PROJECT MANUAL

FOR THE

HIGH KNOB OBSERVATION TOWER AND SITE DESIGN

George Washington & Jefferson National Forests
Clinch Ranger District

Norton, Virginia

March 8, 2011

Government Agency:

USDA, Forest Service
George Washington and Jefferson National Forests
5162 Valleypoint Parkway
Roanoke, VA 24019

Set No. _____

PROJECT MANUAL

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SECTION 01100 - SUMMARY

PART 1 - GENERAL

1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Project consists of an Observation Tower and Site Work.

1. Project Location:
   George Washington and Jefferson National Forests
   Clinch Ranger District
   Near Norton, Virginia
2. Government Agency:
   USDA, Forest Service
   George Washington and Jefferson National Forests
   5162 Valleypoint Parkway
   Roanoke VA 24019
3. Government Representatives:
   Contracting Officer (CO) – Laura Ingram
   Contracting Officer Representative (COR) – Wayne Larson
   No others except as delegated in writing by the CO or COR.

B. The Work consists of the construction of an Observation Tower, abuttment and bridge to Tower, earthen mound, sundial, improved existing trail, ramp from parking lot to existing trail and miscellaneous related work.

1. The Work includes cast-in-place concrete walls, precast concrete, stone veneer, roof structure, trail improvements, handrails, earthen mound, site plantings and related additional materials and labor.

D. Project will be constructed under a general construction contract.

1.2 WORK SEQUENCE

A. The Work shall be conducted in one phase unless otherwise approved by the Government.

1.3 USE OF PREMISES

A. General: Contractor shall have use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited by the Government uses necessary to perform work or to retain other contractors on portions of Project.

1.4 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01100

SECTION 01230 - OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for options.

1.2 DEFINITIONS

A. Option: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Government decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each option is the net addition to or deduction from the Contract Sum to incorporate option into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the option into Project.

1. Include as part of each option, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of option.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each option. Indicate if options have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to options.

C. Execute accepted options under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Options is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each option.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 SCHEDULE OF OPTIONS

A. Option No. 1: Sun Dial, the immediate paving around the sundial that is not part of the trail and the stone and precast concrete topped bench. If Option 1 is not included in the work provide grading as shown and grass same as adjacent area.

B. Option No. 2: Decorative Plants (Tall Grass Seed, Goldstrum Black Eyed Susan, Raspberry Glow Mountain Laural) If Option 2 is not included in the work provide grading as shown and grass same as adjacent area.

END OF SECTION 01230

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General Project coordination procedures.
2. Coordination Drawings.
3. Project meetings.

B. See Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.

5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.

1.3 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Indicate relationship of components shown on separate Shop Drawings.
2. Indicate required installation sequences.

1.4 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, within 3 days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to the Govern,emt, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of the Government; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing.
    d. Designation of responsible personnel.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for processing Applications for Payment.
    g. Distribution of the Contract Documents.
    h. Submittal procedures.
    i. Preparation of Record Documents.
    j. Use of the premises.
    k. Responsibility for temporary facilities and controls.
    l. Parking availability.
    m. Office, work, and storage areas.
    n. Equipment deliveries and priorities.
    o. First aid.

p. Security.
q. Progress cleaning.
r. Working hours.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Government of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related Change Orders.
d. Purchases.
e. Deliveries.
f. Submittals.
g. Review of mockups.
h. Possible conflicts.
i. Compatibility problems.
j. Time schedules.
k. Weather limitations.
l. Manufacturer's written recommendations.
m. Warranty requirements.
n. Compatibility of materials.
o. Acceptability of substrates.
p. Temporary facilities and controls.
q. Space and access limitations.
r. Regulations of authorities having jurisdiction.
s. Testing and inspecting requirements.
t. Required performance results.
u. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements.
4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of the Government, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Change Orders.
        14) Documentation of information for payment requests.

3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

    a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Submittals Schedule.
3. Daily construction reports.
4. Field condition reports.
5. Construction photographs.

B. See Division 1 Section "Closeout Procedures" for submitting photographic data as Project Record Documents at Project closeout.

1.2 DEFINITIONS

A. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

B. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either the Government or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

C. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.

