ATTACHMENT K

CONCRETE, PAVING AND TRAFFIC CONTROL

SPECIFICATIONS

May 18, 2010

PROJECT TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00 SUMMARY OF WORK
01 33 00 SUBMITTAL PROCEDURES
01 42 00 SOURCES FOR REFERENCE PUBLICATIONS
01 50 00 MAINTENANCE OF TRAFFIC (MOT)
01 57 23 EROSION AND SEDIMENT CONTROL (ESC)

DIVISION 02 - EXISTING CONDITIONS

02 41 00 DEMOLITION AND EXISTING CONDITIONS TO REMAIN

DIVISION 03 - CONCRETE

03 30 00 CAST-IN-PLACE CONCRETE

DIVISION 31 - EARTHWORK

31 00 00 EARTHWORK

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 01 16.17 COLD MILLING OF BITUMINOUS PAVEMENTS
32 01 17.16 CRACK SEALING IN BITUMINOUS PAVEMENTS
32 11 24 GRADED AGGREGATE BASE (GAB)
32 12 16 HOT-MIX ASPHALT (HMA)
32 17 24.00 10 TRAFFIC CONTROL DEVICES
32 92 19 TOPSOILING AND SEEDING

-- End of Project Table of Contents --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 11 00

SUMMARY OF WORK

1/02

PART 1 GENERAL

1.1 SCOPE OF WORK FOR UNIT PRICE WORK ITEMS
1.2 COORDINATION
1.3 EXISTING CONDITIONS

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 CONTRACTOR MOBILIZATION
3.2 TASK SCHEDULE SUBMITAL

-- End of Section Table of Contents --

SECTION 01 11 00

SUMMARY OF WORK
1/02

PART 1 GENERAL

1.1 SCOPE OF WORK FOR UNIT PRICE WORK ITEMS

The scope of work for each individual unit price work item shall include all labor, materials, and equipment necessary to perform the work. This includes layout, supervision, coordination, erosion and sediment control, maintenance of traffic, excavation, hauling, and disposal of existing conditions in order to place the work, subgrade preparation, surface preparation, grade adjustments, cleaning, restoration of adjacent area damaged by installing the work, installation of toposoil and seeding, etc. Each line items is a standalone work element and shall not require additional line items added in order to perform the work, unless otherwise indicated.

1.2 COORDINATION

After award of each individual Task, the COTR shall schedule a coordination meeting with the appropriate government personnel and the Contractor in order to schedule the start date, work hours, determine the impacts to sidewalks, roadways, parking lots, gates, and building entrances, determine material storage or staging areas, and identify any special needs for building occupants or persons with disabilities, etc. Center announcments and coordination requirements shall be determined as applicable. Necessary precautions shall be implemented by the Contrator in order to secure the work area, maintain pedestrian and vehicular saftey, and minimize the imipact to Center operations.

1.3 EXISTING CONDITIONS

For each individual Task, a Record of Existing Conditions shall be recorded, in the presence of the COTR prior to beginning work, and shall include all structures and other facilities adjacent to areas of work. Such record shall include existing cracks, settlement, surface damage, etc, and shall be used to verify pre-existing conditions were not as a result of Contractor operations. The Contractor shall not be responsible for so noted pre-existing conditions not included within the work or adjacent to the work area.

PART 2 PRODUCTS (Not applicable)

PART 3 EXECUTION

3.1 CONTRACTOR MOBILIZATION

Before any work Tasks are issued, the Contractor shall submit to the COTR all submittals for work under the technical sections. No work shall begin for which an approved submittal is not on file.

3.2 TASK SCHEDULE SUBMITAL

In general, no detailed breakdown task scheduling submittals are necessary

where work is straightforward, however work shall be coordinated and scheduled to be complete within the task duration. If in the determination of the COTR a scheduling submittal is required based on the complexity of the work or area the work is to be performed, the COTR will request a baseline schedule submittal for review and approval.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 33 00

SUBMITTAL PROCEDURES

02/09

PART 1 GENERAL

1.1 DEFINITIONS
1.1.1 Submittal Descriptions (SD)
1.1.2 Work
1.2 SUBMITTALS
1.3 PREPARATION
1.3.1 Transmittal Form
1.4 QUANTITY OF SUBMITTALS
1.4.1 Number of Copies of Submittals
1.5 VARIATIONS / SUBSTITUTION REQUESTS
1.5.1 Considering Variations
1.5.2 Proposing Variations
1.5.3 Warranting That Variations Are Compatible
1.6 GOVERNMENT REVIEW
1.6.1 Review Notations
1.7 RESUBMIT SUBMITTALS
1.8 APPROVED SUBMITTALS

PART 2 PRODUCTS

PART 3 EXECUTION

-- End of Section Table of Contents --

SECTION 01 33 00

SUBMITTAL PROCEDURES
02/09

PART 1 GENERAL

The COTR may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the technical sections.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

1.1 DEFINITIONS

1.1.1 Submittal Descriptions (SD)

Submittals requirements are specified in the technical sections. Submittals are identified by Submittal Description (SD) numbers and titles as follows:

SD-01 Preconstruction Submittals

Submittals which are required prior to a notice to proceed.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to

a part of work.

Design submittals, design substantiation submittals and extensions of design submittals.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within three years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report which includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports.

Daily logs and checklists.

Final acceptance test and operational test procedure.

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or subcontractor through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

Text of posted operating instructions.

1.1.2 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.2 SUBMITTALS

The Contractor shall submit product submittals for all requirements listed in the technical sections, after award of contract. Once the submittals have been approved the Contractor shall use the approved materials for all work items. Should it become necessary for the Contractor to change material characteristics, source, or supplier, the Contractor shall submit

the proposed change, and receive approval from the COTR prior to using the material in the contract. Only approved materials may be used in the contract work.

1.3 PREPARATION

1.3.1 Transmittal Form

Transmit each submittal to office of COTR. Transmit submittals with transmittal form prescribed by Contract Administrator. On the transmittal form identify Contractor, date of submittal, and include information prescribed by transmittal form.

1.4 QUANTITY OF SUBMITTALS

1.4.1 Number of Copies of Submittals

Submit 7 copies of submittals. The COTR will return 4 copies with the stamped review notation.

1.5 VARIATIONS / SUBSTITUTION REQUESTS

Variations from contract requirements require Government approval pursuant to contract Clause FAR 52.236-21 and will be considered where advantageous to Government.

1.5.1 Considering Variations

Discussion with the COTR prior to submission, will help ensure functional and quality requirements are met and minimize rejections and re-submittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

Specifically point out variations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government.

1.5.2 Proposing Variations

When proposing variation, deliver written request to the Contracting Officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.5.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that the contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.6 GOVERNMENT REVIEW

Upon completion of review of submittals the COTR shall stamp, date, notate, and return submittals to the Contractor. 3 copies of the submittal shall be retained by the Government, and 4 copies shall be returned to the

Contractor.

1.6.1 Review Notations

Review will be completed within 14 calendar days after date of submission. Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "approved" authorize the Contractor to proceed with the work covered.

b. Submittals marked "approved as noted - no resubmit" authorize the Contractor to proceed with the work covered provided he takes no exception to the corrections.

c. Submittals marked "approved as noted - resubmit" indicate partial noncompliance with the contract requirements or design concept, or that submittal is incomplete. Resubmit with appropriate changes. No work shall proceed for this item until resubmittal is approved.

d. Submittals marked "rejected - resubmit" will indicate submittal does not meet the basic requirements and shall be completely resubmitted. No work shall proceed for this item until resubmittal is approved.

1.7 RESUBMIT SUBMITTALS

Contractor shall make corrections required by the COTR. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications; notice as required under the clause entitled, "Changes" is to be given to the Contracting Officer. Contractor is responsible for the dimensions and design of connection details and construction of work. Failure to point out deviations may result in the Government requiring rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, the Contractor shall make such revisions and submission of the submittals in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.8 APPROVED SUBMITTALS

The COTR approval or acceptance of submittals is not be construed as a complete check, and indicates only that the general method of construction, materials, detailing and other information are satisfactorydesign, general method of construction, materials, detailing and other information appear to meet the Contract and technical sections. Approval or acceptance will not relieve the Contractor of the responsibility for any error which may exist. After submittals have been approved or accepted, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS

05/09

PART 1 GENERAL

1.1 REFERENCES
1.2 ORDERING INFORMATION

-- End of Section Table of Contents --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS
05/09

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization, (e.g. ASTM B 564 Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided. Documents listed in the specifications with numbers which were not assigned by the standards producing organization should be ordered from the source by title rather than by number.

ACI INTERNATIONAL (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331
Ph: 248-848-3700
Fax: 248-848-3701
E-mail: bkstore@concrete.org
Internet: http://www.concrete.org

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
444 North Capital Street, NW, Suite 249
Washington, DC 20001
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: http://www.aashto.org

ASPHALT INSTITUTE (AI)
Research Park Drive
P.O. Box 14052
Lexington, KY 40512-4052
Ph: 859-288-4960
Fax: 859-288-4999
E-mail: info@asphaltinstitute.org
Internet: http://www.asphaltinstitute.org

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

Ph: 610-832-9500
Fax: 610-832-9555
E-mail: service@astm.org
Internet: http://www.astm.org

CODE OF FEDERAL REGULATIONS (CFR)
U.S. Government Printing Office
732 N. Capitol Street, NW
Washington, D.C. 20401
Ph:
Fax:
Internet: http://bookstore.gpo.gov/baskets/cfr-listing.jsp

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)
933 North Plum Grove Road
Schaumburg, IL 60173-4758
Ph: 847-517-1200
Fax: 847-517-1206
Internet: http://www.crsi.org/

MARYLAND DEPARTMENT OF ENVIRONMENT (MDE)
1800 Washington Boulevard
Baltimore, Maryland 21230
Ph: 410-537-3000
Fax:
E-mail:
Internet: http://www.mde.state.md.us/

MARYLAND STATE HIGHWAY ADMINISTRATION (MSHA)
707 North Calver Street
Baltimore, Maryland 21202
Ph: 888-204-0138
Fax:
E-mail:
Internet: http://www.marylandroads.com/home.aspx

U.S. DEPARTMENT OF COMMERCE (DOC)
1401 Constitution Avenue, NW
Washington, DC 20230
Ph: 202-482-2000
Internet: http://www.commerce.gov/

Order Publications From:
National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Ph: 703-605-6585
Fax: 703-605-6900
E-mail: info@ntis.gov
Internet: http://www.ntis.gov

U.S. GENERAL SERVICES ADMINISTRATION (GSA)
General Services Administration
1800 F Street, NW
Washington, DC 20405
Ph: 202-501-1021
Internet: www.GSA.gov

Order from:
General Services Administration
Federal Supply Service Bureau
1941 Jefferson Davis Highway
Arlington, VA 22202
Ph: 703-605-5400
Internet: http://apps.fss.gsa.gov/pub/fedspecs/index.cfm

- - - - - Commercial Item Description Documents - - - - -

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 50 00

MAINTENANCE OF TRAFFIC (MOT)

08/09

PART 1 GENERAL

1.1 SUMMARY
1.2 REFERENCES
1.3 SUBMITTALS

PART 2 PRODUCTS

2.1 MOT DEVICES, PRACTICES, AND SETUP PROCEDURES

PART 3 EXECUTION

3.1 TRAFFIC PROVISIONS
3.1.1 Maintenance of Traffic
3.1.2 Peak Hour Restrictions and Work Coordination

-- End of Section Table of Contents --

SECTION 01 50 00

MAINTENANCE OF TRAFFIC (MOT)
08/09

PART 1 GENERAL

1.1 SUMMARY

Requirements of this Section apply to, and are a component of, each section of the specifications.

1.2 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.

MARYLAND STATE HIGHWAY ADMINISTRATION (MSHA)

MUTCD	(2006) Maryland Manual of Uniform Traffic Control Devices

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Traffic control plan

PART 2 PRODUCTS

2.1 MOT DEVICES, PRACTICES, AND SETUP PROCEDURES

MOT devices, practices, and setup procedures shall comply with MUTCD, Part VI.

PART 3 EXECUTION

3.1 TRAFFIC PROVISIONS

3.1.1 Maintenance of Traffic

All MOT shall be in accordance with MUTCD, Part VI.

a. Conduct operations in a manner that will not close any thoroughfare or interfere in any way with traffic except with permission of the COTR. If required by the work complexity the COTR shall request a Traffic Control Plan detailing the proposed controls to traffic movement for approval.

b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the COTR prior to starting any activity that will

obstruct traffic.

c. Provide, erect, and maintain signs, cones, drums, vertical panels, tubular markers, barricades, safety fence, arrow panels, temporary markings, variable message boards, lights, detours, incidental flagging, and other items or devices as needed to protect the work and maintain the safety of pedestrians and vehicular traffic. MOT for each Work Item is incidental effort included in the Work Item unit price, except as noted in item (d.) below.

d. When required to maintain two-way traffic during lane closures, dedicated flagging operations in accordance with MUTCD shall be included as part of the individual task as a separate cost using the appropriate Work Item.

e. MOT shall be removed when no longer required, and approved by the COTR. Restore pavement and shoulder areas damaged by MOT removal.

3.1.2 Peak Hour Restrictions and Work Coordination

Work shall be scheduled to minimize disruptions at Gates areas and major intersections during a.m. and p.m. peaks. Coordinate with COTR and government QA personnel to plan work to minimize disruptions, allowing sufficient time for government to publish internal announcements and notices to Center personnel as may be required. Generally a pre-construction meeting shall be scheduled with the government personnel (COTR, QA, Building FOM, Safety) prior to starting the work so that necessary coordination, work restrictions, announcements, etc may be implemented to minimize impacts to pedestrians and vehicular traffic.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

SECTION 01 57 23

EROSION AND SEDIMENT CONTROL (ESC)

04/08

PART 1 GENERAL

1.1 REFERENCES
1.2 SYSTEM DESCRIPTION
1.2.1 Conformance to Maryland Department of Environment Standards
1.2.2 Permits
1.2.3 Typical Controls for Small Projects
1.3 SUBMITTALS

PART 2 PRODUCTS

2.1 EROSION SEDIMENT CONTROL DEVICES

PART 3 EXECUTION

3.1 INSTALLATION
3.2 INSPECTION AND MAINTENANCE
3.3 REMOVAL

-- End of Section Table of Contents --

SECTION 01 57 23

EROSION AND SEDIMENT CONTROL (ESC)
04/08

PART 1 GENERAL

1.1 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.

MARYLAND DEPARTMENT OF ENVIRONMENT (MDE)

MDE-I	(1994) Maryland Standards and Specifications for Soil Erosion and Sediment Control

1.2 SYSTEM DESCRIPTION

1.2.1 Conformance to Maryland Department of Environment Standards

The work consists of implementing storm water pollution prevention measures to prevent sediment from entering streams or water bodies. All work shall comply with MDE-I. The Contractor shall be familiar with MDE-I, and have personnel who are MDE Certified to be responsible for implementing erosion and sediment control practices.

1.2.2 Permits

For individual tasks, when required, the Government shall obtain an Erosion and Sediment Control Permit from Maryland Department of Environment. When an MDE permit is issued, the Government shall provide a copy of the permit, approved ESC drawings, and any permit requirements to the Contractor for compliance with MDE-I.

For individual tasks, when MDE permitting is not required as determined by the Government, the Contractor must still provide erosion sediment controls to keep the discharge of sediment laden runoff from occurring. Locations for controls may be shown on task drawings, or may be field determined at start of construction with the Contractor.

1.2.3 Typical Controls for Small Projects

The controls listed below are those typically used for small projects that do not require MDE permitting.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Silt Fence

Straw Bale Dike
Erosion Control Matting
Storm Drain Inlet Protection
Filter Bag
Tree Protection

PART 2 PRODUCTS

2.1 EROSION SEDIMENT CONTROL DEVICES

Refer to MDE-I for product, performance, and installation requirements for Silt Fence, Storm Drain Inlet Protection, Straw Bale Dike, Erosion Control Matting, Filter Bag, and Tree Protection.

Permitted projects shall have the relevant control details shown on the approved drawings.

Vegetative Practices for turf materials and stabilization are indicated in Section 32 92 19, Topsoiling and Seeding.

PART 3 EXECUTION

3.1 INSTALLATION

Erosion sediment controls shall be installed prior to any clearing, topsoil striping, or earthwork.

There will be no discharge of excavation ground water to the sanitary sewer. Excavations that are pumped shall be pumped through an approved dewatering practice (filter bag) before discharge. Sediment laden construction site runoff will be prevented from entering any storm drain or natural channel by the use of ESC practices.

The Contractor shall apply vegetative stabilization in accordance with Section 32 92 19, Topsoiling and Seeding, to all disturbed areas and stockpiles within 14 days after stripping and grading activities have ceased in the area.

3.2 INSPECTION AND MAINTENANCE

The Contractor shall conduct daily inspection and maintain continuously in an effective operating condition all erosion and sediment control measures until such time as they are removed.

Conduct inspections at least once every month where sites have been final stabilized to ensure seeding has taken. Implement necessary repairs to sites under construction and to completed sites.

3.3 REMOVAL

Erosion and sediment controls shall be removed only after the area has been stabilized in accordance with Section 32 92 19, Topsoiling and Seeding.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 02 - EXISTING CONDITIONS

SECTION 02 41 00

DEMOLITION AND EXISTING CONDITIONS TO REMAIN

1/02

PART 1 GENERAL

1.1 REFERENCES

PART 2 PRODUCTS - Not Applicable

PART 3 EXECUTION

3.1 PRECAUTION AGAINST MOVEMENT
3.2 EXISTING CONDITIONS TO REMAIN
3.3 DEMOLITION AND REMOVAL WORK
3.3.1 General
3.3.2 Concurrent Operations
3.3.3 Above-Grade Demolition
3.3.4 Below-Grade Demolition
3.3.5 Adjacent Areas to Remain
3.4 DISPOSAL OF REMOVED MATERIALS

-- End of Section Table of Contents --

SECTION 02 41 00

DEMOLITION AND EXISTING CONDITIONS TO REMAIN
1/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926	(2009) Safety and Health Regulations for Construction

PART 2 PRODUCTS - Not Applicable

PART 3 EXECUTION

3.1 PRECAUTION AGAINST MOVEMENT

Contractor shall provide shoring and bracing or other supports to prevent movement, settlement, or collapse of facilities adjacent to areas of alteration and removal that are to remain.

3.2 EXISTING CONDITIONS TO REMAIN

Existing conditions shall not be disturbed beyond the extents indicated. Protect existing conditions not to be disturbed from damage. Repair to new condition any existing conditions that are disturbed beyond extents indicated.

3.3 DEMOLITION AND REMOVAL WORK

3.3.1 General

Demolition shall be in accordance with 29 CFR 1926, Sub-Part T, "Demolition".

Use of explosives shall not be permitted.

3.3.2 Concurrent Operations

Excavation, filling, and other earth-moving operations earthwork, new utility installation, or other new work that is sequential to demolition work shall not be started in areas occupied by structures to be demolished until all demolition in the area has been completed and debris has been removed.

3.3.3 Above-Grade Demolition

Work shall be demolished, or may be removed in integral pieces, at the Contractor's option, subject to approval of the Contracting Officer.

Demolition shall proceed in a systematic manner from the top of the

structure to the ground.

3.3.4 Below-Grade Demolition

Demolished items shall be completely removed and voids backfilled with appropriate material as applicable to the work.

3.3.5 Adjacent Areas to Remain

Square, straight edges shall be provided where existing concrete and paving adjoins new work and other locations. Existing steel reinforcement shall be protected, retained and cleaned for lapping into the new concrete, or it shall be cut off flush with face of concrete as applicable.

3.4 DISPOSAL OF REMOVED MATERIALS

Debris, rubbish, scrap, and other nonsalvaged materials resulting from demolition operations shall be disposed of in accordance with all applicable federal, state and local regulations. Removed materials shall not be stored on the project site.

Burning of materials removed from demolished structures will not be permitted on Government property.

