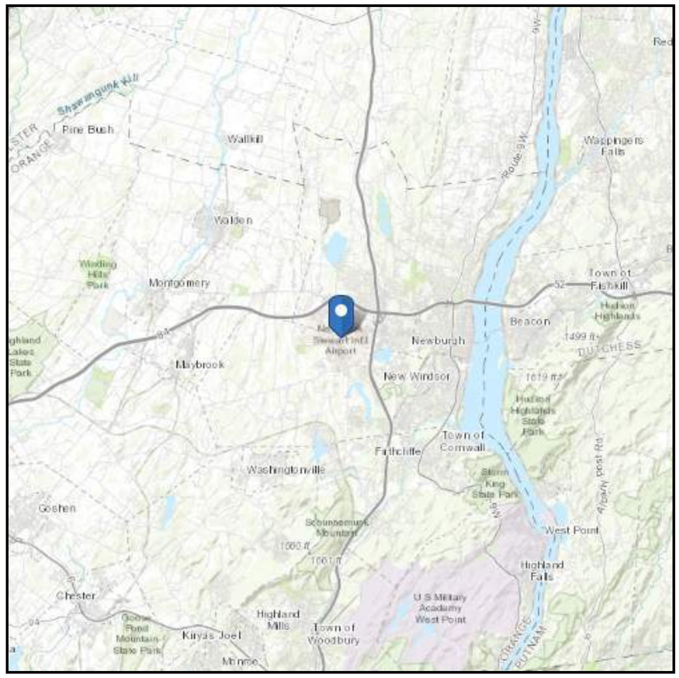
ASCE7 Seismic Hazard Tool Report

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard:	ASCE/SEI 7-16	**Latitude:**	41.50073
Risk Category:	III	**Longitude:**	-74.100587
Soil Class:	C - Very Dense Soil and Soft Rock	**Elevation:**	458.1629281454652 ft (NAVD 88)





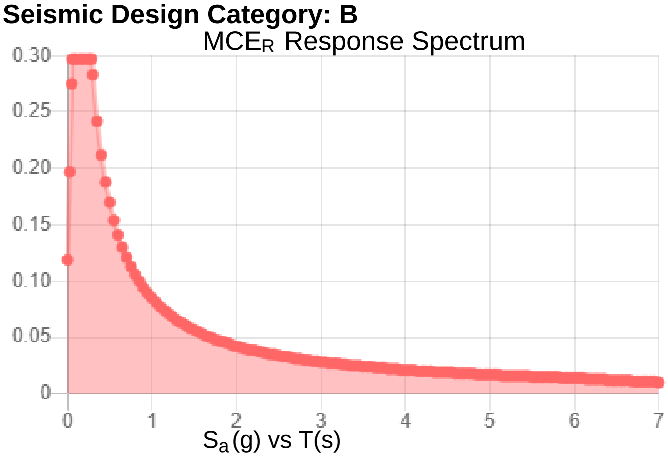
Seismic C - Very Dense Soil and Soft Rock

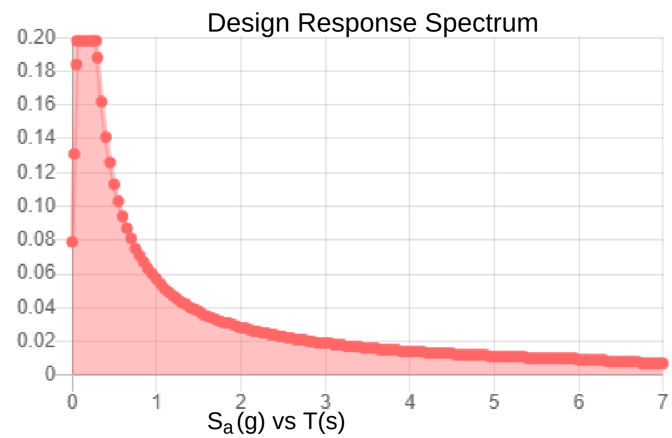
Site Soil Class:

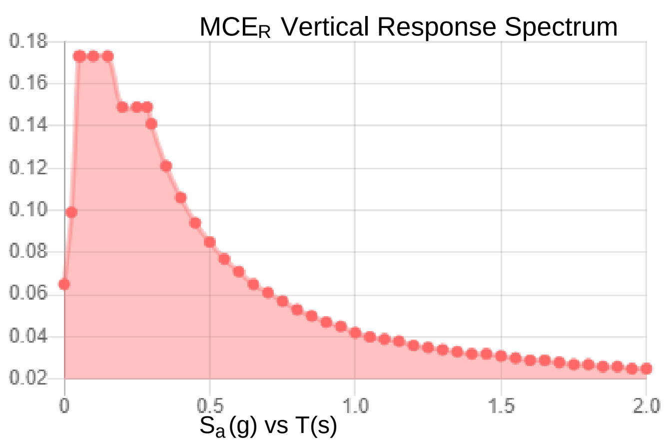
Results:

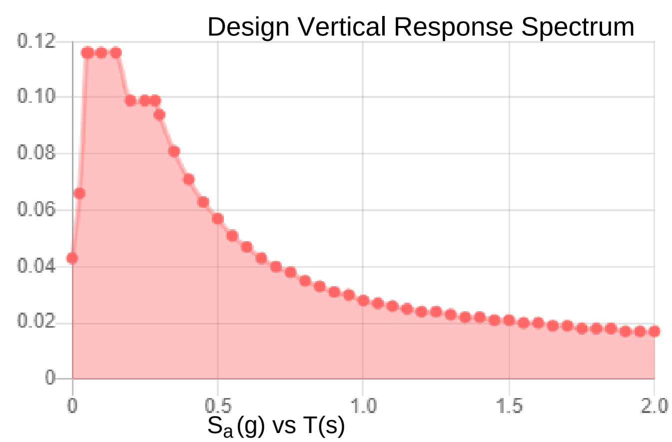
S_S :	0.229	S_{D1} :	0.057
S_1 :	0.057	T_L :	6
F_a :	1.3	PGA :	0.133
F_v :	1.5	PGA_M :	0.168
S_{MS} :	0.297	F_{PGA} :	1.267
S_{M1} :	0.085	I_e :	1.25
S_{DS} :	0.198	C_v :	0.729

Seismic Design Category: B









Data Accessed: **Wed Sep 20 2023**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

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