D. Major Area: A separate structure, or a similar significant construction element.

1.3 SUBMITTALS

A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Requested date for the Government’s approval.

B. Contractor's Construction Schedule: Submit two printed copies of baseline CPM schedule large enough to show entire schedule for entire construction period. Submit updated schedule weekly. Format for each row in schedule shall contain activity number, activity description, original duration, early start date, early finish date, actual start, percent complete, remaining duration, actual finish and resource allocation.

1. Baseline Schedule with report of activity changes and time variances with narrative of explanations. If behind schedule provide recovery plan with acceleration and/or resource planning to regain critical path milestones and project end date.
2. Earned Value Report. .

D. Daily Construction Reports: Submit two copies at biweekly intervals (along with biweekly schedule update).

E. Field Condition Reports: Submit two copies at time of discovery of any differing site conditions.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, Submittals Schedule, CPM reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

C. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities including temporary lighting.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by the Government.
2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for the Government’s administrative procedures necessary for certification of Substantial Completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work Restrictions: Show the effect on the schedule of the following:

a. Use of premises restrictions.
b. Provisions for future construction.
c. Seasonal variations.
d. Environmental control.

2. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Preliminary Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following:

    a. Preparation and processing of submittals.
    b. Purchase of materials.
    c. Delivery.
    d. Fabrication.
    e. Installation.

2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

E. Initial Issue of Baseline Schedule: Prepare a baseline network diagram schedule. Identify critical activities. Prepare schedule showing the following:

1. Task Number
2. Description
3. Original Duration
4. Early Start
5. Late Start
6. Actual Start
7. Percent Complete
8. Remaining Duration
9. Actual Finish
10. Assigned Resource

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Copy of original baseline schedule.
2. Identification of Date and Duration (time) variances from baseline.
3. Changes in the critical path.

4. Explanation of all changes from baseline that incur negative float or impact ctritical path relative to the baseline.
5. If the project falls behind schedule, provide a recovery plan showing acceleration and/or resource modifications required to regain schedule. The COR may request multiple CPM projections with marginal variation of resources as part of the recovery plan validation.

2.5 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording events at Project site, including the following:

1. Daily work performed
2. List of Contractor and Subcontractor personnel on site
3. List of equipment on site
4. High and Low temperatures and general weather conditions
5. Accidents.
6. Stoppages, delays, shortages, and losses.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At biweekly intervals, update schedule to reflect actual construction progress and activities.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

B. Distribution: Distribute copies of approved schedule to the Government, separate contractors, and other parties identified by the Government or Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320

SECTION 01330 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. See Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.

C. See Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals and for erecting mockups.

D. See Division 1 Section "Closeout Procedures" for submitting warranties and Project Record Documents.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Government’s responsive action.

B. Informational Submittals: Written information that does not require Government’s approval. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Government reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on the Government’s receipt of submittal.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Government will advise Contractor when a submittal being processed must be delayed for coordination.
2. If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Allow 15 days for processing each resubmittal.
4. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 4 by 5 inches (100 by 125 mm) on label or beside title block to record Contractor's review and approval markings and action taken by the Government.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Contractor.
    d. Name and address of subcontractor.
    e. Name and address of supplier.
    f. Name of manufacturer.
    g. Unique identifier, including revision number.
    h. Number and title of appropriate Specification Section.
    i. Drawing number and detail references, as appropriate.
    j. Other necessary identification.

E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless the government observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.

1. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. The Government will return submittals, without review, received from sources other than Contractor. Include:

1. Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
2. Transmittal Form

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Use only final submittals with mark indicating approved by the Government in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. The government will return one copy.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Manufacturer's catalog cuts.
e. Printed performance curves.
f. Operational range diagrams.
g. Compliance with recognized trade association standards.
h. Compliance with recognized testing agency standards.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale.

1. Preparation: Include the following information, as applicable:

a. Dimensions.
b. Identification of products.
c. Materials and finishes
d. Fabrication and installation drawings.
e. Roughing-in and setting diagrams.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Notation of coordination requirements.
j. Notation of dimensions established by field measurement.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 24 by 36 inches.

D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."

E. Samples: Prepare physical units of materials or products, including the following:

1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. The government will return submittal with options selected.