Waste materials removed from demolished structures shall be transported from Government property and legally disposed of.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 03 - CONCRETE

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

09/09

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 QUALIFICATIONS FOR CONCRETE TESTING SERVICE
1.4 CONCRETE SAMPLING AND TESTING
1.5 DELIVERY AND STORAGE OF MATERIALS
1.6 QUALITY-CONTROL TESTING DURING CONSTRUCTION
1.7 INSPECTION AND ACCEPTANCE PROVISIONS
1.7.1 Evaluation of Tests
1.7.2 Evaluation of Compressive Strength Tests
1.7.3 Additional Testing of Concrete Structure for Strength
1.7.4 Strength of Concrete Structure
1.7.5 Testing by the Government
1.7.6 Repairing Strength Deficient Concrete

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS
2.1.1 Concrete Aggregates
2.1.2 Cementitious Blends
2.1.3 Cementitious Materials
2.1.3.1 Portland Cement
2.1.3.2 Blended Hydraulic Cements
2.1.4 Cementitious Admixtures
2.1.4.1 Pozzolan (Fly Ash)
2.1.4.2 Ground Granulated Blast-Furnace Slag
2.1.5 Chemical Admixtures
2.1.5.1 Air-Entraining Admixtures
2.1.5.2 Other Admixtures
2.1.6 Water
2.2 CLASSIFICATION AND QUALITY OF CONCRETE
2.2.1 Concrete Classes and Usage
2.2.2 Limits for Concrete Proportions
2.2.3 Coarse Aggregate
2.2.4 Slump
2.2.5 Total Air Content
2.3 READY-MIX CONCRETE
2.4 FORM FACING MATERIALS
2.4.1 Forms for Class A, B, and C Finish (Exposed to View or Surfaced)
2.4.2 Forms for Class D Finish (Concealed)
2.4.3 Forms for Curb, Curb and Gutter, and Pavement
2.4.4 Chamfer Strips
2.4.5 Form Release Agent
2.5 REINFORCEMENT MATERIALS
2.5.1 Reinforcing Bars

2.5.2 Steel Wire
2.5.3 Joint Dowels
2.5.4 Welded Wire Reinforcement
2.5.5 Supports for Reinforcement
2.6 JOINT MATERIALS
2.6.1 Preformed Joint Filler Strips
2.6.2 Joint Sealant Compound
2.7 WATER-VAPOR BARRIER SUBGRADE COVER
2.8 BONDING MATERIALS
2.8.1 Concrete Bonding Agent
2.8.2 Epoxy-Resin Adhesive Binder
2.9 CONCRETE CURING MATERIALS
2.9.1 Absorptive Cover
2.9.2 Moisture-Retaining Cover
2.9.3 Water
2.9.4 Membrane-Forming Curing Compound
2.10 DETECTABLE/TACTILE WARNING SURFACE TILES
2.10.1 Cast In Place Tiles
2.10.2 Surface Mounted Tiles

PART 3 EXECUTION

3.1 INSTALLATION OF CLSM
3.2 FORMWORK
3.2.1 General
3.2.2 Preparation of Form Surfaces
3.2.3 Removal of Forms
3.2.4 Re-Use of Forms
3.3 REINFORCEMENT FABRICATION AND INSTALLATION
3.3.1 General
3.3.2 Fabrication
3.3.3 Placing Reinforcement
3.4 JOINTS
3.4.1 Construction Joints
3.4.2 Isolation Joints in Slabs-on-Grade
3.4.3 Control Joints in Slabs-on-Grade
3.4.4 Expansion and Isolation Joints in Curb, Curb and Gutter, and Sidewalk
3.4.5 Control Joints in Curb, and Curb and Gutter
3.4.6 Control Joints in Sidewalks
3.4.7 Dowels for Sidewalk Expansion Joints
3.5 INSTALLATION OF ANCHORAGE DEVICES
3.5.1 General
3.5.2 Placing Anchorage Devices
3.6 INSTALLATION OF DETECTABLE/TACTILE WARNING SURFACE TILES
3.7 PREPARATIONS FOR CONCRETE PLACING
3.7.1 General
3.7.2 Subgrade Under Foundations and Footings
3.7.3 Subgrade Under Slabs on Ground
3.7.4 Formwork
3.7.5 Reinforcement and Other Embedded Items
3.8 CONCRETE CONVEYING
3.8.1 Transfer of Concrete At Project Site
3.8.2 Mechanical Equipment for Conveying Concrete
3.8.3 Pumping
3.9 CONCRETE PLACING
3.9.1 Cold Weather Concreting
3.9.2 Hot Weather Concreting
3.9.3 General Placing Requirements

3.9.4 Placing Concrete in Forms
3.9.5 Placing Concrete Slabs
3.9.6 Bonding
3.10 FINISHING OF FORMED SURFACES
3.10.1 Repairing and Patching Defective Areas
3.10.2 Smooth (Class A) Final Finish
3.10.3 Smooth(Classes B and C) Final Finish
3.10.4 Rough (Class D) Final Finish
3.10.5 Related Unformed Surfaces
3.11 FINISHING OF SLABS
3.11.1 Scratch Finish
3.11.2 Float Finish
3.11.3 Trowel Finish
3.11.4 Slab Flatness and Levelness Tolerance
3.11.4.1 Straightedge Method
3.11.4.2 F-Number System
3.11.5 Repair Slab Surfaces
3.11.6 Non-Slip Broom Finish
3.12 CONCRETE CURING AND PROTECTION
3.12.1 General
3.12.2 Curing Methods
3.12.3 Curing Formed Surfaces
3.12.4 Curing Unformed Surfaces
3.12.5 Temperature of Concrete During Curing
3.12.6 Protection from Mechanical Injury
3.12.7 Protection After Curing
3.12.8 Sealing Joints

-- End of Section Table of Contents --

SECTION 03 30 00

CAST-IN-PLACE CONCRETE
09/09

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

ACI INTERNATIONAL (ACI)

ACI 117	(2006) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2005) Specifications for Structural Concrete
ACI 302.1R	(2004) Guide for Concrete Floor and Slab Construction
ACI 304R	(2000) Guide for Measuring, Mixing, Transporting and Placing Concrete
ACI 305R	(1999) Hot Weather Concreting
ACI 306R	(1988) Cold Weather Concreting
ACI 315	(1999) Details and Detailing of Concrete Reinforcement
ACI 318	(2008) Building Code Requirements for Structural Concrete and Commentary
ACI 347R	(2004) Guide to Formwork for Concrete

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005) Standard Specifications for Highway Bridges

ASTM INTERNATIONAL (ASTM)

ASTM A 185/A 185M	(2007) Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
ASTM A 53/A 53M	(2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 615/A 615M	(2009) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete

	Reinforcement
ASTM A 82/A 82M	(2007) Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM B 117	(2007a) Standing Practice for Operating Salt Spray (Fog) Apparatus
ASTM C 1028	(2007) Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM C 143/C 143M	(2009) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 150/C 150M	(2009) Standard Specification for Portland Cement
ASTM C 171	(2007) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(2008) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 231	(2009a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2006) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	(2007) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31/C 31M	(2009) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33/C 33M	(2008) Standard Specification for Concrete Aggregates
ASTM C 39/C 39M	(2005e2) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42/C 42M	(2004) Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 494/C 494M	(2008a) Standard Specification for Chemical Admixtures for Concrete
ASTM C 501	(1984; R 2002) Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser
ASTM C 618	(2008a) Standard Specification for Coal

	Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C 881/C 881M	(2002) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 932	(2006) Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering
ASTM C 94/C 94M	(2009) Standard Specification for Ready-Mixed Concrete
ASTM C 989	(2009a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D 543	(2006) Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 6690	(2007) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM D 1751	(2004 R2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 2103	(2008) Standard Specification for Polyethylene Film and Sheeting
ASTM D 4397	(2009) Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 695	(2008) Standard Test Method for Compressive Properties of Rigid Plastics
ASTM E 329	(2008) Standard Specification for Agencies Engaged in Construction and/or Testing
ASTM E 84	(2009a) Standard Test Method for Surface Burning Characteristics of Building Materials

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP	(1997) Manual of Standard Practice

U.S. DEPARTMENT OF COMMERCE (DOC)

PS 1	(1995) Construction and Industrial Plywood

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00,

"Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-03 Product Data

Joint Materials (preformed joint and sealant)
Bonding Materials
Curing Materials
Slab Repair Topping Material
Detectable/Tactile Warning Surface Tiles including Manufacturer's installation instructions
Form Release Agent
Welded Wire Reinforcement
Curing Compound

SD-04 Samples

Provide full size sample of each type of Detectable/Tactile Warning Surface Tiles

SD-05 Design Data

Mix Design Data for each class of concrete. Mix design shall indicate all mix components and compliance with references, including hardened concrete properties. The mix design shall clearly indicate by weight, total portland cement content, and total cement replacement content for each type of material in the mix.

Concrete Aggregates
Portland Cement
Blended Hydraulic Cements, data from cement material manufacturer indicating the constituent weights of Portland Cement, Pozzolan, Fly Ash, and Blast Furnace Slag contained in the blended cements, expressed in percent of the total weight of cementitious material
Cememtitious Admixtures
Chemical Admixtures
Mix design shall indicate amount of mix water to be withheld for later addition at project site

SD-06 Test Reports

Compressive Strength Laboratory Test Reports (only if deficient concrete is suspected)
Delivery Tickets Copy

SD-07 Certificates

Amounts of EPA Designated Materials used, in accordance with the Contract Requirements. To be submitted annually.

1.3 QUALIFICATIONS FOR CONCRETE TESTING SERVICE

The Contractor shall provide concrete testing which shall be performed by an approved qualified independent testing and inspection service experienced in sampling and testing concrete. Testing agency shall meet the requirements of ASTM E 329.

1.4 CONCRETE SAMPLING AND TESTING

Testing by the Contractor shall include sampling and testing concrete materials for quality control testing during construction.

Personnel conducting field tests shall be certified per ACI Certification Program:
Concrete Field Testing Technician - Grade I;
Concrete Construction Inspector.

1.5 DELIVERY AND STORAGE OF MATERIALS

Packaged materials shall be stored on-site in their original, unopened package or container bearing label clearly identifying manufacturer's name, brand name, material, and other pertinent information, in a weathertight and dry place until ready for use in the work.

Reinforcement and other metal items shall be protected from corrosion and shall be kept free from ice, grease, and other coatings that would destroy or reduce bond.

1.6 QUALITY-CONTROL TESTING DURING CONSTRUCTION

Concrete shall be sampled and tested for quality control by the Contractor's independent testing agency during the placement of the concrete as follows:

Note: Generally concrete will not require to be field tested for curb, curb and gutter, and sidewalks for strength. Only when requested by COTR if there is reason to believe that the furnished concrete is deficient and does not meet the specification requirements will concrete be field tested. Delivery tickets must clearly indicate that the material conforms to the specification requirements for strength, cement content, water/cement ratio, admixtures, and batch time. Temperature shall be tested when outside the ranges indicated below.

REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Sampling fresh concrete	ASTM C 172 except modified for slump per ASTM C 94/C 94M	See Note above
Slump test	ASTM C 143/C 143M	See Note above
Air content by pressure method	ASTM C 231	See Note above
Compression test specimens	ASTM C 31/C 31M	See Note above
Concrete temperature		One for each concrete load at point of discharge when air temperature is 40 degrees F or below and 80 degrees F or above; each time a set of compression

REQUIREMENT	TEST METHOD	NUMBER OF TESTS
		test specimens is made
Compressive strength test	ASTM C 39/C 39M	See Note above: two specimens tested at 7 days, three specimens tested at 28 days and one specimen retained in reserve for testing if required
Pumped Concrete		Concrete shall be tested as indicated above, at point of delivery to pump and at discharge end

1.7 INSPECTION AND ACCEPTANCE PROVISIONS

1.7.1 Evaluation of Tests

Test results for slump, air content, concrete temperature, or added water outside the range of acceptable values shall immediately be reported to the concrete supplier and the Government. Concrete placement shall not proceed until adequate corrective measures have been implemented.

1.7.2 Evaluation of Compressive Strength Tests

Concrete quality control test will be evaluated as specified.

Compressive strength tests will be considered satisfactory if the average of three consecutive compressive strength tests equal or exceed the 28-day design compressive strength, and no individual compressive strength test falls below the required 28-day design compressive strength by more than 500 pounds per square inch.

Test reports shall be reported in writing to the Government within 1 day of testing.

1.7.3 Additional Testing of Concrete Structure for Strength

When there is evidence that strength of concrete structure in place does not meet specification requirements, the Contractor's independent testing agency shall have cores drilled from hardened concrete for compressive strength determination shall be made in accordance with ASTM C 42/C 42M, and as follows:

At least three representative cores shall be taken from each member or area of concrete-in-place that is considered potentially deficient. Location of cores shall be approved by the Contracting Officer.

Cores shall be tested after moisture conditioning in accordance with ASTM C 42/C 42M if concrete they represent will be more than superficially wet under service.

Cores shall be air dried, (60 to 80 degrees F with relative humidity less than 60 percent) for 7 days before test and shall be tested dry if concrete they represent will be dry under service conditions.

Strength of cores from each member or area will be considered satisfactory if their average is equal to or greater than 85 percent of the 28-day design compressive strength of the class of concrete.

Core holes shall be filled solid with patching mortar and finished to match adjacent concrete surfaces.

1.7.4 Strength of Concrete Structure

Strength of concrete in place will be considered deficient if it fails to comply with requirements which control strength of structure, including following conditions:

Failure to meet compressive strength tests as evaluated.

Reinforcement not conforming to requirements specified.

Concrete which differs from required dimensions or location in such a manner as to reduce strength.

Concrete curing and protection of concrete against extremes of temperature during curing, not conforming to requirements specified.

Concrete subjected to damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.

Poor workmanship likely to result in deficient strength.

1.7.5 Testing by the Government

The Government may inspect and test concrete separate from the Contractor's responsibilities. This will be done at no cost to the contractor, unless the inspection and testing indicates deficient concrete, for which the contractor shall reimburse the Government for the actual cost of inspection and testing.

1.7.6 Repairing Strength Deficient Concrete

Concrete work that is found inadequate by an "Strength of Concrete Structure" requirements indicated above shall be corrected in a manner approved by the Contracting Officer's Technical Representative.

PART 2 PRODUCTS

2.1 CONCRETE MATERIALS

2.1.1 Concrete Aggregates

Fine and coarse aggregates shall conform to ASTM C 33/C 33M, severe weathering class.

The limit for deleterious substances contained in the coarse aggregate shall be in accordance with ASTM C 33/C 33M Class 4S.

2.1.2 Cementitious Blends

Cement shall be one of the following blends:

a) portland cement/cementitious admixture blend, or
b) portland cement/blended hydraulic cement blend, or
c) portland cement/blended hydraulic cement/cementitious admixture blend.

Final mix designs shall not contain less, nor more than the following total cement replacement (% by weight).

	% MINIMUM	% MAXIMUM
Flyash (alone)	10	25
GGBF Slag (alone)	10	50
Flyash/GGBF Slag (combined)	10	50*

* - Flyash shall not constitute more than 25% of the maximum

Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementious material.

2.1.3 Cementitious Materials

2.1.3.1 Portland Cement

Portland Cement shall conform to ASTM C 150/C 150M, Type I/II or Type II.

2.1.3.2 Blended Hydraulic Cements

Blended hydraulic cement shall be one of the following types, and shall conform to ASTM C 595.

Type IS - Portland Blast-Furnace Slag Cement, slag shall constitute between 25 percent and 70 percent of the mass of the blend.

Type IP-Portland-Pozzolan Cement, pozzolan shall constitute between 15 percent and 40 percent of the mass of the blend.

Type I(PM) - Pozzolan-Modified Portland Cement, pozzolan shall constitute no more than 15% of the mass of the blend.

Type I(SM) - Slag-Modified Portland Cement, slag shall constitute no more than 25% of the mass of the blend.

2.1.4 Cementitious Admixtures

2.1.4.1 Pozzolan (Fly Ash)

Fly ash shall conform to ASTM C 618, Class C or F.

2.1.4.2 Ground Granulated Blast-Furnace Slag

GGBF Slag shall conform to ASTM C 989, Grade 100 or 120.

2.1.5 Chemical Admixtures

2.1.5.1 Air-Entraining Admixtures

Air-entraining admixtures shall conform to ASTM C 260.

2.1.5.2 Other Admixtures

Water-reducing admixtures, retarding admixtures, accelerating admixtures, water-reducing and accelerating admixtures, and water-reducing and retarding admixtures shall conform to ASTM C 494/C 494M.

2.1.6 Water

Water shall be potable.

2.2 CLASSIFICATION AND QUALITY OF CONCRETE

2.2.1 Concrete Classes and Usage

Concrete classes, compressive strength, requirements for air entrainment, and usage shall be as follows:

CONCRETE CLASS	MIN. 28-DAY COMPRESSIVE STRENGTH PSI	REQUIRED AVERAGE COMPRESSIVE STRENGTH (per ACI) PSI*	USAGE
CLSM	100 min, 150 max	-	See Section 31 00 00
F0	3000	4200	Only where indicated
F3	4500	5700	For all project requirements unless otherwise indicated

* Contractor may use ACI 318 Table 5.3.2.1 to determine Required Average Compressive Strength when standard deviation data is available and furnished with Mix Design.

2.2.2 Limits for Concrete Proportions

Limits for maximum water/cement ratio (by weight) for each concrete class shall be as follows:

CONCRETE CLASS	MAX. WATER/CEMENT RATIO BY WEIGHT
CLSM	8
F0	0.50
F3	0.45

2.2.3 Coarse Aggregate

Size of aggregate, designated by the sieve size on which maximum amount of

retained coarse aggregate is 5 to 10 percent by weight, shall be as follows:

MAXIMUM SIZE OF AGGREGATE	ASTM C 33/C 33M SIZE NUMBER	TYPE OF CONSTRUCTION
3/4 inch	67	For all concrete
3/8 inch	9	For all CLSM uses

2.2.4 Slump

Slump for concrete at time and in location of placement shall be not less than 1 inch nor more than 4 inches.

Slump for CSLM only shall be 7 - 10 inches.

2.2.5 Total Air Content

Air content of concrete:

3/4 inch Aggregate: 6 percent

CLSM : Between 0 percent to 10 percent.

All air contents shall be plus or minus 1-1/2 percent.

2.3 READY-MIX CONCRETE

Concrete shall meet the requirements of ASTM C 94/C 94M. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

Ready-mixed concrete manufacturer shall provide duplicate delivery tickets with each load of concrete delivered. Delivery tickets shall provide the following information in addition to that required by ASTM C 94/C 94M:

Type and brand cement

Cement content in 94-pound bags per cubic yard of concrete

Maximum size of aggregate

Amount and brand name of admixtures

Total water content expressed by water/cement ratio

Amount of water allowed to be added at project site (to conform to approved mix design water/cement ratio)

2.4 FORM FACING MATERIALS

2.4.1 Forms for Class A, B, and C Finish (Exposed to View or Surfaced)

Exterior grade plywood shall conform to PS 1, B-B, concrete form, Class 1, not less than 5/8-inch thick, mill oiled and edge sealed. Other form materials may be used provided the smoothness and appearance of the concrete produced is equivalent to plywood forms.

2.4.2 Forms for Class D Finish (Concealed)

Plywood, lumber, metal, or another approved material. Lumber shall be dressed on at least two edges and one side for tight fit.

2.4.3 Forms for Curb, Curb and Gutter, and Pavement

Forms shall be straight, free of distortion, and extend the full depth of the concrete. Forms may be of wood or steel, of ample strength to resist springing during concrete placement.

2.4.4 Chamfer Strips

Chamfer strips shall be wood, metal, PVC, or rubber strips 3/4 inch by 3/4 inch.

2.4.5 Form Release Agent

Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.5 REINFORCEMENT MATERIALS

2.5.1 Reinforcing Bars

Reinforcing bars shall conform to ASTM A 615/A 615M and Supplemental S1, Grade 60.

2.5.2 Steel Wire

Wire shall conform to ASTM A 82/A 82M.

2.5.3 Joint Dowels

Dowels shall conform to ASTM A 615/A 615M, Grade 60. Dowel pipe shall be steel conforming to ASTM A 53/A 53M.

2.5.4 Welded Wire Reinforcement

Reinforcement shall conform to ASTM A 185/A 185M.

2.5.5 Supports for Reinforcement

Supports shall include bolsters, chairs, spacers, and other devices necessary for proper spacing, supporting, and fastening reinforcing bars and wire fabric in place.

Supports shall be wire bar type conforming to ACI 315 and CRSI MSP.

Legs of supports in contact with formwork shall be hot-dip galvanized, or plastic coated after fabrication, or stainless-steel bar supports.

2.6 JOINT MATERIALS

2.6.1 Preformed Joint Filler Strips

Filler strips shall be nonextruding and resilient bituminous type conforming to ASTM D 1751.

2.6.2 Joint Sealant Compound

Compound shall be hot-poured, elastic type conforming to ASTM D 6690.

2.7 WATER-VAPOR BARRIER SUBGRADE COVER

Cover shall be clear polyethylene sheeting, 10-mil, conforming to ASTM D 2103 and ASTM D 4397

2.8 BONDING MATERIALS

2.8.1 Concrete Bonding Agent

Agent shall be an aqueous-phase, film-forming, nonoxidizing, freeze and thaw-resistant compound suitable for brush or spray application conforming to ASTM C 932.

2.8.2 Epoxy-Resin Adhesive Binder

Binder shall be two-component, epoxy-polysulfide polymer type with an amine-type curing-agent conforming to ASTM C 881/C 881M.

2.9 CONCRETE CURING MATERIALS

2.9.1 Absorptive Cover

Cover shall be burlap cloth conforming to ASTM C 171.

2.9.2 Moisture-Retaining Cover

Cover shall be polyethylene film conforming to ASTM C 171.

2.9.3 Water

Water shall be potable.

2.9.4 Membrane-Forming Curing Compound

Compound shall be liquid type conforming to ASTM C 309, Type 1, clear, for interior work; and Type 2, white, pigmented for exterior work.

2.10 DETECTABLE/TACTILE WARNING SURFACE TILES

2.10.1 Cast In Place Tiles

Detectable/Tactile Warning shall be high strength UV stabilized epoxy polymer composition tile with integral non-slip surface texture stamped or cast into the tile. The tile shall be ADA compliant design incorporating an in-line pattern of raised truncated domes measuring nominal 0.2 inch height, nominal 0.9 inch base diameter, and nominal 0.45 inch top diameter, spaced center to center 2.35 inch as measured on a diagonal and 1.67 inch as measured side by side. The field area shall consist of a non-slip surface with a maximum 0.05 inch height. The tile shall exhibit the following minimum properties:

a. The tile shall be yellow in accordance with Federal Standard 595, Color FS 33538.

b. Slip resistance when tested in accordance with ASTM C 1028 shall have a wet and dry static coefficients of friction not less than 0.80 on the top of domes and field area.

c. Compressive strength when test in accordance with ASTM D 695 shall be not less than 28,000 pounds per square inch.

d. Wear resistance when tested in accordance with ASTM C 501 shall be no greater than 0.004 inch loss, at 1000 cycles, 1000 gram load, H22 wheel.

e. Salt and spray performance when tested in accordance with ASTM B 117 shall show no deterioration after 400 hours.

f. Fire resistance when tested in accordance with ASTM E 84 shall have a flame spread less than 15.

g. Chemical stain resistance of tiles when tested in accordance with ASTM D 543 shall withstand without discoloration or staining: 10 percent hydrochloric acid, urine, saturated calcium chloride, black stamp pad ink, chewing gum, red aerosol paint, 10 percent ammonium hydroxide, 1 percent soap solution, turpentine, 5 percent urea, diesel and motor oil.

h. Exhibit no visible damage when mounted on a concrete platform with a 1/2 inch airspace at the underside of the tile top plate then subjected to a 10,400 pound load, corresponding to an AASHTO HB-17 8000 pound individual wheel load with a 30 percent impact factor.

i. Embedment flange spacing shall be no greater than 4 inches center to center spacing for embedment into concrete and shall completely and securely engage the tile to the wet concrete for a fit and firm placement with no movement or rocking.

2.10.2 Surface Mounted Tiles

Surface mounted shall comply with all requirements as indicated for Cast In Place Tiles, with exception of items (h) and (i) do not apply. For surface mounted tiles a system of adhesive and mechanical anchors shall be used to secure the tile to existing hardened concrete for a fit and firm placement with no movement or rocking.

PART 3 EXECUTION

3.1 INSTALLATION OF CLSM

Installation and field testing of CLSM shall be in accordance with Section 31 00 00, "Earthwork".

3.2 FORMWORK

3.2.1 General

Forms shall be constructed to conform to shapes dimensions, lines, elevations, and positions of cast-in-place concrete members as indicated. Forms shall be supported, braced, and maintained sufficiently rigid to prevent deformation under load in accordance with ACI 301 and ACI 347R.

Construct formwork so that finished concrete is of size, shape, alignment,

elevation and position indicated, with tolerance limits of ACI 117.

Concrete surface irregularities shall be gradual when encountered and shall comply as follows:

Class A Finish (1/8 inch) - Surfaces prominently exposed to public view, or given only a paint coating.

Class B Finish (1/4 inch) - surfaces to receive plaster, stucco, or wainscoting.

Class C Finish (1/2 inch) - general standard for surfaces not otherwise classified as Class A, B, or D.

Class D Finish (1 inch) - surfaces where roughness is not objectionable, backfilled foundations, permanently concealed surfaces not requiring Class B finish.

Forms shall be tight to prevent leakage of cement paste during concrete placing.

Form facing materials shall be supported by structural members spaced close to prevent deflection of form facing material. Forms placed in successive units for continuous surfaces shall be fitted to accurate alignment to ensure a smooth completed surface within the tolerances specified. Where necessary to maintain tolerances, such as long spans where immediate supports are not possible, formwork shall be cambered for anticipated deflections in formwork due to weight and pressure of fresh concrete and to construction loads.

Exposed joints, edges, and external corners shall be chamfered a minimum of 3/4 inch by moldings placed in corners of slabs on grade.

Forms shall be readily removable without impact, shock, or damage to concrete.

3.2.2 Preparation of Form Surfaces

Contact surfaces of forms shall be coated with form-coating compound before reinforcement is placed. Form-coating compound shall be a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces that entails bonding or adhesion nor impede wetting of surfaces to be cured with water or curing compounds. Excess form-coating compound shall not be allowed to stand in puddles in the forms nor to come in contact with concrete against which fresh concrete will be placed. Thinning of form-coating compound shall be made with thinning agent of the type, in the amount, and under the conditions recommended by form-coating compound manufacturer's printed or written directions.

3.2.3 Removal of Forms

Formwork for curb, curb and gutter, sidewalk, and pavement may be removed 12 hours after placing concrete.

When formwork is removed during concrete curing period, exposed concrete shall be cured as specified.

3.2.4 Re-Use of Forms

Surfaces of forms that are to be re-used shall be cleaned and repaired, except that split, frayed, or delaminated form facing material shall not be re-used. Contact surfaces of re-used forms shall be coated as specified.

3.3 REINFORCEMENT FABRICATION AND INSTALLATION

3.3.1 General

Details of reinforcement shall be in accordance with ACI 315, ACI 318 ACI 318M, ACI 347R, and as specified.

3.3.2 Fabrication

Reinforcing bars shall be shop fabricated, bent cold, to conform to shapes and dimensions indicated for reinforcement:

Fabrication tolerances shall be in accordance with ACI 304R, ACI 315, and ACI 117.

Hooks and bends shall be in accordance with ACI 315, and ACI 318ACI 318M.

Rebending of a reinforcing bar that has been bent incorrectly shall not be permitted. Bending shall be in accordance with standard approved practice and by approved machine methods.

Reinforcing bars shall be delivered bundled, tagged, and marked. Tags shall be metal with bar size, length, mark, and other information pressed in by machine. Marks shall correspond with those used on the placing drawings.

Reinforcement which has any of the following defects shall not be used:

Bar lengths, depths, and bends beyond specified fabrication tolerances

Bends or kinks not indicated on drawings or approved shop drawings

Bars with reduced cross-section due to rusting or other cause

Defective reinforcement shall be replaced with new reinforcement having required shape, form, and cross-section area.

3.3.3 Placing Reinforcement

Reinforcement shall be placed in accordance with ACI 315 and ACI 318ACI 318M.

Clean reinforcement of loose rust and mill scale, earth, and other foreign materials.

Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover.

Welded wire reinforcement shall be installed in lengths as long as possible.

Reinforcements shall be secured to supports by means of tie wire. Wire shall be black, soft iron wire, not less than 16 gage.

3.4 JOINTS

Joints shall be installed as indicated on the drawings. Joints not indicated shall be made and located so as not to impair strength and appearance of the structure and shall be as approved. Construct joints true to line with faces perpendicular to surface plane of concrete.

3.4.1 Construction Joints

Construction joints shall be located as follows:

In slabs on ground, so as to divide slab into areas not in excess of 1,200 square feet

Construction joints shall not be used in curb, curb and gutter, or pavements. Joints shall be in accordance with the pattern as shown on drawings.

Keyways at least 1-1/2-inches deep shall be provided in construction joints.

Joints shall be perpendicular to main reinforcement. Reinforcement shall be continued across construction joints, unless otherwise indicated.

Apply a concrete bonding agent where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.4.2 Isolation Joints in Slabs-on-Grade

Joints shall be provided at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

Joints shall be filled with premolded joint filler strips 1/2 inch thick, extending full slab depth. Filler strips shall be installed at proper level below finish floor elevation with a slightly tapered, dress-and-oiled wood strip temporarily secured to top of filler strip to form a groove not less than 3/4 inch in depth where joint will be sealed with sealing compound and not less than 1/4 inch in depth where joint sealing is not required. Wood strip shall be removed after concrete has set. Contractor shall clean groove of foreign matter and loose particles after surface has dried.

3.4.3 Control Joints in Slabs-on-Grade

Joints shall be provided to form panels as indicated.

Under and on exact line of each control joint, 50 percent of welded wire fabric reinforcement shall be cut before placing concrete.

Joints shall be 1/8-inch wide by 1/4 of slab depth and shall be formed after initial floating by grooving and finishing. Repeat grooving after applying surface finish.

3.4.4 Expansion and Isolation Joints in Curb, Curb and Gutter, and Sidewalk

Transverse expansion joints shall be provided as indicated, maximum of 50 foot intervals. Isolation joints shall be provided where concrete abuts other rigid structures, sidewalks, concrete pavements, manholes, building

walls, etc. Joint shall be pre-molded joint filler, not less than 1/2 inch nor more than 1 inch below finished surface.

3.4.5 Control Joints in Curb, and Curb and Gutter

Transverse control joints shall be provided as indicated, or control joints shall be spaced at maximum 10 foot intervals. Joints shall be constructed with metal separator plates. Depth of joint shall be approximately 2 inches.

3.4.6 Control Joints in Sidewalks

Transverse control joints shall be spaced at intervals equal to the sidewalk width, maximum of 10 foot intervals. Joints shall be formed using grooving tool, 1/8 inch wide by 1/4 sidewalk depth.

3.4.7 Dowels for Sidewalk Expansion Joints

Install two 1/2 inch dowel sleeves and dowels at sidewalk expansion joints.

3.5 INSTALLATION OF ANCHORAGE DEVICES

3.5.1 General

Anchorage devices and embedded items required for other work that is attached to, or supported by, cast-in-place concrete shall be set and built in as part of the work of this section, using setting drawings, templates, instructions, and directions furnished with items to be embedded.

3.5.2 Placing Anchorage Devices

Anchorage devices and embedded items shall be positioned accurately and supported against displacement. Openings in anchorage devices such as slots and threaded holes shall be filled with an approved, removable material to prevent entry of concrete into openings.

3.6 INSTALLATION OF DETECTABLE/TACTILE WARNING SURFACE TILES

Detectable/tactile warning surface tiles shall be installed in accordance with the manufacturer's installation procedures and instructions.

3.7 PREPARATIONS FOR CONCRETE PLACING

3.7.1 General

Surfaces against which concrete is to be placed shall be free of debris, loose material, standing water, snow, ice, and other deleterious substances before start of concrete placing.

Do not add water to concrete during delivery, at project site, or during placement unless specifically required by the concrete mix design, or unless approved by the COTR.

3.7.2 Subgrade Under Foundations and Footings

When subgrade material is semiporous and dry, subgrade surface shall be sprinkled with water as required to eliminate suction at the time concrete is deposited. When subgrade material is porous, subgrade surface shall be sealed by covering surface with specified water barrier subgrade cover; this may also be used over semiporous, dry subgrade material instead of

water sprinkling.

3.7.3 Subgrade Under Slabs on Ground

Before construction of slabs on ground, underground work on pipes and conduits shall have been completed and approved.

Previously constructed earthwork shall be inspected by the Contractor for adequate compaction and surface tolerances as specified.Drainage fill surface under interior slabs on ground shall be covered with specified water-vapor barrier subgrade cover immediately prior to placing reinforcement. Subgrade cover shall be installed to avoid puncture or tear. Punctures or tears over 12 inches shall be patched with separate sheets lapped not less than 6 inches. All punctures or tears less than 12 inches shall be sealed with pressure-sensitive vapor barrier tape not less than 2-inches wide. Lapped joints shall be sealed with vapor barrier adhesive or pressure-sensitive vapor barrier tape not less than 2-inches wide. Subgrade cover sheets shall be laid with not less than a 6-inch lap at edges and ends and in direction in which concrete is to be placed.

3.7.4 Formwork

Formwork shall be complete and approved.

3.7.5 Reinforcement and Other Embedded Items

Reinforcement, joint materials, and other embedded materials shall be secured in position, inspected, and approved before start of concrete placing.

3.8 CONCRETE CONVEYING

3.8.1 Transfer of Concrete At Project Site

Concrete shall be handled from point of delivery and transfer to concrete conveying equipment and to locations of final deposit as rapidly as practical by methods which will prevent segregation and loss of concrete mix materials.

3.8.2 Mechanical Equipment for Conveying Concrete

Equipment shall ensure a continuous flow of concrete at delivery end and shall be as approved. Runways for wheeled concrete-conveying equipment shall be provided from concrete delivery point to locations of final deposit. Interior surfaces of concrete conveying equipment shall be free of hardened concrete, debris, water, snow, ice, and other deleterious substances.

3.8.3 Pumping

Pumping shall not result in separation or loss of materials nor cause interruptions to permit loss of plasticity between successive increments. Loss of slump in pumping equipment shall not exceed 2 inches. Pipe size shall not change rapidly, nor shall the diameter be less than three times the maximum aggregate size.

3.9 CONCRETE PLACING

Mixed concrete shall be discharged within 1-1/2 hours after introduction of

mixing water to the cement/aggregate. Concrete shall be placed within 15 minutes after it has been discharged from the truck.

3.9.1 Cold Weather Concreting

Protect concrete work from physical damage or reduced strength that could be caused by lack of heat; comply with ACI 306R, and as follows:

When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 degrees F and not more than 80 degrees F at point of placement.

Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.

3.9.2 Hot Weather Concreting

When air temperature is above 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 1 hour.

Protect concrete work from quality degradation that will be caused by any combination of excessive heat, low relative humidity, and wind velocity; comply with ACI 305R, and as follows:

Cool ingredients before mixing to maintain concrete temperature below 90 degrees F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9.3 General Placing Requirements

Concrete shall be deposited continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be provided as specified. Concrete placing shall be performed at such a rate that concrete which is being integrated with fresh concrete is still plastic. Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to procedures which will cause segregation.

Concrete to receive other construction shall be screeded to proper level to avoid excessive skimming or grouting.

Concrete which becomes nonplastic and unworkable or does not meet quality

control limits as specified or has been contaminated by foreign materials shall not be used. Use of retempered concrete will not be permitted. Rejected concrete shall be removed from the site.

3.9.4 Placing Concrete in Forms

Concrete placed in forms shall be deposited in horizontal layers not exceeding 24 inches.

Concrete placed in forms shall be consolidated by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Vibrators shall be designed to operate with vibratory element submerged in concrete and shall maintain a speed of not less than 9,000 impulses per minute when submerged in concrete. Vibrating equipment shall be adequate in number of units and power of each unit to properly consolidate concrete. Vibration of forms and reinforcement shall not be permitted. Vibrators shall not be used to transport concrete inside forms. Vibrators shall be inserted and withdrawn vertically at uniformly spaced points not farther apart than visible effectiveness of machine. Vibrator shall not be inserted into lower courses of concrete that have begun to set. At each insertion, duration of vibration shall be limited to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of concrete mix.

Placing of concrete in supporting elements shall not be started until concrete previously placed in columns and walls is no longer plastic and has been in place a minimum of 2 hours.

3.9.5 Placing Concrete Slabs

Concrete for slabs shall be placed and consolidated in a continuous operation, within the limits of approved construction joints until placing of panel or section is completed.

During concrete placing operations, concrete shall be consolidated by mechanical vibrating equipment so that concrete is worked around reinforcement and other embedded items and into corners. Concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground shall be consolidated by mechanical vibrators as specified. Concrete in remainder of slabs shall be consolidated by vibrating bridge screeds, roller pipe screeds, or other approved method. Consolidation operations shall be limited to time necessary to obtain consolidation of concrete without bringing an excess of fine aggregate to the surface. Concrete to be consolidated shall be as dry as practical and surfaces thereof shall not be manipulated prior to finishing operations. Concrete shall be brought to correct level with a straightedge and struck-off. Bull floats or darbies shall be used to smooth surface, leaving it free of humps or hollows. Sprinkling of water on plastic surface shall not be permitted.

Finish of slabs shall be as specified.

3.9.6 Bonding

Surfaces of set concrete at joints, except where bonding is obtained by use of concrete bonding agent, shall be roughened and cleaned of laitance, coatings, loose particles, and foreign matter. Surfaces shall be roughened in a manner that will expose the aggregate uniformly and will not leave laitance, loosened particles of aggregate, nor damaged concrete at the surface.

Bonding of fresh concrete that has set shall be obtained as follows:

At joints between footings and walls or columns, between walls or columns and the beams or slabs they support, and elsewhere unless otherwise specified; roughened and cleaned surface of set concrete shall be dampened, but not saturated, immediately prior to placing of fresh concrete.

At joints in exposed-to-view work; at vertical joints in walls; at joints near midpoint of span in girders, beams, supported slabs, and other structural members; and at joints in work designed to contain liquids; the roughened and cleaned surface of set concrete shall be dampened but not saturated and covered with a cement grout coating.

Cement grout shall consist of equal parts of portland cement and fine aggregate by weight with not more than 6 gallons of water per sack of cement. Cement grout shall be applied with a stiff broom or brush to a minimum thickness of 1/16 inch. Fresh concrete shall be deposited before cement grout has attained its initial set.

Bonding of fresh concrete to concrete that has set may be obtained by use of a concrete bonding agent. Such bonding material shall be applied to cleaned concrete surface in accordance with approved printed instructions of bonding material manufacturer.

3.10 FINISHING OF FORMED SURFACES

3.10.1 Repairing and Patching Defective Areas

Immediately after removal of forms, defective areas shall be repaired and patched with cement mortar. Defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

Honeycomb, rock pockets, voids over 1/2 inch in any dimension, and holes left by tie rods and bolts shall be cut out to solid concrete, but in no case to a depth of less than 1 inch Edges of cuts shall be perpendicular to surface of concrete. Before placing cement mortar, area to be patched at least 6 inches adjacent thereto shall be cleaned, dampened with water, and brush coated with bonding agent. Cement mortar for patching shall consist of one part standard portland cement to two parts fine aggregate passing No. 16 mesh sieve and as little water as necessary for handling and placing. Where concrete surface will be exposed to view, portland cement portion of cement mortar shall be a blend of white and standard portland cement so that when dry, cement mortar will match surrounding concrete in color. Cement mortar shall be compacted in place and struck off slightly higher than the surrounding surface. Holes extending through concrete shall be filled by means of a plunger type gun or other suitable device from unexposed face, using a stop held at exposed face to ensure complete filling.

Fins and other projections shall be removed and rubbed down with wood blocks, so as not to exceed projections previously indicated for class A, B, C, or D finishes. Abrupt irregularities shall be removed and ground down so as to have a gradual transition.

3.10.2 Smooth (Class A) Final Finish

Finish shall be given to concrete surfaces that are to be prominently exposed to public view.

Not later than one day after form removal, moisten concrete surface and rub with carborundum brick or other abrasive until producing a uniform color and texture. Do not apply cement grout other than created by the rubbing process.

3.10.3 Smooth(Classes B and C) Final Finish

Finish shall be the concrete surface having texture imparted by form facing material used.

3.10.4 Rough (Class D) Final Finish

Finish shall be the concrete surface having texture imparted by form facing material used.

3.10.5 Related Unformed Surfaces

Tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces shall be struck off smooth after concrete is placed and shall be finished to a texture matching that of adjacent formed surfaces. Final surface treatment on formed surfaces shall continue uniformly across adjacent unformed surfaces.

3.11 FINISHING OF SLABS

Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

Surface shall uniformly slope to drains where indicated.

3.11.1 Scratch Finish

A scratch finish shall be given to slab surfaces that are to receive concrete floor topping, mortar setting beds, or other bonded, applied, cementitious finish flooring material

While still plastic, texture concrete surface using stiff brushes, brooms, or rakes, after the surface has been screeded and bull-floated or darbied.

3.11.2 Float Finish

A float finish shall be given to slab surfaces that are to receive trowel finish and other finishes as specified and to slab surfaces that are to be covered with membrane waterproofing, membrane roofing, or terrazzo.

After placing is completed, concrete shall not be worked further until ready for floating. Floating shall begin when water has disappeared, or when concrete mix has stiffened sufficiently to permit proper operation of a power-driven float, or when both conditions have occurred. Any surface water remaining shall be removed before floating. Surface shall then be consolidated with power-driven floats. Hand floating shall be used in locations inaccessible to power-driven floats.

3.11.3 Trowel Finish

Finish shall be given to slab surfaces that are to be exposed to view, and to slab surfaces to be covered with resilient flooring, paint, or other finish coating system.

After completion of float finish, the surface shall receive a trowel finish. First troweling after completion of float finish shall be done by a power-driven trowel and shall produce a smooth surface which is free of defects but which may contain some trowel marks.

Additional trowelings shall be done by hand after surface has hardened sufficiently. Final troweling shall be started when a ringing sound is produced as trowel is moved over surface. Surface shall be consolidated by hand troweling operation. Finished surface shall be free of trowel marks, uniform in texture and appearance. Surface defects of sufficient magnitude to show through floor covering shall be removed by grinding.

3.11.4 Slab Flatness and Levelness Tolerance

Sidewalk does not require flatness or levelness testing unless appearance of a deficiency exists. Sidewalks shall have a transverse cross slope of 2 percent maximum.

3.11.4.1 Straightedge Method

For slab areas not exceeding 10,000 square feet, surface finish shall be measured using straightedge method.

Measure surface so gap at any point between concrete surface and an unelevevated free-standing 10 foot long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:

a. 1/4 inch - all slabs not requiring 1/8 inch tolerance

b. 1/8 inch - thin floor-covering, such as paint finish or vinyl composition tile.

3.11.4.2 F-Number System

For slab areas exceeding 10,000 square feet, surface finish shall be measured using F-Number system.

Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/ E 1155M for randomly trafficked floor surface:

a. F_F17, F_L15 (both MLV) all slabs not requiring finish below
b. F_F24, F_L17 (both MLV) thin floor covering such as paint or vinyl composition tile

3.11.5 Repair Slab Surfaces

Slab surfaces which have been tested for surface tolerances, and fall outside the allowable tolerance, shall be corrected for low and high areas by cutting, patching, and grinding as necessary. The repaired slab shall be durable, matching the adjacent slab in uniformity, quality, and finish. Repairs shall provide a smooth, plane, and level surface.