3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Submit three sets of Samples. The Government will retain two Sample sets; remainder will be returned.

4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Attach label on unexposed side.
5. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location.

G. Delegated-Design Submittal: Comply with requirements in Division 1 Section "Quality Requirements."

H. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

J. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

L. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

M. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."

O. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions

and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.

Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections.

R. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with Quality Control approval stamp before submitting to the Government.

B. Approval Stamp: Stamp each submittal with a uniform, Quality Control approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 THE GOVERNMENT'S ACTION

A. Action Submittals: The Government will review each submittal, make marks to indicate Approved, Approved with Comments or Disapproved, and return it. Any Submittal returned Approved with Comments is only approved upon incorporation of the comments into the resultant action.

B. Informational Submittals: The Government will review each submittal and will not return it, or will reject and return it if it does not comply with requirements.

END OF SECTION 01330

SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-control services required by the Government or authorities having jurisdiction are not limited by provisions of this Section.

C. See Divisions 2 through 16 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Government or its agents.

C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.

D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Government.

1.4 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent endorsement or report on the inspection of the testing agency by a recognized authority.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

G. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

H. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.6 QUALITY CONTROL

B. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.

1. Contractor is to provide a Quality Control Supervisor separate from the Construction Supervisor. The Quality Control Supervisor shall submit for approval a Quality Control Plan. The Quality Control Supervisor shall not be subordinate to the Construction Supervisor or the Project Manager.

2. Where independent testing agencies are required by code or indicated in the contract documents, engage a qualified testing agency to perform these quality-control services.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Special Tests and Inspections: Contractor will engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction.

1. Testing agency will notify the Government and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to the Government with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and reinspect corrected work.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with the Government and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify the Government and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4. Facilities for storage and field-curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
2. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400

SECTION 01420 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": The term "approved," when used to convey Government's action on Contractor's submittals, applications, and requests, is limited to government's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by Government, requested by Government, and similar phrases.

D. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on Drawings or to other paragraphs or schedules in Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is the Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

J. The term "experienced," when used with an entity, means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. "Project site" is the space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source and make them available on request.

E. Abbreviations and Acronyms for Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

F. Abbreviations and Acronyms for Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA Aluminum Association, Inc. (The)

AAMA American Architectural Manufacturers Association

AAN American Association of Nurserymen
(See ANLA)

AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists (The)
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute/ACI International
ACPA	American Concrete Pipe Association
AFPA	American Forest & Paper Association (See AF&PA)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AHA	American Hardboard Association
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction, Inc.
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALCA	Associated Landscape Contractors of America
ALSC	American Lumber Standard Committee
ANLA	American Nursery & Landscape Association (Formerly: AAN - American Association of Nurserymen)
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts
APA	APA-The Engineered Wood Association
APA	Architectural Precast Association
API	American Petroleum Institute
ASCA	Architectural Spray Coaters Association
ASCE	American Society of Civil Engineers

ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)
CCFSS	Center for Cold-Formed Steel Structures
CDA	Copper Development Association Inc.
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CGSB	Canadian General Standards Board
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPPA	Corrugated Polyethylene Pipe Association Division of Plastics Pipe Institute
CRSI	Concrete Reinforcing Steel Institute
CSI	Construction Specifications Institute (The)
DHI	Door and Hardware Institute
EIMA	EIFS Industry Members Association
EJMA	Expansion Joint Manufacturers Association, Inc.

FM	Factory Mutual System (See FMG)
FMG	FM Global (Formerly: FM - Factory Mutual System)
GA	Gypsum Association
HMMA	Hollow Metal Manufacturers Association Division of National Association of Architectural Metal Manufacturers
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.
IAS	International Approval Services (See CSA International)
ICRI	International Concrete Repair Institute
IRI	HSB Industrial Risk Insurers
ITS	Intertek Testing Services
LGSI	Light Gage Structural Institute
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MFMA	Metal Framing Manufacturers Association
MHIA	Material Handling Industry of America
ML/SFA	Metal Lath/Steel Framing Association (See SSMA)
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)
NAIMA	North American Insulation Manufacturers Association (The)
NAMI	National Accreditation and Management Institute, Inc.
NCMA	National Concrete Masonry Association
NeLMA	Northeastern Lumber Manufacturers' Association