After concrete has cured at least 14 days, correct high areas by grinding.

Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar.

Correct other low areas with a repair topping. Cut out low areas to ensure a minimum topping depth of 1/4 inches to match adjacent floor elevations. Prepare, mix and apply repair topping according to manufacturer's written instructions.

3.11.6 Non-Slip Broom Finish

Finish shall be given to surfaces of exterior concrete unless otherwise indicated.

Immediately after completion of trowel finish, surface shall be slightly roughened by brooming with a fiber-bristle brush in a direction transverse to that of main traffic.

3.12 CONCRETE CURING AND PROTECTION

3.12.1 General

Freshly placed concrete shall be protected from premature drying and cold or hot temperature and shall be maintained without drying at a relatively constant temperature for the period of time necessary for hydration of cement and proper hardening of concrete.

Initial curing shall start as soon as free water has disappeared from surface of concrete after placing and finishing. Concrete shall be kept moist for minimum 72 hours.

Final curing shall immediately follow initial curing and before concrete has dried. Final curing shall continue until cumulative number of hours or fraction thereof (not necessarily consecutive) during which temperature of air in contact with the concrete is above 50 degrees F has totaled 168 hours. Alternatively, if tests are made of cylinders kept adjacent to the structure and cured by the same methods, final curing may be terminated when the average compressive strength has reached 70 percent of the 28-day design compressive strength. Rapid drying at end of final curing period shall be prevented.

3.12.2 Curing Methods

Curing shall be accomplished by moist curing, by moisture-retaining cover curing, by membrane curing, and by combinations thereof, as specified.

Moist curing:

Moisture curing shall be accomplished by any of the following methods:

Keeping surface of concrete wet by covering with water

Continuous water-fog spraying

Covering concrete surface with absorptive cover for curing concrete saturated with water and keeping absorptive cover wet by water spraying or intermittent hosing. Absorptive cover shall be placed to provide coverage of concrete surfaces and edges with a

slight overlap over adjacent absorptive covers.

Moisture-retaining cover curing:

Moisture-retaining cover curing shall be accomplished by covering concrete surfaces with moisture-retaining cover for curing concrete. Cover shall be placed directly on concrete in widest practical width, with sides and ends lapped at least 3 inches. Cover shall be weighted to prevent displacement; tears or holes appearing during curing period shall be immediately repaired by patching with pressure-sensitive, waterproof tape or other approved method.

Membrane curing (RESTRICTIVE, see 2nd paragraph):

Membrane curing shall be accomplished by applying specified membrane-forming curing compound to damp concrete surfaces as soon as moisture film has disappeared. Curing compound shall be applied uniformly in a two-coat operation by power-spraying equipment using a spray nozzle equipped with a wind guard. Second coat shall be applied in a direction at right angles to direction of first coat. Total coverage for two coats shall be not more than 200 square feet per gallon of curing compound. Concrete surfaces which are subjected to heavy rainfall within 3 hours after curing compound has been applied shall be resprayed by method and at rate specified. Continuity of coating shall be maintained for entire curing period and damage to coating during this period shall be repaired immediately.

Membrane-curing compounds shall not be used on surfaces that are to be covered with coating material applied directly to concrete or with a covering material bonded to concrete, such as other concrete, liquid chemical floor hardener, waterproofing, damproofing, membrane roofing, painting, vinyl composition tile, and other coatings and finish materials.

3.12.3 Curing Formed Surfaces

Curing of formed surfaces, including undersurfaces of girders, beams, supported slabs, and other similar surfaces shall be accomplished by moist curing with forms in place for full curing period or until forms are removed. If forms are removed before end of curing period, final curing of formed surfaces shall be accomplished by any of the curing methods specified above, as applicable.

3.12.4 Curing Unformed Surfaces

Initial curing of unformed surfaces, such as monolithic slabs, floor topping, and other flat surfaces, shall be accomplished by membrane curing.

Unless otherwise specified, final curing of unformed surfaces shall be accomplished by any of curing methods specified above, as applicable.

Final curing of concrete surfaces to receive liquid floor hardener of finish flooring shall be accomplished by moisture-retaining cover curing.

3.12.5 Temperature of Concrete During Curing

When temperature of atmosphere is 40 degrees F and below, temperature of concrete shall be maintained at not less than 55 degrees F throughout concrete curing period or 45 degrees F when the curing period is measured

by maturity. When necessary, arrangements shall be made before start of concrete placing for heating, covering, insulation, or housing as required to maintain specified temperature and moisture conditions for concrete during curing period.

When the temperature of atmosphere is 80 degrees F and above or during other climatic conditions which will cause too rapid drying of concrete, arrangements shall be made before start of concrete placing for installation of wind breaks, of shading, and for fog spraying, wet sprinkling, or moisture-retaining covering of light color as required to protect concrete during curing period.

Changes in temperature of concrete shall be uniform and shall not exceed 5 degrees F in any 1 hour nor 50 degrees F in any 24-hour period.

3.12.6 Protection from Mechanical Injury

During curing period, concrete shall be protected from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration and from damage caused by rain or running water.

3.12.7 Protection After Curing

Finished concrete surfaces shall be protected from damage by construction operations.

3.12.8 Sealing Joints

Prepare, clean, and install joint sealant according to manufacturer's written instructions.

Isolation, expansion, and control joints which will not be covered with finish flooring material shall be sealed with joint sealing compound after concrete curing period. Groove shall be slightly underfilled with joint sealing compound to prevent extrusion of compound. Excess material shall be removed as soon after sealing as possible.

Seal exterior expansion and isolation joints.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 31 - EARTHWORK

SECTION 31 00 00

EARTHWORK

1/02

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 SAMPLING AND TESTING
1.3.1 Existing Conditions and Subsurface Data
1.3.2 Soil Testing and Inspection Service
1.3.3 Tests For Proposed Soil Materials
1.3.4 Quality Control Testing During Construction
1.3.5 Evaluation of Test Results

PART 2 PRODUCTS

2.1 EARTHWORK MATERIALS
2.1.1 Engineered Fill
2.1.2 High Quality Satisfactory Soil Material
2.1.3 Medium Quality Satisfactory Soil Material
2.1.4 Low Quality Satisfactory Soil Material
2.1.5 Unsatisfactory Soil Materials
2.1.6 Graded Aggregate Base Course Material
2.1.7 Drainage Fill
2.1.8 Bedding
2.1.9 Sand
2.1.10 Controlled Low Strength Material (CLSM)
2.1.11 Stone Riprap for Ditches
2.1.12 Geotextile
2.1.12.1 Geotextile for Riprap Base
2.1.12.2 Geotextile for Underdrain
2.1.13 Underdrain Pipe
2.2 SHORING AND BRACING MATERIALS

PART 3 EXECUTION

3.1 PREPARATION
3.2 PROTECTION
3.3 CLEARING AND GRUBBING
3.4 STOCKPILED MATERIALS
3.5 UNAUTHORIZED EXCAVATION
3.6 OSHA REQUIREMENTS FOR EXCAVATION
3.7 EXCAVATION FOR STRUCTURES
3.8 WATER REMOVAL
3.9 REMOVAL OF UNSATISFACTORY SOIL MATERIALS
3.10 PROOF-ROLLING
3.11 FILLING AND BACKFILLING
3.11.1 Preparations Prior to Placement
3.11.2 Placement and Compaction

3.11.3 CLSM Installation
3.12 COMPACTION
3.12.1 Percentage of Maximum Density Requirements
3.12.2 Moisture Control
3.13 GRADING
3.13.1 Subgrade Tolerances
3.14 RIRRAP DITCHES
3.15 UNDERDRAINS
3.16 MAINTENANCE
3.16.1 Protection of Graded Areas
3.16.2 Reconditioning Compacted Areas
3.17 DISPOSAL OF EXCESS AND WASTE MATERIALS

-- End of Section Table of Contents --

SECTION 31 00 00

EARTHWORK
1/02

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 252	(2008) Corrugated Polyethylene Drainage Pipe
AASHTO M 43	(2005) Sizes of Aggregate for Road and Bridge Construction

ASTM INTERNATIONAL (ASTM)

ASTM C 117	(2004) Standard Test Method for Materials Finer than 75-microns (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 136	(2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D 698	(2007; e1) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)
ASTM D 1557	(2007) Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2700 kN-m/cu m))
ASTM D 2487	(2006) Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 6398	(2008a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D 3740	(2008) Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used In Engineering Design and Construction
ASTM D 4318	(2005) Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index

	of Soils
ASTM D 448	(2008) Standard Classification for Size of Aggregate for Road and Bridge Construction
ASTM D 4491	(1999a; R 2004e1) Water Permeability of Geotextiles by Permittivity
ASTM D 4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM F 758	(1995; R 2007e1) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage

ACI INTERNATIONAL (ACI)

ACI 229R	(1999) Controlled Low Strength Materials (CLSM)

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926	(2009) Safety and Health Regulations for Construction

MARYLAND STATE HIGHWAY ADMINISTRATION (MSHA)

MSHA-III	(2008) Standard Specifications for Construction and Materials

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-03 Product Data
- Earthwork Materials
- Riprap
- Geotextile
- Underdrain Pipe

SD-06 Test Reports

- Proposed Materials
- Delivery Tickets
- Field Test Reports shall be submitted the day the area is tested

SD-07 Certificates

- Nuclear Density Device (if using radioactive density measuring device), which shall include GSFC Form 23-6I, Operator Qualifications, and State of Maryland Reciprocal Agreement w/ NRC (if so licensed) or General License Title (if so licensed)

- Testing agency qualifications.

Shoring and Bracing Materials
Excavation Permit Requests
Daily Reports

1.3 SAMPLING AND TESTING

1.3.1 Existing Conditions and Subsurface Data

All excavated material, excluding material classified as PT, shall be considered as a Satisfactory common backfill material in the area where excavated, unless modified by the COTR in the individual task.

1.3.2 Soil Testing and Inspection Service

A certified soil-testing service approved by the COTR shall be provided by the Contractor for field-testing for quality control during construction period.

Testing agencies shall conform to the requirements of ASTM D 3740.

1.3.3 Tests For Proposed Soil Materials

Materials shall be approved by the Contracting Officer prior to start of work.

MATERIAL	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Satis-factory soil materials	Sieve analysis	ASTM C 136	One from each source of materials to determine con-formance to definition of satisfactory soil materials; additional tests whenever there is any apparent change. This applies to imported material only, unless modified by the COTR in an individual task.
	Amount of material pass-ing No. 200 sieve	ASTM C 117	
	Liquid limit, Plastic limit, and plasticity index	ASTM D 4318	
	Mechanical analysis	ASTM D 422	
	Moisture-density (see Note 1 below)	ASTM D 698, Method C ASTM D 1557, Method C	
	Classifica-tion	ASTM D 2487	

NOTE: ASTM D 698 shall be used for grass, tree, shrub, sidewalk, and utility trench areas. ASTM D 1557 shall be used for slab and pavement areas.

1.3.4 Quality Control Testing During Construction

Soil materials shall be tested during construction as follows:

Tests on a lift shall be completed before starting installation of the succeeding lift.

For testing quantity purposes, lifts and Number of Tests requirements start with each work day.

MATERIAL	REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Soil materials specified			All tests previously required for proposed materials if materials to be used in construction differ from originally approved materials. No new material shall be installed without all tests having been performed, submitted, and approved.
Soil material-in-place after compaction	Density of soil-in-place (see Notes 1 and 2 below)	ASTM D 6398	Slabs and other loaded surface area: For each lift: one test per 2000 square ft., or minimum of 4 tests, whichever is greater. Sidewalk and incidental slab areas: For each lift: one test per 300 lineas feet, or minimum of 4 tests, whichever is greater. Grass, tree, and shrub areas (not including trench backfill): For each lift: one test per 10,000 square ft., or minimum of 4 tests, whichever is greater.
PROOF-ROLLING		COTR Inspection	Fully-loaded Tandem, passes sufficient to cover area

NOTE 1: Density of soil-in-place is indicated to be ASTM D 6398. Additional ASTM methods may be employed upon submission of procedure and approval by the government.

NOTE 2: For Tasks that have less than 500 tons of earthwork material placed, no field density testing shall be required, unless there is reason to believe that the soil-in-place density does not meet the specification requirements, then testing shall be done if requested by the COTR. For Tasks greater than 500 tons of earthwork material placed, field testing shall be accomplished in accordance with the requirements above.

1.3.5 Evaluation of Test Results

Results of density of soil-in-place tests shall be considered satisfactory if the average of any group of four consecutive tests which are selected is in each instance equal to or greater than the specified density, and if not more than one density test in five has a value more than 2 percentage points below the specified density.

When tests indicate that earthwork has not achieved degree of compaction required, the material shall be scarified, moistened or dried, or it shall be removed and replaced with soil to depth required, and recompacted and retested until required compaction is obtained.

PART 2 PRODUCTS

2.1 EARTHWORK MATERIALS

Materials shall be free of clay clods, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, and other deleterious matter and shall be as follows:

Note 1: The top 3 feet of fill/backfill embankment material outside and adjacent to a building slab, pavement, or other structural surface supporting superimposed loads shall be High Quality Satisfactory Soil Material that allows subsurface drainage to exterior grade. This embankment shall minimally extend 10 feet beyond the footprint, or to a depth of 3 feet, whichever is greater.

AREA CLASSIFICATION	EARTHWORK MATERIALS
Under footings/foundations	Undisturbed Earth
Under building slabs, and other structural slabs	Drainage Fill (to depth shown on the drawings, or minimum 5 inches).
Under Drainage Fill	High Quality Satisfactory Soil Material See Note 1 above.
Under Pavement	Graded Aggregate Base.
Under Graded Aggregate Base	High Quality Satisfactory Soil Material See Note 1 above.
Trench (under slabs or pavements)	CLSM - flowable fill (from top of bedding to underside of slab or

AREA CLASSIFICATION	EARTHWORK MATERIALS
	pavement section, unless otherwise indicated)
Sub-surface drainage systems	Drainage Fill (to extents indicated).
Under grassed, tree, and shrub areas	Low, Medium, or High Quality Satisfactory Soil Material.
Under sidewalks	Low, Medium, or High Quality Satisfactory Soil Material.

2.1.1 Engineered Fill

Engineered fill, if required, will be addressed by individual Tasks.

2.1.2 High Quality Satisfactory Soil Material

Satisfactory soil material shall mean ASTM D 2487 soil classifications GW, GP, GM, SW, and SP.

2.1.3 Medium Quality Satisfactory Soil Material

Medium quality satisfactory soil material shall mean ASTM D 2487 soil classifications GC, SC, SM, ML, and CL.

2.1.4 Low Quality Satisfactory Soil Material

Low quality satisfactory soil material shall mean ASTM D 2487 soil classifications MH and CH.

2.1.5 Unsatisfactory Soil Materials

Unsatisfactory soil material shall mean ASTM D 2487 soil classifications OL,OH, and PT, and earthwork materials of any area classification that have a moisture content at the time of compaction beyond the range necessary to achieve the required density.

2.1.6 Graded Aggregate Base Course Material

Refer to Section 32 11 24, Graded Aggregate Base (GAB), for material and installation requirements.

2.1.7 Drainage Fill

Drainage fill shall be a washed, narrow graded crushed gravel, crushed stone, or sand conforming to ASTM D 448, size 57.

2.1.8 Bedding

Bedding material shall be a naturally or artificially graded crushed gravel, crushed stone, or crushed sand conforming to ASTM D 448, size 89, 9, or 10.

2.1.9 Sand

Sand shall be natural sand.

2.1.10 Controlled Low Strength Material (CLSM)

CLSM - shall comply with ACI 229R and Section 03 30 00, "Cast-In-Place Concrete".

2.1.11 Stone Riprap for Ditches

Stone for riprap shall be field or quarry stone from an approved source. Riprap shall be uniformly graded from the smallest to the largest pieces. The maximum dimension shall not exceed four times the minimum dimension. the stone will be accepted upon visual inspection at the point of usage as follows, conforming to MSHA-III, Section 901.02.01, Class I:

CLASS OF RIPRAP	SIZE	PERCENT OF TOTAL by weight
I	Heavier than 150 pounds	0
	Heavier than 40 pounds	50
	Less than 2 pounds	10 max

Optimum gradation is 50 percent of the stone being above and 50 percent of the stone being below the midsize. Reasonable visual tolerances apply.

Capping stone shall conform to AASHTO M 43, size 2 inch to 4 inch.

2.1.12 Geotextile

2.1.12.1 Geotextile for Riprap Base

Geotextile shall conform to MSHA-III Section 921.09, with a minimum Grab Strength of 200 pounds when tested in accordance with ASTM D 4632, and a maximum Apparent Size Opening of 0.30 millimeter when tested in accordance with ASTM D 4751.

2.1.12.2 Geotextile for Underdrain

Geotextile shall conform to MSHA-III Section 921.09, with a minimum Grab Strength of 120 pounds when tested in accordance with ASTM D 4632, and a maximum Apparent Size Opening of 0.21 millimeter when tested in accordance with ASTM D 4751, and shall additionally have a minimum flow rate of 125 gallons per minute per square foot when tested in accordance with ASTM D 4491.

2.1.13 Underdrain Pipe

Underdrain pipe shall conform to ASTM F 758 Schedule 40 PVC, or AASHTO M 252 Type S HDPE, 6 inch diameter, Class 2 perforations.

2.2 SHORING AND BRACING MATERIALS

Materials need not be new, but shall be in a servicable condition.

PART 3 EXECUTION

3.1 PREPARATION

No earthwork shall be performed without a signed and approved Excavation Permit provided by the Government.

Before earthwork is started, the location of all adjacent underground utilities shall be carefully verified by hand methods. Utilities to be left in place shall be protected from damage.

No existing utility indicated for removal shall be removed without a signed and approved Utility Outage provided by the Government.

During the course of the work, the contractor shall maintain as-built drawings, clearly marking all new work, changes, and utilities encountered with accurate location and elevation. All work shall be referenced using GSCM-1.

Clearly delineate the extents of earthwork bounderies by marking as indicated in paragraph below entitled "PROTECTION".

3.2 PROTECTION

Earthwork areas shall be barricaded, taped, and posted with warning signs for the safety of persons. Warning lights shall be provided during hours of darkness.

Adjacent structures, pavements, utilities, etc. shall be protected against damage, including settlement, lateral movement, undermining, washout, or other harmful conditions. Clearly mark existing conditions not to be disturbed.

Existing conditions outside the extent of clearing and grubbing shall be protected from damage by clearing and grubbing operations.

3.3 CLEARING AND GRUBBING

It is not intended that work under this contract shall require significant clearing and grubbing of large woody plants when performing a work item. Clearing and grubbing, if required to implement work items, shall consist of the removal of an occasional tree within the work area not exceeding 6 inch diameter breast height or 25 feet in height. Other areas shall be shrubbery, field grass, mulched areas, turfgrass, etc.

Remove obstructions, trees, shrubs, grass, vegetation, and other organic matter to permit installation of new work.

Strip topsoil to whatever depths encountered to prevent intermingling with underlying soil or other material.

Completely remove stumps roots, obstructions, and debris of cleared areas. Use only hand methods for grubbing within dripline of trees remaining.

Fill depresions caused by clearing and grubbing with earthwork materials suitable for the type of area.

3.4 STOCKPILED MATERIALS

Stockpiled materials shall be placed, graded, and shaped for proper drainage. Differing materials shall be separated to preclude intermixing. Adequate sediment control shall be provided for all stockpiles. Stockpiles shall not be adjacent to excavations nor within tree drip-lines.

3.5 UNAUTHORIZED EXCAVATION

Unauthorized excavation shall consist of removal of materials beyond indicated elevation, depth or extents without specific direction and shall be replaced as specified at no additional cost to the Government.

Unauthorized excavation under foundations shall be filled by lowering the bottom elevation of the foundation to the excavation bottom without altering the approved top elevation. Reduced bearing capacities resulting from improper Contractor techniques (softening due to surface water contamination, overexcavation, etc.) shall be corrected at the Contractor's expense.

Elsewhere unauthorized excavations shall be backfilled and compacted as specified for authorized excavations of the same classification.

3.6 OSHA REQUIREMENTS FOR EXCAVATION

The Contracotr shall comply with the requirements for excavation as outlined in OSHA regulations 29 CFR 1926, Subpart P, Excavation.

Excavations shall be provided with protective systems utilizing either sloping/benching techniques or the use of shoring/bracing techniques. If sloping/benching is used, sides shall not be sloped steeper than 1.5:1 (Horizontal:Vertical)(34 degrees from the horizontal) unless designed in accordance with OSHA requirements.

Sloping/benching shall not be used in areas adjacent to vehicular traffic or other vibrational sources.

Shoring and bracing in excavations shall be maintained regardless of the length of time excavations will be open. Shoring and bracing shall be carried down with the excavation.

Wherever subsequent removal of sheet piling could permit the lateral movement of soil under adjacent structures, steel sheet piling or pressure-creosoted timber sheet piling shall be used and left permanently in place, cut off as required.

3.7 EXCAVATION FOR STRUCTURES

Excavation for structures shall conform to the dimensions and elevations indicated and shall extend a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services and other construction indicated, and for inspection.

In excavating for footings and foundations, care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall be done just before concrete is placed. Bottoms shall be trimmed to the required lines and grades to leave a solid bed to receive concrete.

Bottom of footing or foundation shall be verified to meet the bearing capacity requirements indidcated on the drawings. No footing or foundation shall be installed prior to approval of test results. Where bearing capacity is less than required, the Contracting Officer shall be notified.

3.8 WATER REMOVAL

Water shall not be permitted to accumulate in earthwork areas. Dewatering systems shall be provided by the Contractor to convey water away from excavations and earthwork area so that softening of foundation bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur. Dewatering systems and methods of disposal shall be approved by the Contracting Officer.

Dewatering shall be continued until construction subject to water pressure has obtained full specified strength and backfill is completed.

Water removal from earthwork area shall be conveyed to approved collecting or runoff areas. Temporary drainage ditches and other diversions as necessary shall be provided and maintained outside of earthwork area limits. Pumped water must pass through an approved sediment control device such as a geotextile filter bag attached to the end of the pumping hose.

Trench excavations for utilities shall not be used for temporary drainage ditches.

3.9 REMOVAL OF UNSATISFACTORY SOIL MATERIALS

Unsatisfactory soil materials encountered that extend below the required elevations shall be excavated to the depth directed.

3.10 PROOF-ROLLING

Prior to installation of fill or backfill in building slab and pavement areas, the subgrade shall be proofrolled with a loaded tandem dump truck to identify any soft pockets or areas of excess yeilding in the presence of the COTR. Do not proofroll wet or saturated subgrades.

3.11 FILLING AND BACKFILLING

3.11.1 Preparations Prior to Placement

Earthwork shall be placed as promptly as the work permits but not until completion of the following:

Completion and approval of construction below finish grade

Inspection, testing, approval, and recording location of underground utilities

Removal of falsework

Removal of shoring and bracing and filling of voids with satisfactory soil material

Removal of trash and debris

Vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials shall be removed from ground surface prior to the

placement of earthwork.

Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stripped, or broken up in such manner that fill material will bond with the existing material.

3.11.2 Placement and Compaction

Earthwork materials shall be placed in lifts not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand operated tampers. Before compaction, each lift of material shall be moistened or aerated as necessary to be compacted to the percentage of maximum density for each area classification as specified. Earthwork material shall not be placed on surfaces that are muddy, frozen, icy, or contain frost.

Earthwork materials adjacent to structures shall be brought up evenly around structures and shall be carried up to the indicated elevations.

Compaction adjacent to structures (not including reinforced manholes or valve boxes), within a horizontal distance from the face of the structure equal to the depth of earthwork material (measured from the bottom of footing or bottom of foundation) to final grade, shall be done with power-driven hand tampers.

Compaction adjacent to and over top of utilities shall be done with power-equipment of capacity that will not damage the utility.

3.11.3 CLSM Installation

CLSM shall be placed continuous, and should not require any vibration for consolidation. CLSM shall be protected from freezing before hardening.

3.12 COMPACTION

3.12.1 Percentage of Maximum Density Requirements

Actual density of each lift of earthwork material-in-place shall be not less than the following percentages of the maximum density of the same soil material determined by the moisture-density test specified.

AREA CLASSIFICATION	PERCENT MAXIMUM DENSITY
Building slabs, pavements, and other structural slabs, Subbase Courses	Top 1 foot: 97% Below top 1 foot: 95%
Utility Trenches	90%
Sidewalks	90%
Grass, Tree, and Shrub Areas	90%

3.12.2 Moisture Control

Where the moisture content of a lift of soil material is too low before compaction, the required amount of water shall be uniformly applied to the surface of the lift of soil material and the lift of soil disked or otherwise mixed until a uniform moisture content is reached.

Moisture content of a lift of soil material that is excessive shall be removed by drying.

3.13 GRADING

Areas subjected to earthwork shall be uniformly graded. Finished surface shall be smooth, within tolerances, compacted, and with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

Areas outside the building lines for each structure shall be hand-graded to drain away from the structure and to prevent ponding of water after rains.

In no instance shall subgrade tolerance impede proper drainage.

3.13.1 Subgrade Tolerances

AREA	TOLERANCE
Building Slabs, Concrete/Asphaltic Pavements, or Other Structural Slabs, Sidewalks, Steps, and Incidental Slab Areas	+/- 1/2 inch
All Other Areas	+/- 1 inch

3.14 RIRRAP DITCHES

Ditches shall conform to line and grade. Ensure that the ditch sides and bottom are smooth and firm, free from protruding objects that would damage the geotextile.

Place the geotextile on the prepared subgrade with the adjacent edges overlapped at least 2 feet. Replace or repair damaged geotextile.

Place stones by mechanical or other acceptable method to produce a reasonably graded mass of stone. Methods that cause extensive segregation are unacceptable. Cap riprap with capping stone.

3.15 UNDERDRAINS

Trench excavation for underdrains shall conform to line and grade. Ensure that sides and and bottom are smooth and firm, free from protruding objects that would damage or tear the geotextile.

Place the geotextile in the prepared trench. Ensure that it is of sufficient width to completely enclose the underdrain trench, including overlaps. Place the geotextile tightly against the trench to eliminate voids beneath the geotextile. Avoid wrinkles and folds. Maintain at least a 2 foot overlap at joint ends or breaks. Pin joints and overlaps to securely hold the geotextile in place until placement of the cover material. Pin longitudinal joint, overlaps, and edges no more than 50 feet on center. Replace or repair damaged geotextile.

Place the underdrain pipe slope to maintain positive drainage toward the outlet, minimum of 0.5 percent. Place the pipe with 3 inch of stone below the pipe invert. Place perforated pipes with the perforations down and arranged symmetrically about the vertical axis. Make joints and

connections in accordance with the manufacturer's recommendations.

Underdrains shall be 24 inch deep by 18 inch wide, with underdrain pipe and drainage fill, wrapped in geotextile. Geotextile shall be overlapped a minimum of 11 inch. Outlet to structure or natural grade as required.

3.16 MAINTENANCE

3.16.1 Protection of Graded Areas

Newly graded areas shall be protected from traffic and erosion and shall be maintained free of trash and debris.

3.16.2 Reconditioning Compacted Areas

Where approved compacted areas are disturbed by subsequent construction operations or adverse weather, the area (to depth required) shall be scarified, reshaped, and compacted as specified to the required density prior to further construction.

3.17 DISPOSAL OF EXCESS AND WASTE MATERIALS

Excess soil materials shall be disposed of per work item schedule. If the work item schedule does not indicate method of disposal, then excess materials shall be removed from Government Property.

Waste materials, trash, and debris, shall be removed from Government property.

Permits and fees for disposal shall be paid by the Contractor.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 01 16.17

COLD MILLING OF BITUMINOUS PAVEMENTS

08/08

PART 1 GENERAL

1.1 EQUIPMENT
1.1.1 Milling Machine
1.1.2 Grinding for Pavement Repair

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 MILLING OPERATION
3.2 CONTRACTOR QUALITY CONTROL
3.2.1 Depth Tests
3.2.2 Flatness Tests
3.3 REMOVAL OF MILLED MATERIAL

-- End of Section Table of Contents --

SECTION 32 01 16.17

COLD MILLING OF BITUMINOUS PAVEMENTS
08/08

PART 1 GENERAL

1.1 EQUIPMENT

1.1.1 Milling Machine

Provide a cold-milling power operated planing machine or grinder capable of removing, in one pass, a layer of asphalt pavement at the specified depth and at least half the lane width. The machine shall be capable of accurately establishing profile grade control and have a positive means for controlling slope elevation. The machine shall be capable of preventing dust from escaping into the atmosphere. The resultant surface shall be true to the established grade and be skid resistant.

1.1.2 Grinding for Pavement Repair

Equipment used to repair defects in HMA operations shall be grinding equipment that has a cutting mandrel with carbide tipped cutting teeth and designed specifically for grinding asphalt surfaces to close tolerances. The equipment shall accurately establish slope elevations and profile grade controls. Follow immediately behind the grinding machine with a vacuum equipped street sweeper, capable of removing all loose material from the roadway without causing dust to escape into the air.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 MILLING OPERATION

Milling shall proceed with care to the specified depth. Areas adjacent to manholes, inlets, valve boxes, gutter pans, etc. that could be damaged by milling shall be removed by hand methods. The milled material shall be removed from the pavement and loaded into trucks.

Mill one lane at a time. If the milling depth exceed 2-1/2 inches on highways carrying traffic, mill the abutting lane or shoulder on the same day. Mill the abutting lane or shoulder, regardless of depth, prior to weekends or temporary shutdowns. Otherwise, if the milling depth is 2-1/2 inches or less, the abutting lane or should may be milled on alternate days. Where uneven pavement joints exist, provide adequate advance warning signs.

When HMA paving is being applied to the traveled way carrying traffic with a posted speed less than or equal to 40 miles per hour, construct a temporary tie-in at least 4 feet in length for each 1 inch of pavement depth. When HMA paving is being applied to the traveled way carrying traffic with a posted speed greater than 40 miles per hour, construct a temporary tie-in at least 10 feet in length for each 1 inch of pavement depth. Construct temporary tie-ins before traffic is allowed to cross the transverse joint. Construct temporary tie-ins 10 foot or greater using a

paver.

After the milling operation is complete, fill all depressions, potholes, and other irregularities using HMA. Construct an HMA wedge at existing valves, manholes, inlets, etc., if the work is not overlaid prior to returning the area to traffic.

3.2 CONTRACTOR QUALITY CONTROL

The Contractor shall be responsible for providing all necessary effort to perform quality control testing and reporting. Report shall be provided to the COTR on the day of the work. Repairs, if required, shall be reviewed and agreed with the COTR before continuing the work.

Tests shall be performed in the presence of the COTR.

3.2.1 Depth Tests

Test the milled surface for conformance with the requirements by running lines of levels at intervals of 25 feet longitudinally and 25 feet transversely to determine the elevation of the completed pavement. Areas shall be within 1/8 inch of specified depth. Incomplete depth shall be further milled to bring in conformance. Areas of excess depth shall be filled with hot-mix asphalt at no additional cost during subsequent overlay operations. If overlay is not occurring, and the milled surface is the final surface, then skin patching for correcting low areas will not be permitted. Remove and replace the deficient low area. Remove sufficient material to allow at least 1 inch of asphalt concrete to be placed.

3.2.2 Flatness Tests

Test the finished milled surface with a 10 foot straightedge. Other approved devices may be used, provided that when satisfactorily and properly operated, such devices reveal all surface irregularities exceeding the tolerances specified. Correct surface irregularities that depart from the testing edge by more than 1/8 inch for general milling, or 1/16 inch for grinding milling, by additional milling to bring in conformance per procedure indicated above.

3.3 REMOVAL OF MILLED MATERIAL

Material that is removed shall become the property of the Contractor and disposed of off-site. Area shall be broomed, swept, or vacuumed as needed to remove dust prior to returning area to traffic.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 01 17.16

CRACK SEALING IN BITUMINOUS PAVEMENTS

08/08

PART 1 GENERAL

1.1 REFERENCES
1.2 SYSTEM DESCRIPTION
1.2.1 Routing Equipment
1.2.2 Concrete Saw
1.2.3 Sandblasting Equipment
1.2.4 Waterblasting Equipment
1.2.5 Hand Tools
1.2.6 Crack Sealing Equipment
1.3 SUBMITTALS
1.4 DELIVERY, STORAGE, AND HANDLING

PART 2 PRODUCTS

2.1 SEALANTS
2.2 BACKUP MATERIALS

PART 3 EXECUTION

3.1 PREPARATION OF CRACKS
3.1.1 Cracks
3.1.1.1 Hairline Cracks
3.1.1.2 Small Cracks
3.1.1.3 Medium Cracks
3.1.1.4 Large Cracks
3.1.2 Existing Sealant Removal
3.1.3 Routing
3.1.4 Sawing
3.1.5 Sandblasting
3.1.6 Backup Material
3.1.7 Rate of Progress of Crack Preparation
3.2 PREPARATION OF SEALANT
3.3 INSTALLATION OF SEALANT
3.3.1 Time of Application
3.3.2 Sealing the Crack
3.4 CLEANUP
3.5 CONTRACTOR QUALITY CONTROL
3.5.1 Crack Cleaning
3.5.2 Crack Seal Application Equipment
3.5.3 Crack Sealant

-- End of Section Table of Contents --

SECTION 32 01 17.16

CRACK SEALING IN BITUMINOUS PAVEMENTS
08/08

PART 1 GENERAL

1.1 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 C 509	(2006) Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM D 6690	(2007) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM D 789	(2007) Standard Method for Determination of Solution Viscosities of Polyamide (PA)

MARYLAND STATE HIGHWAY ADMINISTRATION (MSHA)

MSHA-III	(2008) Standard Specifications for Construction and Materials

1.2 SYSTEM DESCRIPTION

Installation shall comply with MSHA-III, Section 510, Filling Cracks in Hot Mix Asphalt Pavements.

1.2.1 Routing Equipment

Provide routing equipment which is a self-powered machine operating a power driven tool or bit specifically designed for routing bituminous pavements. The bit shall rotate about a vertical axis at sufficient speed to cut a smooth vertical-walled reservoir in the pavement surface and shall maintain accurate cutting without damaging the sides or top edges of the reservoir. Provide a router capable of following the trace of the crack without deviation.

1.2.2 Concrete Saw

Provide a self-propelled power saw with small diameter (6 inches or less) water-cooled diamond or abrasive saw blades for cutting cracks to the depths and widths specified and for removing filler that is embedded in the cracks or adhered to the crack faces. The diameter of the saw blade shall be small enough to allow the saw to closely follow the trace of the crack.

1.2.3 Sandblasting Equipment

Include in the sandblasting equipment an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. The maximum nozzle opening shall not exceed 1/4 inch. The air compressor shall be portable; and shall be capable of furnishing not less than 150 cfm and maintaining a line pressure of not less than 90 psi at the nozzle while in use. Demonstrate compressor capability under job conditions before approval. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the crack about 1 inch above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle as necessary to secure satisfactory results.

1.2.4 Waterblasting Equipment

Include with the waterblasting equipment a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. The water tank and auxiliary resupply equipment shall be of sufficient capacity to permit continuous operations. The hose, wand, and nozzle shall be capable of cleaning the crack faces and the pavement surface on both sides of the crack for a width of at least 1/2 inch. A pressure gauge mounted at the pump shall show at all times the pressure inpsi at which the equipment is operating.

1.2.5 Hand Tools

Hand tools may be used, when approved, for removing defective sealant from cracks and repairing or cleaning the crack faces.

1.2.6 Crack Sealing Equipment

Provide unit applicators, used for heating and installing the hot-poured crack sealant materials, that are mobile and equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the crack to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. Allow the sealant to circulate through the delivery hose and return to the inner kettle when not in use, due to the applicator unit design.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealant and Backup material, including Manufacturer's Installation instructions

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the job site for defects; unload, and store them with a minimum of handling to avoid damage. Provide storage facilities at the job site to protect materials from weather and to maintain them at the temperatures recommended by the manufacturer.

PART 2 PRODUCTS

2.1 SEALANTS

Provide sealant conforming to ASTM D 6690, Type II.

2.2 BACKUP MATERIALS

Provide backup material that is a compressible, nonshrink, nonstaining, nonabsorptive material and nonreactive with the crack sealant. The melting point of the backing material shall be at least 5 degrees F greater than the maximum pouring temperature of the sealant being used, when tested in accordance with ASTM D 789. The material shall have a water absorption of not more than 5 percent by weight when tested in accordance with ASTM C 509. The backup material shall be 25 percent (plus or minus 5 percent) larger in diameter than the nominal width of the crack.

PART 3 EXECUTION

3.1 PREPARATION OF CRACKS

Immediately before the installation of the crack sealant, thoroughly clean the cracks to remove oxidized pavement, loose aggregate and foreign debris. The preparation shall be as follows:

3.1.1 Cracks

3.1.1.1 Hairline Cracks

Cracks that are less than 1/8 inch wide are not sealed by crack filling.

3.1.1.2 Small Cracks

Cracks that are 1/8 to 3/4 inch wide shall be routed to a nominal width 1/8 inch greater than the existing nominal width and to a depth not less than 3/4 inch, waterblasted and cleaned and dried using compressed air.

3.1.1.3 Medium Cracks

Cracks that are 3/4 to 2 inches wide shall be waterblasted and cleaned and dried using compressed air.

3.1.1.4 Large Cracks

Cracks that are greater than 2 inches wide shall be repaired using HMA techniques.

3.1.2 Existing Sealant Removal

Cut loose the in-place sealant from both crack faces and to firm substrate, using a concrete saw or hand tools as specified in paragraph EQUIPMENT. Depth shall be sufficient to accommodate any backup material that is required to maintain the depth of new sealant to be installed. Prior to further cleaning operations, remove all old loose sealant remaining in the crack opening by blowing with compressed air.

3.1.3 Routing

Perform routing of the cracks using a rotary router with a bit that is at least 1/8 inch wider than the nominal width of the crack to remove all residual old sealant (resealing), oxidized pavement and any loose aggregate in the crack wall.

3.1.4 Sawing

Perform sawing of the cracks using a power-driving concrete saw as specified in paragraph EQUIPMENT. Stiffen the blade as necessary with suitable dummy (or used) blades or washers. Immediately following the sawing operation, clean the crack opening using a water jet to remove all saw cuttings and debris.

3.1.5 Sandblasting

Sandblast clean the crack faces and the pavement surfaces extending a minimum of 1/2 inch from the crack edges. Use a multiple-pass technique until the surfaces are free of dust, dirt, old sealant residue, or foreign debris that might prevent the sealant material from bonding to the asphalt pavement. After final cleaning and immediately prior to sealing, blow out the cracks with compressed air and leave them completely free of debris and water. Ensure that sandblasting does not damage the pavement.

3.1.6 Backup Material

Use backup material on all cracks that have a depth greater than 3/4 inch. Insert the backup material into the lower portion of the crack as shown on the drawings. Ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

3.1.7 Rate of Progress of Crack Preparation

Limit the stages of crack preparation, which include routing, waterblasting of the crack faces, air pressure cleaning and placing of the backup material, to only that linear footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

Do not heat hot-poured sealants in excess of the safe heating temperature recommended by the manufacturer, as shown on the sealant containers. Withdraw and waste sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation.

3.3 INSTALLATION OF SEALANT

3.3.1 Time of Application

The ambient air temperature and the pavement temperature within the joint wall shall be a minimum of 50 degrees F and rising at the time of application of the materials. Do not apply sealant if moisture is observed in the crack.

Seal cracks immediately following final cleaning of the crack walls and following the placement of the backup material (when required). Cracks that cannot be sealed under the conditions specified, or when rain

interrupts sealing operations, shall be recleaned and allowed to dry prior to installing the sealant.

3.3.2 Sealing the Crack

Immediately preceding, but not more than 50 feet ahead of the crack sealing operations, perform a final cleaning with compressed air. Fill the cracks from the bottom up to 1/16 inch below or level with the pavement surface. Remove excess or spilled sealant from the pavement by approved methods and discard it. If after 2 hours any filled crack is not in conformance with this requirement, refill the crack as required. Install the sealant in a manner which prevents the formation of voids and entrapped air. Several passes with the applicator wand may be necessary to obtain the specified sealant depth from the pavement surface. Do not use gravity methods or pouring pots to install the sealant material. Cracks shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within 3 hours.

3.4 CLEANUP

Upon completion of the project, remove unused materials from the site and leave the pavement in a clean condition.

3.5 CONTRACTOR QUALITY CONTROL

3.5.1 Crack Cleaning

Cleaned cracks shall be approved by the COTR prior to installation of the crack sealant.

3.5.2 Crack Seal Application Equipment

Inspect the application equipment to ensure conformance to temperature requirements and proper installation. Evidences of bubbling, improper installing, and failing to cure or set will cause to suspend operations until causes of the deficiencies are determined and corrected.

3.5.3 Crack Sealant

Inspect the crack sealant for proper cure and set rating, bonding to the bituminous pavement, cohesive separation within the sealant, reversion to liquid, and entrapped air and voids. Sealants exhibiting any of these deficiencies, at any time prior to the final acceptance of the work, shall be removed from the crack, wasted, and replaced as specified herein at no additional cost.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 11 24

GRADED AGGREGATE BASE (GAB)

08/08

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 SAMPLING AND TESTING
1.3.1 Soil Testing and Inspection Service
1.4 SYSTEM DESCRIPTION AND EQUIPMENT

PART 2 PRODUCTS

2.1 GAB AGGREGATE

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION
3.2 TRANSPORTING AND DELIVERY
3.3 GAB PLACEMENT
3.4 COMPACTING AND FINISHING
3.5 CONTRACTOR QUALITY CONTROL
3.5.1 Task Tonnage Less Than 500 Tons
3.5.2 Task Tonnage Exceeds 500 Tons
3.6 MAINTENANCE

-- End of Section Table of Contents --

SECTION 32 11 24

GRADED AGGREGATE BASE (GAB)
08/08

PART 1 GENERAL

1.1 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 D 1556	(2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2007) Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft) (2700 kN-m/cu m)
ASTM D 6938	(2008a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D 3740	(2008) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

MARYLAND STATE HIGHWAY ADMINISTRATION (MSHA)

MSHA-III	(2008) Standard Specifications for Construction and Materials

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

GAB Material

SD-06 Test Reports

Delivery Tickets
Field Testing Data
Laboratory Density Data

SD-07 Certificates

Nuclear Density Device (if using radioactive density measuring device), which shall include GSFC Form 23-6I, Operator

Qualifications, and State of Maryland Reciprocal Agreement w/ NRC (if so licensed) or General License Title (if so licensed)

1.3 SAMPLING AND TESTING

1.3.1 Soil Testing and Inspection Service

A certified soil-testing service approved by the COTR shall be provided by the Contractor for field-testing for quality control during construction period.

Testing agencies shall conform to the requirements of ASTM D 3740.

1.4 SYSTEM DESCRIPTION AND EQUIPMENT

Perform the work consisting of graded aggregate base course to be used underneath asphalt pavement, which is composed of crushed graded mineral aggregate screened and processed in a central plant and placed on a prepared subgrade. Construct each course to the depth, section, or elevation required and roll, finish, and approve it before the placement of the next course.

Materials and installation shall comply with MSHA-III, Part 3, Technical Requirements, as described herein, unless otherwise indicated or modified.

Spreading equipment shall be suitable for the task and shall prevent segregation of the coarse aggregate. Rollers for compaction shall comply with Section 32 12 16, Hot Mix Asphalt (HMA).

PART 2 PRODUCTS

2.1 GAB AGGREGATE

GAB aggregate shall conform to MSHA-III, Section 901, classification Graded Aggregate - Base.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

Before beginning GAB construction, complete the approved subgrade to final line and grade at least 500 feet ahead. Construct the foundation as specified in 31 00 00, Earthwork. If traffic, including construction equipment, is allowed to use the subgrade foundation or preceeding layer, distribute the loading over the entire width of the course to aid in obtaining uniform and thorough compaction. Remove rutting by reshaping and recompacting the affected area.

The subgrade shall be proof-rolled with a fully loaded tandem dump truck prior to the start of GAB installation. Proofrolling shall not be conducted when precipitation has occurred during the previous 24 hours, or when the COTR determines that the subgrade is not sufficiently dry. When under the action of the proof rolling, the subgrade yields, pumps, or otherwise fails, the COTR shall determine whether to delay proof rolling for further drying, or whether additional excavation and subgrade replacement shall be required.

3.2 TRANSPORTING AND DELIVERY

Handle and transport GAB material in a manner that minimizes segregation and loss of moisture. Cover all loads in accordance with State laws unless hauling is off road and is approved. Unless approved, do not dump material into piles, haul over the completed GAB, or stockpile on the job site.

3.3 GAB PLACEMENT

Place GAB when the ambient air and surface temperatures are at least 32 degrees F and rising. Do not place material on frozen subgrade.

Spread the GAB material uniformly and in layers of approximately equal thickness, to provide the specified depth. Avoid segregation of the coarse material. Build shoulders or berms at least 2 feet wide on each side of the base and to the top elevation of each uncompacted layer, except when placing the base against concrete curbs or gutters.

Do not place material during precipitation. When precipitation has occurred during the previous 24 hours, the COTR will determine if the subgrade or previous GAB course is sufficiently dry, or if the previously approved subgrade or GAB course shows evidence of yielding, pumping, or failing it shall be considered insufficiently dry and placement shall terminate until conditions are suitable. If precipitation begins during placement, then placement shall be terminated.

Shape the surface of the GAB material to the specified line, grade, and cross section. Set grades longitudinally and transversely with fixed controls spaced no greater than 25 feet.

When a compacted course 6 inches in thickness is required, place material in a single layer. When a compacted course in excess of 6 inches is required, place material in layers of equal thickness. Do not exceed 6 inches or have less than 3 inches in thickness for any compacted layer.

3.4 COMPACTING AND FINISHING

Immediately after placement, compact the material to the required density. During compaction operations, maintain the moisture content of the material to within 2 percent of optimum moisture. Compact the layer with steel-faced, vibrating or pneumatic-tired rollers, or other suitable compacting equipment or combinations thereof. Continue compacting until the layer is compacted through the full depth to a field density of at least 97 percent of the maximum density at optimum moisture content. In areas not accessible to rollers or compactors, compact the mixture with mechanical hand tampers using reduced layer thicknesses.

Begin compaction operations, except on superelevated curves, at the sides of the course. Overlap the shoulder or berm at least 1 foot and progress toward the center parallel to the center line of the roadway. On superelevated curves, begin compaction at the low side and progress toward the high side. Continue compaction operations until all compaction marks are removed.

If the mixture is excessively moistened by rain, aerate by blade graders, or other suitable equipment. Aerate until the moisture content of the material is that needed to obtain the required density. Finish the surface of the layer by a combination of rolling and blading. Final surface shall be smooth and free from waves, irregularities, and ruts or soft yielding

spots. Recondition, reshape, and recompact areas damaged by freezing, rainfall, other weather conditions, or construction or other traffic.

3.5 CONTRACTOR QUALITY CONTROL

The Contractor shall be responsible for providing all necessary effort to perform quality control testing and reporting. Report shall be provided to the COTR on the day of the work. Repairs, if required, shall be reviewed and agreed with the COTR before continuing the work.

3.5.1 Task Tonnage Less Than 500 Tons

a. Delivery Tickets - furnish copies of supplier delivery ticket with gross, tare, and net load tonnage; daily cumulative job tonnage; and GAB designation.

b. Smoothness - Test with a 10 foot straightedge, applied parallel with and at right angles to the center line of the paved area. Correct deviations in the surface in excess of 3/8 inch by loosening, adding or removing material, reshaping, watering, and compacting. The smoothness requirements specified herein apply only to the top layer when base course is constructed in more than one layer.

c. Grade - Finish grade of the GAB shall be within 1/2 inch of the required grade or elevation.

d. Thickness - Measure thickness of GAB course at intervals such that there will be a depth measurement for at least each 500 square yards of complete base course. Make depth measurements by test holes, at least 3 inches in diameter, through the base course. Where base course deficiency is more than 1/2 inch, correct by scarifying, adding mixture of proper gradation, reblading, and recompacting. Where the measured thickness is more than 1/2 inch thicker than indicated, consider it as the indicated thickness plus 1/2 inch for determining the average. The average thickness is the average of the depth measurements and shall not underrun the thickness indicated.

e. Density testing is not required for task tonnage less than 500 tons, unless there is cause to question the Contractor's ability to achieve the target density, including inadequate compaction effort, yielding subgrade, or moisture conditions outside the optimal range.

3.5.2 Task Tonnage Exceeds 500 Tons

The Contractor shall perform all quality control as indicated for task tonnage less than 500 tons. In addition the Contractor shall conduct nuclear gauge testing in the presence of the COTR to monitor GAB density in accordance with ASTM D 1556 or ASTM D 6938. Maximum density shall be determined in the laboratory in accordance with ASTM D 1557, Method D.

3.6 MAINTENANCE

After construction is completed, maintain the GAB course. Maintenance includes drainage, rolling, shaping, and watering, as necessary, to maintain the course in proper condition. Correct deficiencies in thickness, composition, construction, smoothness, and density, which develop during the maintenance, to conform to the requirements specified herein. When maintenance cannot be accomplished by repair, replace for the full depth of the GAB. Maintain sufficient moisture by light sprinkling

with water at the surface to prevent a dusty condition.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 12 16

HOT-MIX ASPHALT (HMA)

08/09

PART 1 GENERAL

1.1 REFERENCES
1.2 SYSTEM DESCRIPTION AND EQUIPMENT
1.2.1 Asphalt Mixing Plant
1.2.2 Geotextile Paving Fabric Equipment
1.2.3 Hauling Units
1.2.4 Pavers
1.2.5 Rollers
1.3 SUBMITTALS
1.4 SAMPLING AND TESTING
1.4.1 HMA Testing and Inspection Service

PART 2 PRODUCTS

2.1 GEOTEXTILE PAVING FABRIC
2.2 HOT MIX ASPHALT
2.3 TACK COAT

PART 3 EXECUTION

3.1 GEOTEXTILE PAVING FABRIC INSTALLATION
3.2 FOUNDATION PREPARATION
3.3 TACK COAT
3.4 TRANSPORTING AND DELIVERY
3.5 HOT MIX ASPHALT PLACEMENT
3.6 COMPACTION
3.7 JOINTS
3.8 EDGE DROP-OFF
3.9 TIE-IN
3.10 CONTRACTOR QUALITY CONTROL
3.10.1 Task Tonnage Less Than 500 Tons
3.10.2 Task Tonnage Exceeds 500 Tons

-- End of Section Table of Contents --

SECTION 32 12 16

HOT-MIX ASPHALT (HMA)
08/09

PART 1 GENERAL

1.1 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 M 288	(2006) Standard Specification for Geotextile Specification for Highway Applications

ASPHALT INSTITUTE (AI)

AI MS-04	(1989 Edition) The Asphalt Handbook

ASTM INTERNATIONAL (ASTM)

ASTM D 2950	(2005) Density of Bituminous Concrete in Place by Nuclear Methods
ASTM D 3740	(2008) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 995	(1995b; R 2002) Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

MARYLAND STATE HIGHWAY ADMINISTRATION (MSHA)

MSHA-III	(2008) Standard Specifications for Construction and Materials

1.2 SYSTEM DESCRIPTION AND EQUIPMENT

Perform the work consisting of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared foundation. Construct each course to the depth, section, or elevation required by the drawings and roll, finish, and approve it before the placement of the next course.

Materials and installation shall comply with MSHA-III, Part 3, Technical Requirements, as described herein, unless otherwise indicated or modified. All contract work is fixed price. Pay factors for incentives, reductions, and adjustments to liquid asphalt price do not apply.

1.2.1 Asphalt Mixing Plant

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of ASTM D 995.

1.2.2 Geotextile Paving Fabric Equipment

Equipment for handling geotextile paving fabric shall be a tractor or similar mechanical device with mounted laydown equipment that is capable of handling full rolls of fabric. The equipment shall be capable of laying the fabric smoothly without excessive wrinkles and/or folds.

1.2.3 Hauling Units

Trucks for hauling HMA shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material (petroleum based products shall not be used)as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather and ensure that the mixture will be delivered to the site at no less than the minimum placement temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened. Each unit shall have convenient access from ground level to insert thermometers to determine mix temperature.

1.2.4 Pavers

Pavers shall be self-propelled, with an activated screed, heated, and capable of spreading and finishing courses of HMA to meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling unit without adversely affecting the finished surface.

Pavers shall have an integral receiving hopper of sufficient capacity to permit a uniform spreading operation and equipped with a distribution system and augers to place the mixture uniformly in front of the screed without segregation of the coarse aggregate particles. The screed shall produce a finished surface of the required smoothness and texture without tearing, shoving, or gouging the mixture.

Pavers shall have automatic controls capable of maintaining the grade and transverse slope of the screed within the required tolerance. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. A transverse slope controller shall not be used to control grade. Provide controls capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 30 feet in length.
b. Taut stringline set to grade.
c. Short ski or shoe for joint matching.
d. Laser control.

When screed extensions are used, auger extensions shall be used to maintain a distance no greater than 18 inches from the end of the auger to the end gate.

Provide reference lines or other approved markings to control the horizontal alignment.

Manual operation will be permitted to make grade changes in the construction of irregularly shaped and minor areas.

If a breakdown or malfunction of any automatic control occurs, the equipment may be operated manually for the remainder of the workday, providing that the finished mat conforms to the required lines and grades.

1.2.5 Rollers

Rollers shall be self-propelled, reversible, steel wheeled or pneumatic tire, in good condition and operated in a manner that does not damage the asphalt mat and that delivers the optimal combination of densification and ride smoothness requirements. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Do not use equipment which causes excessive crushing of the aggregate.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design
Tack
Paving Fabric

SD-06 Test Reports

Materials used in Mix Design
Delivery Tickets
Field Testing Data

SD-07 Certificates

Nuclear Density Device (if using radioactive density measuring device), which shall include GSFC Form 23-6I, Operator Qualifications, and State of Maryland Reciprocal Agreement w/ NRC (if so licensed) or General License Title (if so licensed)

1.4 SAMPLING AND TESTING

1.4.1 HMA Testing and Inspection Service

HMA field testing shall be furnished by the Contractor. A certified HMA testing service approved by the Contracting Officer shall be provided by the Contractor. Testing shall include field-testing for quality control during construction period.

Testing agencies shall conform to the requirements of ASTM D 3740.

PART 2 PRODUCTS

2.1 GEOTEXTILE PAVING FABRIC

Geotextile paving fabric shall conform to AASHTO M 288, Paving Fabric.

2.2 HOT MIX ASPHALT

a. Hot mix asphalt shall meet the requirements of MSHA-III, Section 904 "Performance Graded Asphalt Binders and Hot Mix Asphalt".

b. Asphalt Binder for all mix designs shall be PG64-22.

c. Superpave mix design shall be Design Level 2, ESAL 300,000 to <3,000,000, Ndesign 65.

d. Surface mix shall be PG64-22 9.5 mm.
Base mix shall be PG64-22 19.0 mm.

e. Mix designs used in this contract shall be a State of Maryland approved mix complying with the above requirements.

2.3 TACK COAT

Tack Coat shall be emulsified asphalt meeting the requirements of MSHA-III, Section 904.03.

PART 3 EXECUTION

3.1 GEOTEXTILE PAVING FABRIC INSTALLATION

The surface shall be free of dirt, water , vegetation and other deleterious materials. Open cracks 3/8 inch or smaller shall be filled with sand mixed asphalt.

Asphalt sealant shall be applied with truck mounted distributor per the manufacturer's recommendations, but not less than 0.25 gallons per square yard of residual asphalt.

The paving fabric shall be laid down onto the prepared surface with a minimum of wrinkles or folds while the sealant is still warm and tacky. The fabric shall be placed with the non heat treated (fuzzy) side down providing optimum bond between the fabric and the pavement. Wrinkles or folds shall be slit and laid flat in the direction of the paving operation. Broom the fabric to increase the contact with the sealant and pavement.

Overlap paving fabric a maximum of 1 to 3 inch to ensure complete coverage. Transverse joints shall be shingle overlap in direction of paving operation to prevent pickup by paver.

Blot up any excessive bleed through of sealant or spread sand to absorb excess sealant to minimize hauling units or paver lifting the fabric. Minimize wheel turning of equipment on paving fabric to avoid movement or damage to the fabric. Repair damaged areas. Proceed with HMA overlay.

3.2 FOUNDATION PREPARATION

Prior to placement of paving material, the foundation shall be constructed

as specified. When paving over existing pavement, remove all excess crack filling and patch material. All spalls and potholes shall be cleaned, tack coated, and filled with compacted patching before placement of paving material. Manholes, valve boxes, inlets, and other appurtenances with the area to be paved shall be adjusted to grade as directed.

3.3 TACK COAT

Tack coat shall be applied to all pavements to be overlaid, including adjacent curbs, gutter pans, and appurtenances. Prior to applying the tack coat, remove all loose and foreign materials from the surface. Apply using full circulation spray bars that are laterally and vertically adjustable and that provide triple fanning and overlapping action. The resulting coating shall be residual asphalt uniformly applied at a rate of 0.01 to 0.05 gallon per square yard.

3.4 TRANSPORTING AND DELIVERY

Transport the HMA from the mixing plant to the site in clean, tight vehicles. Schedule deliveries so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Provide adequate artificial lighting for night placements. Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F. When practical for extended lane pulls with several days of operations, use a material transfer vehicle operated to produce continuous forward motion of the paver.

3.5 HOT MIX ASPHALT PLACEMENT

Do not place HMA on a frozen graded aggregate base.

Place HMA mixtures used as the final surface when the ambient air and surface temperatures are at least 40 degrees F. Place mixtures used as intermediate and base layers when the ambient air and surface temperatures are at least 32 degrees F, and place polymer-modified surface mixes when the ambient air and surface temperatures are at least 50 degrees F. The pavement surfaces shall be clean, dry, and approved by the COTR before HMA paving begins. When the weather conditions differ from these limits, or when it begins raining while the work is underway, the contractor shall cease placement operations and complete roller operations on the mat in-place.

Should the Contractor elect to place material in hauling units on-site on en route, the COTR reserves the right to require the Contractor to have an approved independent testing agency take sample cores for density testing at locations determined by the COTR. Should the cores reveal a density less than the minimum requirement, the COTR may require the deficient area to be removed and replaced. Material placed outside of approved weather restrictions that has surface course finish deficiencies may also be required to be removed. All cost for testing and replacements shall be at the expense of the Contractor at no additional cost to the Government.

Delivery of the mixture by the hauling units and placement should be continuous. At the time of placement, the temperature of the mixture shall be at least 225 degree F. HMA shall be placed by paver. Do not broadcast loose mixture over the new surface.

Place and compact the mix at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, place

the mixture to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it will have the required thickness and conform to the grade and contour indicated. Regulate the speed of the paver to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. Place the mixture in consecutive adjacent strips having the full lane width where possible, or a minimum width of 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

3.6 COMPACTION

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. Compact the surface as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor, except steel wheel rollers shall be used for the first rolling of all joints and edges, the initial breakdown rolling, and the finish rolling. 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 displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Furnish sufficient rollers to handle the output of the plant. Continue rolling 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 mixture to the roller, keep the wheels properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, 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 will not be allowed.

HMA shall be placed and roller densification operations completed before the mixture has cooled to a temperature of 185 degrees F. As it cools below this temperature the asphalt becomes stiff and further mix densification is extremely difficult. Mix placement temperature, air temperature, wind, humidity, mat thickness, and temperature of the base surface affect the rate of cooling and thus the time available for compaction. Figure 7.2 of AI MS-04 provides typical cooling rate curves for various mix temperatures. The COTR reserves the right to require the Contractor's independent testing agency to core test any areas placed that are suspected to be density deficient by any combination of low placement temperature, ambient temperature extremes, or thin mat thickness. All cost for testing and replacement shall be at the expense of the Contractor at no additional cost to the Government.

HMA shall be compacted to achieve a density between 92 to 95 percent of the theoretical maximum density (TMD). TMD is that density furnished by the producer's daily plant testing for the particular mix design being used. Density less than 88 percent or greater than 97 percent may be cause for rejection at the discretion of the COTR.

Roller marks shall not be visible after rolling operations. After rolling is completed, no traffic of any kind shall be permitted on the pavement until the pavement has cooled to less than 140 degrees F.

3.7 JOINTS

Both longitudinal and transverse joints in successive courses shall be staggered so that one is not above the other. Stagger transverse joints by the length of the paver. Stagger longitudinal joints at least 6 inches, and arrange so that the longitudinal joint in the top course is within 6 inches of the line dividing traffic lanes. Construct joints in a manner to provide a continuous bond between the old and new surfaces. When constructing longitudinal joints adjacent to existing HMA pavement overlap the existing pavement 1 to 1-1/2 inches. The initial longitudinal roller pass shall be on the un-compacted hot mat and 6 inches to 1 foot from the joint. The successive roller pass shall compact the overlapped material and the 6 inch to 1 foot material simultaneously.

When placing a surface course, cut back the edge of the existing pavement for its full depth at transverse joints to expose a fresh surface, and apply tack coat material. Joints which are irregular, damaged, uncompacted, cold at the time of placing adjacent lanes, or otherwise defective, shall be cut back a maximum of 3 inches from the top of the course with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. Apply tack coat to all cold joints, and against curbs, gutters, headers, manholes, etc.

Joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.8 EDGE DROP-OFF

Where HMA paving is being applied to highways carrying traffic, all compacted pavement courses exceeding 2-1/2 inches in depth shall be matched with the abutting lane or shoulder on the same working day. Where compacted pavement courses of 2-1/2 inches or less are placed, the Contractor shall have the option of paving the abutting lane or shoulder on alternate days. Pave the abutting lane or shoulder prior to weekends and temporary shutdowns, regardless of the depth of the compacted pavement course. When uneven pavement joints exist, place advance warning traffic control devices in conformance with Section 01 50 00, Maintenance of Traffic (MOT).

3.9 TIE-IN

When HMA paving is being applied to the traveled way carrying traffic with a posted speed less than 40 miles per hour, construct a temporary tie-in at least 4 feet in length for each 1 inch of pavement depth. When HMA paving is being applied to the traveled way carrying traffic with a posted speed greater than 40 miles per hour, construct a temporary tie-in at least 10 feet in length for each 1 inch of pavement depth. Construct temporary tie-ins before traffic is allowed to cross the transverse joint.

At the final tie-in point, remove a transverse portion of the existing pavement to a depth so the design thickness of the final surface course is maintained. Construct the final tie-in to a length equal to the posted speed per 1 inch depth of the design thickness of the final course, with a length of at least 25 feet per 1 inch depth and a maximum length of 50 feet per 1 inch depth.

3.10 CONTRACTOR QUALITY CONTROL

The Contractor shall be responsible for providing all necessary effort to perform quality control testing and reporting. Report shall be provided to the COTR on the day of the work. Repairs, if required, shall be reviewed and agreed with the COTR before continuing the work.

3.10.1 Task Tonnage Less Than 500 Tons

a. Delivery Tickets - furnish copies of supplier delivery ticket with date; gross, tare, and net load tonnage; daily cumulative job tonnage; job total to date tonnage; and State Mix Designation.

b. Mix Temperature and Ambient Weather - determine the temperature at the time of placement and the ambient air and foundation temperatures.

c. Smoothness - have an approved 10 foot straightedge available at all times. After final compaction of each course, the surface of each pavement course shall be true to the established line and grade and shall be sufficiently smooth so that when tested with the straightedge placed upon the surface parallel with the center line, the surface does not deviate more than 1/8 inch. The transverse slope of the finished surface of each course when tested with the straightedge placed perpendicular to the center line, shall not deviate more than 3/16 inch.

Check transverse joints using the straightedge immediately after the initial rolling. When the surface of each course varies more than 1/8 inch from true, make immediate corrections so that the finished joint surface is within tolerance.

Hold the straightedge in contact with the surface and move it ahead one-half the length of the straightedge for each successive measurement. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

d. Grade - The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 1/2 inch from the plan grade established. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. If drainage functions properly and tie-in grades are smooth and level, then visual grade check is adequate. Otherwise the grade shall be determined by running lines of levels at intervals of 25 feet, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface.

e. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

f. Density testing is not required for task tonnage less than 500 tons, unless there is cause to question the Contractor's ability to achieve the target density, including inadequate compaction effort or extremes in ambient or placing temperatures.

3.10.2 Task Tonnage Exceeds 500 Tons

The Contractor shall perform all quality control as indicated for task tonnage less than 500 tons. In addition the Contractor shall conduct nuclear gauge testing in the presence of the COTR to monitor pavement density in accordance with ASTM D 2950. If gauge testing indicates density deficiencies, the Contractor shall arrange for Core Testing in accordance with MSHA-III.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 17 24.00 10

TRAFFIC CONTROL DEVICES

04/08

PART 1 GENERAL

1.1 REFERENCES
1.2 EQUIPMENT
1.2.1 Paint Application Equipment
1.2.1.1 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines
1.2.1.2 Hand-Operated, Push-Type Machines
1.2.2 Thermoplastic Application Equipment
1.2.2.1 Thermoplastic Material
1.2.2.2 Application Equipment
1.2.2.3 Mobile and Maneuverable
1.2.3 Reflective Media Dispenser
1.2.4 Surface Preparation Equipment
1.2.4.1 Sandblasting Equipment
1.2.4.2 Waterblast Equipment
1.2.5 Marking Removal Equipment
1.2.5.1 Shotblasting Equipment
1.2.5.2 Chemical Equipment
1.3 SUBMITTALS
1.4 DELIVERY, STORAGE, AND HANDLING
1.5 ENVIRONMENTAL REQUIREMENTS

PART 2 PRODUCTS

2.1 PAINT
2.2 THERMOPLASTIC COMPOUNDS
2.2.1 Composition Requirements
2.2.2 Physical Properties
2.2.2.1 Drying Time
2.2.2.2 Softening Point
2.2.2.3 Specific Gravity
2.2.3 Asphalt Concrete Primer
2.2.4 Portland Cement Concrete Primer
2.3 PREFORMED THERMOPLASTICS
2.4 TRAFFIC SIGNS, POSTS, AND HARDWARE
2.5 REFLECTIVE MEDIA
2.6 SAMPLING AND TESTING

PART 3 EXECUTION

3.1 SURFACE PREPARATION
3.1.1 Pretreatment for Early Painting
3.1.2 Cleaning Existing Pavement Markings
3.1.3 Cleaning Concrete Curing Compounds
3.2 APPLICATION
3.2.1 Paint

3.2.1.1 Rate of Application
3.2.1.2 Drying
3.2.2 Thermoplastic Compounds
3.2.2.1 Longitudinal Markings
3.2.2.2 Primer
3.2.2.3 Markings
3.2.3 Reflective Media
3.2.4 Preformed Thermoplastic
3.3 TESTING
3.4 SIGN AND POST INSTALLATION

-- End of Section Table of Contents --

SECTION 32 17 24.00 10

TRAFFIC CONTROL DEVICES
04/08

PART 1 GENERAL

1.1 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 M 247	(2008) Glass Beads Used in Traffic Paints
AASHTO M 249	(2009) White and Yellow Reflective Thermoplastic Striping Material (Solid Form)

ASTM INTERNATIONAL (ASTM)

ASTM B 209	(2007) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM D 4956	(2009) Standard Specification for Retroflective Sheeting for Traffic Control
ASTM D 792	(2008) Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM E 28	(1999; R 2009) Standard Test Methods for Softening Point of Resins Derived from Naval Stores by Ring and Ball Apparatus

MARYLAND STATE HIGHWAY ADMINISTRATION (MSHA)

MUTCD	(2006) Maryland Manual of Uniform Traffic Control Devices
MSHA-III	(2008) Standard Specifications for Construction and Materials
MSHA-II	(Undated, via MSHA website) Maryland Book of Standards for Highways and Incidental Structures

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS TT-B-1325	(Rev C) Beads (Glass Spheres) Retro-Reflective (Metric)
FS TT-P-1952	(Rev D) Paint, Traffic and Airfield

1.2 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

1.2.1 Paint Application Equipment

1.2.1.1 Self-Propelled or Mobile-Drawn Pneumatic Spraying Machines

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 5 mph, and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified, and of even and uniform thickness with clear-cut edges. Equipment used for marking streets and highways shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of two different colors of paint as specified. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

1.2.1.2 Hand-Operated, Push-Type Machines

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

1.2.2 Thermoplastic Application Equipment

1.2.2.1 Thermoplastic Material

Thermoplastic material shall be applied to the primed pavement surface by spray techniques or by the extrusion method, wherein one side of the shaping die is the pavement and the other three sides are contained by, or are part of, suitable equipment for heating and controlling the flow of material. By either method, the markings shall be applied with equipment that is capable of providing continuous uniformity in the dimensions of the stripe.

1.2.2.2 Application Equipment

a. Application equipment shall provide continuous mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the extrusion shoe or spray gun shall prevent accumulation and clogging. All parts of the equipment which come into contact with the material shall be easily accessible and exposable for cleaning and maintenance. All mixing and conveying parts up to and including the extrusion shoes and spray guns shall maintain the material at the required temperature with heat-transfer oil or electrical-element-controlled heat.

b. The application equipment shall be constructed to ensure continuous uniformity in the dimensions of the stripe. The applicator shall provide a means for cleanly cutting off stripe ends squarely and shall provide a method of applying "skiplines". The equipment shall be capable of applying varying widths of traffic markings.

c. The applicator shall be equipped with a drop-on type bead dispenser capable of uniformly dispensing reflective glass spheres at controlled rates of flow. The bead dispenser shall be automatically operated and shall begin flow prior to the flow of composition to assure that the strip is fully reflectorized.

1.2.2.3 Mobile and Maneuverable

Application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc. The equipment used for the placement of thermoplastic pavement markings shall be of two general types: mobile applicator and portable applicator.

a. Mobile Application Equipment: The mobile applicator shall be defined as a truck-mounted, self-contained pavement marking machine that is capable of hot applying thermoplastic by either the extrusion or spray method. The unit shall be equipped to apply the thermoplastic marking material at temperatures exceeding 375 degrees F, at widths varying from 3 to 12 inches and in thicknesses varying from 20 to 190 mils and shall have an automatic drop-on bead system. The mobile unit shall be capable of operating continuously and of installing a minimum of 20,000 lineal feet of longitudinal markings in an 8-hour day.

(1) The mobile unit shall be equipped with a melting kettle which holds a minimum of 6000 pounds of molten thermoplastic material. The kettle shall be capable of heating the thermoplastic composition to temperatures of 375 to 425 degrees F. A thermostatically controlled heat transfer liquid shall be used. Heating of the composition by direct flame will not be allowed. Oil and material temperature gauges shall be visible at both ends of the kettle.

Extrusion type units shall be equipped with a minimum of two extrusion shoes located one on each side of the truck, and shall be capable of marking simultaneous edgeline and centerline stripes. Each extrusion shoe shall be a closed, oil-jacketed unit; shall hold the molten thermoplastic at a temperature of 375 to 425 degrees F; and shall be capable of extruding a line of 3 to 8 inches in width; and at a thickness of not less than 125 mils nor more than 190 mils, and of generally uniform cross section.

Spray type units shall be equipped with a spray gun system. The spray system shall consist of a minimum of four spray guns, located two on each side of the truck, and shall be capable of marking simultaneous edgeline and centerline stripes. The spray system shall be surrounded (jacketed) with heating oil to maintain the molten thermoplastic at a temperature of 375 to 425 degrees F; and shall be capable of spraying a stripe of 3 to 12 inches in width, and in thicknesses varying from 55 mils to 95 mils, and of generally uniform cross section.

(2) The mobile unit shall be equipped with an electronic programmable line pattern control system. The control system shall be capable of applying skip or solid lines in any sequence, through any and all of the extrusion shoes, or the spray guns, and in programmable cycle lengths. In addition, the mobile unit shall be equipped with an automatic counting mechanism capable of recording the number of lineal feet of thermoplastic markings applied to the pavement surface with an accuracy of 0.5 percent.

b. Portable Application Equipment: The portable applicator shall be defined as hand-operated equipment, specifically designed for placing special markings such as crosswalks, stopbars, legends, arrows, and short lengths of lane, edge and centerlines. The portable applicator shall be capable of applying thermoplastic pavement markings by the extrusion method. The portable applicator shall be loaded with hot thermoplastic composition from the melting kettles on the mobile applicator. The portable applicator shall be equipped with all the necessary components, including a materials storage reservoir, bead dispenser, extrusion shoe, and heating accessories, so as to be capable of holding the molten thermoplastic at a temperature of 375 to 425 degrees F, of extruding a line of 3 to 12 inches in width, and in thicknesses of not less than 60 mils nor more than 190 mils and of generally uniform cross section.

1.2.3 Reflective Media Dispenser

The dispenser for applying the reflective media shall be attached to the paint dispenser and shall operate automatically and simultaneously with the applicator through the same control mechanism. The dispenser shall be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified, at all operating speeds of the applicator to which it is attached.

1.2.4 Surface Preparation Equipment

1.2.4.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted. The compressor shall be capable of furnishing not less than 150 cfm of air at a pressure of not less than 90 psi at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

1.2.4.2 Waterblast Equipment

The water pressure shall be specified at 2600 psi at 140 degrees F in order

to adequately clean the surfaces to be marked.

1.2.5 Marking Removal Equipment

Equipment shall be mounted on rubber tires and shall be capable of removing markings from the pavement without damaging the pavement surface or joint sealant. Waterblasting equipment shall be capable of producing an adjustable, pressurized stream of water. Sandblasting equipment shall include an air compressor, hoses, and nozzles. The compressor shall be equipped with traps to maintain the air free of oil and water.

1.2.5.1 Shotblasting Equipment

Shotblasting equipment shall be capable of producing an adjustable depth of removal of marking and pavement. Each unit shall be self-cleaning and self-contained, shall be able to confine dust and debris from the operation, and shall be capable of recycling the abrasive for reuse.

1.2.5.2 Chemical Equipment

Chemical equipment shall be capable of application and removal of chemicals from the pavement surface, and shall leave only non-toxic biodegradable residue.

1.3 SUBMITTALS

SD-03 Product Data

Thermoplastic
Preformed Thermoplastic Shapes
Paint

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

Material Data

Supplier's literature on sign base material and retroflective sheeting composition

SD-07 Certificates

Volatile Organic Compound (VOC)

Certificate stating that the proposed pavement marking paint meets the VOC regulations of Maryland and Ozone Transport Commission.

1.4 DELIVERY, STORAGE, AND HANDLING

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

1.5 ENVIRONMENTAL REQUIREMENTS

Pavement surface shall be free of moisture. Surface temperature shall be

at least 40 degrees F and rising at the beginning of operations.

PART 2 PRODUCTS

2.1 PAINT

The paint shall be a durable, non-cracking, fast dry, waterborne traffic paint, consisting of a homogeneous mixture, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for roads and parking areas shall conform to FS TT-P-1952, WHITE, YELLOW, BLUE, and BLACK. Pavement marking paints shall comply with Maryland and Ozone Transport Commission VOC limits.

2.2 THERMOPLASTIC COMPOUNDS

The thermoplastic reflectorized pavement marking compound shall be extruded or sprayed in a molten state onto a primed (if required by manufacturer) pavement surface. Following a surface application of glass beads and upon cooling to normal pavement temperatures, the marking shall be an adherent reflectorized strip of the specified thickness and width that is capable of resisting deformation by traffic.

2.2.1 Composition Requirements

The binder component shall be formulated as a hydrocarbon or alkyd resin. The pigment, beads and filler shall be uniformly dispersed in the binder resin. The thermoplastic composition shall be free from all skins, dirt, and foreign objects.

The material shall contain a minimum of 30 percent intermixed graded glass beads by weight, conforming to AASHTO M 247, with a minimum of 80 percent true spheres. The material must have factory applied surface beads in addition to the intermixed beads at a rate of 1 pound per 10 square feet.

2.2.2 Physical Properties

2.2.2.1 Drying Time

When installed at 70 degrees F and in thicknesses between 125 mils and 190 mils, after curing 15 minutes.

2.2.2.2 Softening Point

The composition shall have a softening point of not less than 194 degrees F when tested in accordance with ASTM E 28.

2.2.2.3 Specific Gravity

The specific gravity of the composition shall be between 1.9 and 2.2 as determined in accordance with ASTM D 792.

2.2.3 Asphalt Concrete Primer

The primer for asphalt concrete pavements shall be a thermosetting adhesive with a solids content of pigment reinforced synthetic rubber and synthetic plastic resin dissolved and/or dispersed in a volatile organic compound (VOC). Solids content shall not be less than 10 percent by weight at 70 degrees F and 60 percent relative humidity. A wet film thickness of 5 mils

plus or minus 1 mil, shall dry to a tack-free condition in less than 5 minutes.

2.2.4 Portland Cement Concrete Primer

The primer for Portland cement concrete pavements shall be an epoxy resin primer. The primer shall be of the type recommended by the manufacturer of the thermoplastic composition. Epoxy primers recommended by the manufacturer shall be approved by the COTR prior to use. Requests for approval shall be accompanied with technical data, instructions for use, and a 1 quart sample of the primer material.

2.3 PREFORMED THERMOPLASTICS

Preformed thermoplastics shall conform to size and shape of MUTCD markings: ONLY, Through Lane-Use Arrow, Turn Lane-Use Arrow, and Turn and Through Lane-Use Arrow. Thickness shall be 90 mils.

Markings shall be capable of being affixed to bituminous and/or concrete pavements by the use of the normal heat of a propane torch.

The markings must be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastic when heated with a torch.

The material shall be composed of an ester modified resin resistant to degradation by motor fuels, lubricants, hydraulic fluids, and antifreeze, in conjunction with aggregates, pigments, binders and glass beads which have been factory produced as a finished product. The material shall conform to AASHTO M 249. The material shall be resistant to deterioration due to exposure to sunlight, water, salt, and road chemicals.

The material shall contain a minimum of 30 percent intermixed graded glass beads by weight, conforming to AASHTO M 247, with a minimum of 80 percent true spheres. The material must have factory applied surface beads in addition to the intermixed beads at a rate of 1 pound per 10 square feet.

The top surface of the preformed material shall have regularly spaced indents that act as visual cue during application that the material has reached a molten state sufficient for satisfactory adhesion and for post installation inspection that proper installation procedures have been followed.

2.4 TRAFFIC SIGNS, POSTS, AND HARDWARE

Signs shall conform to ASTM B 209, Alloy 6061-T6, 0.080 inch thickness, anodized mill finish, with sealed surface over Retroflective Sheeting conforming to ASTM D 4956, Type III, MSHA-III, Section 950.03.01, and MUTCD. Sign legend and background sheeting shall be from the same sheeting manufacturer.

Posts shall be 4 inch by 4 inch preservative pressure treated southern yellow pine grade 2.

Mounting hardware shall be stainless steel.

2.5 REFLECTIVE MEDIA

Reflective media for roads and streets shall conform to FS TT-B-1325, Type I, Gradation A or AASHTO M 247, Type I.

2.6 SAMPLING AND TESTING

Paint, thermoplastic, and glass sphere materials proposed for use shall be delivered to the project site in sealed and labeled containers. Materials shall be inspected by COTR for compliance to approved submittals. If materials appear to be defective during or after application the Contractor shall pull samples and have the material tested.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Thoroughly clean surfaces to be marked before application of the pavement marking material. Clean surfaces to a width of 4 inch to 6 inch wider than the markings. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be recleaned, when work has been stopped due to rain.

3.1.1 Pretreatment for Early Painting

Where early painting is required on rigid pavements, apply a pretreatment with an aqueous solution, containing 3 percent phosphoric acid and 2 percent zinc chloride, to prepared pavement areas prior to painting.

3.1.2 Cleaning Existing Pavement Markings

In general, markings shall not be placed over existing pavement marking patterns. Remove existing pavement markings, which are in good condition but interfere or conflict with the newly applied marking patterns. Deteriorated or obscured markings that are not misleading or confusing or interfere with the adhesion of the new marking material do not require removal. New preformed and thermoplastic pavement markings shall not be applied over existing preformed or thermoplastic markings. Whenever grinding, scraping, sandblasting or other operations are performed the work must be conducted in such a manner that the finished pavement surface is not damaged or left in a pattern that is misleading or confusing. When these operations are completed the pavement surface shall be blown off with compressed air to remove residue and debris resulting from the cleaning work.

3.1.3 Cleaning Concrete Curing Compounds

On new portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new

concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddle deposits of curing compound in the valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

3.2 APPLICATION

Widths. When covering old markings the new markings shall align with the old markings within 1/4 inch, unless otherwise directed by the COTR. For new markings the traveled way lane widths and width of longitudinal lines shall be as specified. Lane widths shall be measured from center to center of the lane lines once a control line is established for the lane configuration of the roadway. When measurements are taken from existing longitudinal lines, the point of reference shall be the center of the single line or the center of the space between dual lines. The traveled way lane widths are in compliance when they have an acceptable appearance and are within 2 inches from the proposed lane width.

Alignment. Place markings in a straight and uniform manner. Lane lines are in compliance when they have an acceptable appearance and are visually in alignment, with no more than a 3/8 inch variation in any 40 foot section of traveled way. Maintain longitudinal alignment through all intersections and breaks, even though the lines themselves may discontinue. Do not apply pavement line markings over longitudinal joints; offset the markings 2 inch.

Curing. Protect the markings until dry or cured. If a vehicle damages uncured markings, reapply the markings and remove marks left on the pavement by the vehicle at no additional cost.

Layout Markings. Remove layout markings that detract from the overall appearance or function of the final markings as determined by the COTR.

3.2.1 Paint

Paint shall be applied to clean dry surfaces. Paint shall be applied pneumatically with approved equipment at rate of coverage specified in the approved product data and in accordance with the manufacturer's listed pavement and air temperature ranges, but not less than 40 degrees F nor greater than 95 degrees F. Provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

3.2.1.1 Rate of Application

a. Reflective Markings for Roadways: Pigmented binder shall be applied evenly to the pavement area to be coated at a rate of 20 to 30 mils wet film thickness, and shall achieve a dry film thickness of not less than 15 mils. Glass spheres shall be applied uniformly to the wet paint on road and street pavement at a rate of 6 plus or minus 0.5 pounds of glass spheres per gallon of paint.

b. Nonreflective Markings for Parking Lots: Paint shall be applied evenly to the pavement surface to be coated at a rate of 20 to 30 mils wet film thickness, and shall achieve a dry film thickness of not less than 15 mils.

3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

3.2.2 Thermoplastic Compounds

Thermoplastic pavement markings shall be placed upon dry pavement; surface dry only will not be considered an acceptable condition. At the time of installation, the pavement surface temperature shall be a minimum of 40 degrees F and rising. Thermoplastics, as placed, shall be free from dirt or tint. Thermoplastic coating thicknesses shall be:

Roadway center and edge lines: 90 mils
MUTCD ONLY and Arrow Shapes: 90 mils
Stop Bars, Crosswalks: 60 mils

3.2.2.1 Longitudinal Markings

All centerline, skipline, edgeline, and other longitudinal type markings shall be applied with a mobile applicator. All special markings, crosswalks, stop bars, legends, arrows, and similar patterns shall be placed with a portable applicator, using the extrusion method, or preformed as specified.

3.2.2.2 Primer

After surface preparation has been completed the asphalt and/or concrete pavement surface shall be primed. The primer shall be applied with spray equipment. Primer materials shall be allowed to "set-up" prior to applying the thermoplastic composition. The asphalt concrete primer shall be allowed to dry to a tack-free condition, usually occurring in less than 10 minutes. The Portland cement concrete primer shall be allowed to dry in accordance with the thermoplastic manufacturer's recommendations. To shorten the curing time of the epoxy resins an infrared heating device may be used on the concrete primer.

a. Asphalt Concrete Primer: Primer shall be applied to all asphalt concrete pavements at a wet film thickness of 0.005 inch, plus or minus 0.001 inch (265-400 square feet/gallon).

b. Portland Cement Concrete Primer: Primer shall be applied to all

concrete pavements (including concrete bridge decks) at a wet film thickness of between 0.04 to 0.05 inch (320-400 square feet/gallon).

3.2.2.3 Markings

After the primer has "set-up", the thermoplastic shall be applied at temperatures no lower than 375 degrees F nor higher than 425 degrees F at the point of deposition. Immediately after installation of the marking, drop-on glass spheres shall be mechanically applied so that the spheres are held by and imbedded in the surface of the molten material.

a. Extruded Markings: All extruded thermoplastic markings shall be applied at the specified width and at a thickness of not less than 120 mils nor more than 190 mils.

b. Sprayed Markings: All sprayed thermoplastic markings shall be applied at the specified width and the thickness not greater than 90 mils.

c. Reflective Glass Spheres: Immediately following application, reflective glass spheres shall be dropped onto the molten thermoplastic marking at the rate of 1 pound/20 square feet of compound.

3.2.3 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

3.2.4 Preformed Thermoplastic

The material shall be applied in accordance with the manufacturer's instructions.

On asphalt the material shall be applied using the propane torch method recommended by the manufacturer. The material must be able to be applied without minimum requirements for ambient and road temperatures and without any preheating of the pavement to a specific temperature. The material must be able to be applied without the use of a thermometer. The pavement shall be clean, dry, and free of debris.

On concrete the material shall be applied as indicated above, and with a compatible primer sealer in accordance with the manufacturers instructions.

3.3 TESTING

When required by the COTR to determine conformance the the required coating thickness, test the Wet Film Thickness (WFT) and/or Dry Film Thickness (DFT) of markings.

3.4 SIGN AND POST INSTALLATION

Post installation shall conform to MSHA-II, Standard No. MD812.01 and MD812.04, except that embedment for single signs is 4 foot only into firm soil providing adequate support for lateral wind loading on the sign. Signs shall be placed providing a 7 foot height from base of nearest

pavement to bottom of sign. Location shall be as directed and in conformance with MUTCD details. If specular reflection is apparent on any sign, reposition as directed.

-- End of Section --

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 92 19

TOPSOILING AND SEEDING

10/06

PART 1 GENERAL

1.1 REFERENCES
1.2 System Description
1.3 SUBMITTALS
1.4 DELIVERY AND STORAGE

PART 2 PRODUCTS

2.1 SEED
2.1.1 Seed Specifications
2.1.2 Permanent Seed
2.1.3 Temporary Seed
2.2 TOPSOIL
2.2.1 Salvaged Topsoil
2.2.2 Imported Topsoil
2.2.3 Topsoil Specifications
2.2.4 For Sites Having Disturbed Areas Less Than 5 Acres
2.2.5 For Sites Having Disturbed Areas Over 5 Acres
2.3 SOIL AMENDMENTS
2.3.1 Soil Tests
2.3.2 Fertilizers
2.3.3 Lime
2.4 MULCH SPECIFICATIONS (In order of preference)
2.4.1 Straw
2.4.2 Wood Cellulose Fiber Mulch (WCFM)
2.5 WATER

PART 3 EXECUTION

3.1 PREPARATION
3.1.1 EXTENT OF WORK
3.2 TOPSOILING APPLICATION
3.3 METHODS OF SEEDING
3.3.1 Hydroseeding
3.3.2 Dry Seeding
3.3.3 Drill or Cultipacker Seeding
3.4 SEEDBED PREPARATION
3.4.1 Temporary Seeding
3.4.2 Permanent Seeding
3.5 MULCHING SEEDED AREAS
3.6 SECURING STRAW MULCH (MULCH ANCHORING)
3.7 INCREMENTAL STABILIZATION - CUT SLOPES
3.8 INCREMENTAL STABILIZATION OF EMBANKMENTS - FILL SLOPES
3.9 PROTECTION OF SEEDED AREAS
3.10 REPAIRS AND MAINTENANCE

3.10.1 Adequacy of Stabilization
3.10.2 Mowing

-- End of Section Table of Contents --

SECTION 32 92 19

TOPSOILING AND SEEDING
10/06

PART 1 GENERAL

1.1 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.

MARYLAND DEPARTMENT OF ENVIRONMENT (MDE)

MDE-1	(1994) Maryland Standards and Specifications for Soil Erosion and Sediment Control

1.2 System Description

Seeding shall comply with MDE-1, Chapter G20.0, Vegetative Stabilization. Topsoiling shall comply with MDE-1, Chapter G21.0, Topsoil.

Areas having slopes steeper than 2:1 require special consideration and design for stabilization and shall have appropriate stabilization as shown on the plans.

1.3 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Topsoil

Seed

Soil Amendments

SD-06 Test Reports

Topsoil composition tests (reports and recommendations).

SD-07 Certificates

State certification and approval for seed

1.4 DELIVERY AND STORAGE

Protect material from drying out and from contamination during delivery, on-site storage, and handling.

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Material may be furnished in bulk

with certificate indicating the above information.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Seed Specifications

All seed must meet the requirements of the Maryland State Seed Law. All seed shall be subject to re-testing by a recognized seed laboratory. All seed used shall have been tested within the 6 months immediately preceding the date of sowing such material on the work. Seed tags shall be made available to the COTR to verify type and rate of seed used.

The inoculant for treating legume seed in the seed mixtures shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species. Inoculant's shall not be used later than the date indicated on the container. Add fresh inoculant as directed on package. Use four times the recommended rate when hydroseeding. Note: It is very important to keep inoculant as cool as possible until used. Temperatures above 75 to 80 degrees F can weaken bacteria and make the inoculant less effective.

2.1.2 Permanent Seed

Seeding grasses and legumes to establish ground cover for a minimum of one year on disturbed areas generally receiving low maintenance.

For areas receiving low maintenance, apply ureaform fertilizer (46-0-0) at 3-1/2 pounds per 1000 square feet (150 pounds per acre), in addition to the soil amendments shown in the table below, to be performed at the time of seeding. Permanent Seeding Summary (Both Mix 1 and Mix 3 are acceptable):

Seeding Mixture: Hardiness Zone 6b (from Table 25)					Fertilizer Rate			Lime Rate
No.	Species	Application Rate (lb/ac)	Seeding Dates	Seeding Depths	N	P205	K20	
1	Tall Fescue(75%) Canada Bluegrass(10% Kentucky Bluegrass(10% Redtop (5%)	150 lb	3/1-5/15 8/15-10/1	1/2"	90 lb/ac (2 lb/sf	175 lb/ac (4 lb/sf)	175 lb/ac (4 lb/sf)	2 tons/ac (100 lb/ 1000 sf)
3	Tall Fescue(85%) Perennial Ryegrass(10%) Kentucky Bluegrass(5%)	125 lb 15 lb 10 lb		1"				

2.1.3 Temporary Seed

Vegetation - annual grass or grain used to provide cover on disturbed areas for up to 12 months. For longer duration of vegetative cover, Permanent

Seeding is required. Temporary Seeding Summary (Either Mix Number is acceptable):

Seeding Mixture: Hardiness Zone 6b (from Table 25)					Fertilizer Rate (10-10-10)	Lime Rate
No.	Species	Application Rate(lb/ac)	Seeding Dates	Seeding Depths		
1	Annual Ryegrass	50 lb	3/1-4/30 8/15-11/1	1/4"-1/2"	600 lb/ac (15 lb/ 1000sf)	2 ton/ac (100 lb/ 1000 sf)
2	Weeping Lovegrass	40 lb	5/1-8/14	1/4"-1/2"		
3	Millet	50 lb	5/1-8/14	1/2"		

2.2 TOPSOIL

2.2.1 Salvaged Topsoil

Topsoil salvaged from the existing site may be used provided that it meets the standards as set forth in these specifications.

2.2.2 Imported Topsoil

Conform to the standards below.

2.2.3 Topsoil Specifications

a. Topsoil shall be a loam, sandy loam, clay loam, silt loam, sandy clay loam, loamy sand. Other soils may be used if recommended by an agronomist or soil scientist and approved by the COTR. Regardless, topsoil shall not be a mixture of contrasting textured subsoils and shall contain less than 5 percent by volume of cinders, stones, slag, coarse fragments, gravel, sticks, root, trash, or other materials larger than 1-1/2 inches in diameter. Remove debris and stones larger than 3/4 inch in any dimension remaining on or protruding from the surface after finish grading.

b. Topsoil must be free of plants or plant parts such as bermuda grass, quackgrass, Johnsongrass, nutsedge, poison ivy, thistle, or others as specified.

c. Where the subsoil is either highly acidic or composed of heavy clays, ground limestone shall be spread at the rate of 4 to 8 tons per acre (200 to 400 pounds per 1000 square feet) prior to the placement of topsoil. Lime shall be distributed uniformly over designated areas and worked into the soil in conjunction with tillage operations as described in the following procedures.

2.2.4 For Sites Having Disturbed Areas Less Than 5 Acres

a. Place topsoil (if required) and apply soil amendments as specified below.

2.2.5 For Sites Having Disturbed Areas Over 5 Acres

a. On soil meeting Topsoil Specifications, obtain test results dictating fertilizer and lime amendment required to bring the soil into compliance with the following:

i. pH for topsoil shall be between 6.0 and 7.5. If the tested soil demonstrates a pH of less than 6.0, sufficient lime shall be prescribed to raise the pH to 6.5 or higher.

ii. Organic content of topsoil shall be not less than 1.5 percent by weight.

iii. Topsoil having soluble salt content greater than 500 parts per million shall not be used.

iv. No sod or seed shall be placed on soil which has been treated with soil sterilants or chemicals used for weed control until sufficient time has elapsed (14 days minimum) to permit dissipation of phyto-toxic materials.

Note: Topsoil substitutes or amendments, as recommended by a qualified agronomist or soil scientist and approved by the COTR, may be used in lieu of natural topsoil.

b. Place topsoil (if required) and apply soil amendments as specified below.

2.3 SOIL AMENDMENTS

Incorporate lime and fertilizer into the top 3 inches to 5 inches of soil by disking or other suitable means.

2.3.1 Soil Tests

Soil tests must be performed to determine the exact ratios and application rates for both lime and fertilizer on sites having disturbed areas over 5 acres. Soil analysis may be performed by the University of Maryland or a recognized commercial laboratory. Soil samples taken for engineering purposes may also be used for chemical analyses.

2.3.2 Fertilizers

Fertilizers shall be uniform in composition, free flowing and suitable for accurate application by approved equipment. Manure may be substituted for fertilizer with prior approval from the appropriate approval authority. Fertilizers shall all be delivered to the site fully labeled according to the applicable state fertilizer laws and shall bear the name, trade name or trademark and warrantee of the producer.

2.3.3 Lime

Lime materials shall be ground limestone (hydrated or burnt lime may be substituted) which contains at least 50% total oxides (calcium oxide plus magnesium oxide). Limestone shall be ground to such fineness that at least 50 percent will pass through a #100 mesh sieve and 98 percent to 100 percent will pass through a #20 mesh sieve.

2.4 MULCH SPECIFICATIONS (In order of preference)

Mulch shall be free from noxious weeds, mold, and other deleterious materials.

2.4.1 Straw

Straw shall consist of thoroughly threshed wheat, rye, or oat straw, reasonably bright in color, and shall not be musty, moldy, caked, decayed, or excessively dusty and shall be free of noxious weed seeds as specified in the Maryland Seed Law.

NOTE: ONLY STERILE STRAW SHOULD BE USED IN AREAS WHERE ONE SPECIES OF GRASS IS DESIRED.

2.4.2 Wood Cellulose Fiber Mulch (WCFM)

a. WCFM shall consist of specially prepared wood cellulose processed into a uniform fibrous physical state.

b. WCFM shall be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry.

c. WCFM, including dye, shall contain no germination or growth inhibiting factors.

d. WCFM material shall be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with seed, fertilizer and other additives to form a homogeneous slurry. The mulch material shall form a blotter-like ground cover , on contact with the soil without inhibiting the growth of the grass seedlings.

e. WCFM material shall contain no elements or compounds at concentration levels that will be phyto-toxic.

f. WCFM must conform to the following physical requirements: fiber length to approximately 10 millimeter, diameter approximately 1 millimeter, pH range of 4.0 to 8.5, ash content of 1.6 percent maximum and water holding capacity of 90 percent minimum.

2.5 WATER

Source of water shall be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.2 TOPSOILING APPLICATION

a. When topsoiling, maintain needed erosion and sediment control practices.

b. Grades on the areas to be topsoiled, which have been previously established, shall be maintained, albeit 4 to 8 inches higher in elevation.

Topsoil shall be uniformly distributed in a 4 to 8 inch layer and lightly compacted to a minimum thickness of 4 inches. Spreading shall be performed in such a manner that sodding or seeding can proceed with a minimum of additional soil preparation and tillage. Any irregularities in the surface resulting from topsoiling or other operations shall be corrected in order to prevent the formation of depressions or water pockets.

Topsoil shall not be placed while the topsoil or subsoil is in a frozen or muddy condition, when the subsoil is excessively wet or in a condition that may otherwise be detrimental to proper grading and seedbed preparation.

3.3 METHODS OF SEEDING

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit. Seeding seasons shall be as indicated in the Seed Tables above.

3.3.1 Hydroseeding

Apply seed uniformly with hydroseeder (slurry includes seed and fertilizer), broadcast or drop seeder, or a cultipacker seeder.

a. If fertilizer is being applied at the time of seeding, the application rates amounts will not exceed the following: nitrogen - maximum 100 pounds per acre total of soluble nitrogen; P205 (phosphorous) - 200 pounds per acre; K20 (potassium) - 200 pounds per acre.

b. Lime - use only ground agricultural limestone, (up to 3 tons per acre may be applied by hydroseeding). Normally, not more than 2 tons are applied by hydroseeding at any one time. Do not use burnt or hydrated lime when hydroseeding.

c. Seed and fertilizer shall be mixed on site and seeding shall be done immediately and without interruption.

3.3.2 Dry Seeding

This includes use of conventional drop or broadcast spreaders.

a. Seed spread dry shall be incorporated into the subsoil at the rates prescribed on the Temporary or Permanent Seeding Summaries or Tables 25 or 26. The seeded area shall then be rolled with a weighted roller to provide good seed to soil contact.

b. Where practical, seed should be applied in two directions perpendicular to each other. Apply half the seeding rate in each direction.

3.3.3 Drill or Cultipacker Seeding

Mechanized seeders that apply and cover seed with soil.

a. Cultipacking seeders are required to bury the seed in such a fashion as to provide at least 1/4 inch of soil covering. Seedbed must be firm after planting.

b. Where practical, seed should be applied in two directions perpendicular to each other. Apply half the seeding rate in each direction.

3.4 SEEDBED PREPARATION

3.4.1 Temporary Seeding

a. Seedbed preparation shall consist of loosening soil to a depth of 3 to 5 inches by means of suitable agricultural or construction equipment, such as disc harrows or chisel plows or rippers mounted on construction equipment. After the soil is loosened it should not be rolled or dragged smooth but left in the roughened condition. Sloped areas (greater than 3:1) should be tracked leaving the surface in an irregular condition with ridges running parallel to the contour of the slope.

b. Apply fertilizer and lime as prescribed on the plans.

c. Incorporate lime and fertilizer into the top 3 to 5 inches of soil by disking or other suitable means.

3.4.2 Permanent Seeding

a. Minimum soil conditions required for permanent vegetative establishment:

1. Soil pH shall be between 6.0 and 7.0.
2. Soluble salts shall be less than 500 parts per million (ppm).
3. The soil shall contain less than 40 percent clay but enough fine grained material (greater than 30 percent silt plus clay) to provide the capacity to hold a moderate amount of moisture. An exception is if lovegrass or sercia lespedeza is to be planted, then a sandy soil (less than 30 percent silt plus clay) would be acceptable.

b. Areas previously graded in conformance with the drawings shall be maintained in a true and even grade, then scarified or otherwise loosened to a depth of 3 to 5 inches to permit bonding of the topsoil to the surface area and to crate horizontal erosion check slots to prevent topsoil from sliding down a slope.

c. Apply soil amendment as per soil test or as included on the plans.

d. Mix soil amendments into the top 3 to 5 inches of topsoil by disking or other suitable means. Lawn areas should be raked to smooth the surface, remove large objects like stones and branches, and ready the area for seed application. Where site conditions will not permit normal seedbed preparation, loosen surface soil be dragging with a heavy chain or other equipment to roughen the surface. Steep slopes (steeper than 3:1) should be tracked by a dozer leaving the soil in an irregular condition with ridges running parallel to the contour of the slope. The top 1 to 3 inches of soil should be loose and friable. Seedbed loosening may not be necessary on newly disturbed areas.

3.5 MULCHING SEEDED AREAS

Mulch shall be applied to all seeded areas immediately after seeding.

a. If grading is completed outside of the seeding season, mulch alone shall be applied as prescribed in this section and maintained until the seeding season returns and seeding can be performed in accordance with these specifications.

b. When straw mulch is used, it shall be spread over all seeded areas at the rate of 2 tons per acre. Mulch shall be applied to a uniform loose depth of between 1 and 2 inches. Mulch applied shall achieve a uniform distribution and depth so that the soil surface is not exposed. If a mulch anchoring tool is to be used, the rate should be increase to 2.5 tons per acre.

c. Wood cellulose fiber used as a mulch shall be applied at a net dry with of 1,500 pounds per acre. The wood cellulose fiber shall be mixed with water, and the mixture shall contain a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.

3.6 SECURING STRAW MULCH (MULCH ANCHORING)

Mulch anchoring shall be performed immediately following mulch application to minimize loss by wind or water. This may be done by one of the following methods (listed by preference), depending upon size of area and erosion hazard.

a. A mulch anchoring tool is a tractor drawn implement designed to punch and anchor mulch into the soil surface a minimum of 2 inches. This practice is most effective on large areas, but is limited to flatter slopes where equipment can operate safely. If used on sloping land, this practice should be used on the contour if possible.

b. Wood cellulose fiber may be used for anchoring straw. The fiber binder shall be applied at a net dry weight of 750 pounds per acre. The wood cellulose fiber shall be mixed with water and the mixture shall contain a maximum of 50 pounds of wood cellulose fiber per 100 gallons of water.

c. Application of liquid binders should be heavier at the edges where wind catches mulch, such as in valleys and in crests of banks. The remainder of area should appear uniform after binder application. Synthetic binder - such as Acrylic DLR (Agro-Tack), DCA-70, Petroset, Terra Tax II, Terra Tack AR or other approved equal may be used at rates recommended by the manufacturer to anchor mulch.

d. Lightweight plastic netting may be stapled over the mulch according to manufacturer's recommendations. Netting is usually available in rolls 4 to 15 feet wide and 300 to 3000 feet long.

3.7 INCREMENTAL STABILIZATION - CUT SLOPES

a. All cut slopes shall be dressed, prepared, seeded and mulched as the work progresses. Slopes shall be excavated and stabilized in equal increments not to exceed 15 feet.

b. Construction sequence (Refer to Figure 4 of MDE-1):

1. Excavate and stabilize all temporary swales, side ditches, or berms that will be used to convey runoff from the excavation.

2. Perform phase 1 excavation, dress, and stabilize.

3. Perform phase 2 excavation, dress, and stabilize. Overseed phase 1 areas as necessary.

4. Perform final phase excavation, dress, and stabilize. Overseed previously seeded areas as necessary.

NOTE: Once excavation has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

3.8 INCREMENTAL STABILIZATION OF EMBANKMENTS - FILL SLOPES

a. Embankments shall be constructed in lifts as prescribed on the plans.

b. Slopes shall be stabilized immediately when the vertical height of the multiple lifts reaches 15 feet, or when the grading operation ceases as prescribed in the plans.

c. At the end of each day, temporary berms and pipe slope drains should be constructed along the top edge of the embankment to intercept surface runoff and convey it down the slope in a non-erosive manner to a sediment trapping device.

d. Construction sequence (Refer to Figure 5 of MDE-1):

1. Excavate and stabilize all temporary swales, side ditches, or berms that will be used to divert runoff around the fill. Construct Slope Silt Fence on low side of fill as shown in Figure 5, unless other methods shown on the plans address this area.

2. Place phase 1 embankment , dress and stabilize.

3. Place phase 2 embankment, dress and stabilize.

4. Place final phase embankment, dress and stabilize. Overseed previously seeded areas as necessary.

NOTE: Once the placement of fill has begun the operation should be continuous from grubbing through the completion of grading and placement of topsoil (if required) and permanent seed and mulch. Any interruptions in the operation or completing the operation out of the seeding season will necessitate the application of temporary stabilization.

3.9 PROTECTION OF SEEDED AREAS

Immediately after seeding, protect area against traffic and other use. All necessary Erosion and Sediment Control devices and practices shall remain in place until the areas are stabilized in accordance with below. After stabilization is complete ESC devices shall be removed and the areas repaired.

3.10 REPAIRS AND MAINTENANCE

3.10.1 Adequacy of Stabilization

Inspect all seeded areas for failures and make necessary repairs, replacements, and reseedings within the planting season.

a. Once the vegetation is established, the site shall have 95 percent groundcover to be considered adequately stabilized.

b. If the stand provides less than 40 percent ground coverage, reestablish following original lime, fertilizer, seedbed preparation and seeding recommendations.

c. If the stand provides between 40 percent and 94 percent ground coverage, overseeding and fertilizing using 1/2 of the rates originally applied shall be done.

d. The Contractor is responsible for establishing long-term growth. Reestablishment or overseeding and fertilizing shall be accomplished the following planting season if unable to establish the required growth during the initial season. Bare areas in excess of 5 percent are not permitted. Provide straw mulch on bare areas that are not able to be seeded within the planting season and remove prior to re-work during the following planting season.

3.10.2 Mowing

The Contractor shall be responsible for mowing the freshly planted area contained within the fenced construction site extents until the site is accepted by the COTR and the construction fencing is removed. Mowing shall maintain the grass 3 inches to 6 inches.

-- End of Section --