NFPA	National Fire Protection Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSA	National Stone Association
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting and Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PIMA	Photographic & Imaging Manufacturers Association (Formerly: NAPM - National Association of Photographic Manufacturers)
RCSC	Research Council on Structural Connections
SAE	SAE International
SDI	Steel Deck Institute
SDI	Steel Door Institute
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPIB	Southern Pine Inspection Bureau (The)
SPRI	SPRI (Single Ply Roofing Institute)
SSINA	Specialty Steel Industry of North America
SSMA	Steel Stud Manufacturers Association (Formerly: ML/SFA - Metal Lath/Steel Framing Association)
SSPC	SSPC: The Society for Protective Coatings
SWRI	Sealant, Waterproofing & Restoration Institute
TPI	Truss Plate Institute
TPI	Turfgrass Producers International
UL	Underwriters Laboratories Inc.

USG United States Gypsum Company
A Subsidiary of USG Corporation

WCLIB West Coast Lumber Inspection Bureau

WIC Woodwork Institute of California

WMMPA Wood Moulding & Millwork Producers Association

WWPA Western Wood Products Association

G. Abbreviations and Acronyms for Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

BOCA BOCA International, Inc.

CABO Council of American Building Officials
(See ICC)

IAPMO International Association of Plumbing and Mechanical Officials (The)

ICBO International Conference of Building Officials

ICC International Code Council
(Formerly: CABO - Council of American Building Officials)

SBCCI Southern Building Code Congress International, Inc.

H. Abbreviations and Acronyms for Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE Army Corps of Engineers
CRD Standards

CFR Code of Federal Regulations

CPSC Consumer Product Safety Commission

DOC Department of Commerce

DOD Department of Defense
DOD Specifications and Standards

EPA Environmental Protection Agency

FAA	Federal Aviation Administration Department of Transportation
FCC	Federal Communications Commission
FDA	Food and Drug Administration
FED-STD	Federal Standard (See FS)
FS	Federal Specification (Available from DOD, GSA, and NIBS)
FTMS	Federal Test Method Standard (See FS)
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley Laboratory (See LBNL)
LBNL	Lawrence Berkeley National Laboratory
MILSPEC	Military Specification and Standards (See DOD)
NCHRP	National Cooperative Highway Research Program (See TRB)
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety & Health Administration (See CFR 29)
RUS	Rural Utilities Service (See USDA)
TRB	Transportation Research Board
USDA	Department of Agriculture
USPS	Postal Service

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01420

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. See Division 1 Section "Execution Requirements" for progress cleaning requirements.

1.3 USE CHARGES

A. General: Cost or use charges for temporary facilities are not chargeable to the Government and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the government, testing and inspecting agencies and personnel of authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Provide materials suitable for use intended.

2.2 EQUIPMENT

A. Field Offices: Prefabricated, mobile units, or job-built construction with lockable entrances, operable windows, and serviceable finishes; on foundations adequate for normal loading.

B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required. Proposed locations must be approved by COR prior to facility placement.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Contractor shall provide temporary power service. There are no utilities on-site.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion.

B. Temporary Roads: Construct and maintain temporary roads adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas.
3. Recondition base after temporary use, including removing contaminated material.

C. Common-Use Field Office: Provide a weathertight field office for use as a common facility by all personnel engaged in construction activities; of sufficient size to accommodate required office personnel and meetings of 6 persons at Project site. Keep office clean and orderly.

D. Storage and Fabrication Trailers: Provide trailers sized, furnished, and equipped to accommodate materials and equipment involved. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site. Contractor is responsible to protect on site storage from vandalism and theft.

3.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. The site is remote and prone to vandalism and theft. Contractor shall provide project coordination and security measures as necessary to prevent or minimize damage to or theft of on site materiazls and equipment. Contractor is responsible for replacement of damaged or stolen materials, equipment and completed work at no cost to the Government until project closeout and final acceptance by the Government.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to daylight hours.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

D. Site Enclosure Fence: When excavation begins, install enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.

1. Set fixed chain-link fence posts in compacted mixture of gravel and earth.
2. Set portable chain-link fence posts in concrete bases.
3. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.

4. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.

E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

END OF SECTION 01500

SECTION 01700 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. See Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of existing site conditions affecting the Work.

B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Do not proceed with utility interruptions without Government's written permission.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Government. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Government promptly.

B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.

4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Government when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including grading, fill and topsoil placement, slopes, and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, foundations and floor levels. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by government.
2. Allow for building movement, including thermal expansion and contraction.

F. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

G. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials or into waterways will not be permitted. Disposing of waste materials in Government receptacles will not be permitted.

G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period.

I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.8 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

END OF SECTION 01700

SECTION 01770 – CONSTRUCTION CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Government's personnel.
6. Final cleaning.

B. See Division 1 Section "Construction Progress Documentation" for submitting Final Completion construction photographs and negatives.

C. See Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for products of those Sections.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise government of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting government unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and digital photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Government. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Government. Advise Government's personnel of changeover in security provisions.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Submit changeover information related to Government's occupancy, use, operation, and maintenance.
10. Complete final cleaning requirements, including touchup painting.

11. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Government will either proceed with inspection or notify Contractor of unfulfilled requirements. Government will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Government, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final INVOICE AND CONTRACT RELEASE (fs-6300-16).
2. Submit certified copy of government's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by government. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct government's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, government will either proceed with inspection or notify Contractor of unfulfilled requirements. Government will prepare a final Certificate OF Final Inspection (FS-6300-15) after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.5 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for government's reference during normal working hours.

B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
4. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders and Record Drawings, where applicable.

D. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.6 OPERATION AND MAINTENANCE MANUALS

A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data: Include emergency instructions and procedures, system and equipment descriptions, operating procedures, and sequence of operations.
2. Maintenance Data: Include manufacturer's information, list of spare parts, maintenance procedures, maintenance and service schedules for preventive and routine maintenance, and copies of warranties and bonds.

B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.7 WARRANTIES

A. Submittal Time: Submit written warranties on request of government for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom-clean in unoccupied spaces.
h. Remove labels that are not permanent.
i. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

j. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

SECTION 02230 - SITE CLEARING AND PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Protecting existing trees and vegetation to remain.
2. Removing trees and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping.
5. Removing above-grade site improvements.

B. Related Sections include the following:

1. Division 1 Section "Construction Facilities and Temporary Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
2. Division 2 Section "Selective Demolition" for partial demolition of buildings or structures undergoing alterations.
3. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
4. Division 2 Section "Exterior Planting" for finish grading, including placing and preparing topsoil for lawns and planting.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of weeds, roots, and other deleterious materials.

1.4 MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain on Government’s property, cleared materials shall become Contractor's property and shall be removed from the site.

1.5 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Locate and clearly flag trees and vegetation to remain or to be relocated.

D. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.3 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.

3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
4. Use only hand methods for grubbing within drip line of remaining trees.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding 8-inch (200-mm) loose depth, and compact each layer to a density equal to adjacent original ground.

3.4 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72 inches (1800 mm).
2. Do not stockpile topsoil within drip line of remaining trees.

3.5 SITE PREPARATION

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

C. Once clearing and grubbing has been performed, the planned structure and fill areas to be proofrolled using a loaded tandem axle dump truck driving in a cris-cross pattern. Proofrolling should be performed using a minimum load of 15 tons. Proofroll testing should be performed under the observation of a geotechnical engineer. Soft, or unsuitable, areas of soil should undercut and stabilized at the direction of the Government.

3.6 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Government's property.

END OF SECTION 02230

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Subbase course for concrete walks and pavements.
5. Base course for trail paving.
6. Subsurface drainage backfill for walls and trenches.
7. Excavating and backfilling trenches within building lines.

B. Related Sections include the following:

1. Division 1 Section "Construction Facilities and Temporary Controls."
2. Division 2 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
3. Division 2 Section "Foundation Drainage Systems" for drainage of footings, slabs-on-grade, and walls.
4. Division 2 Section "Exterior Planting" for finish grading, including placing and preparing topsoil for lawns and plantings.
5. Division 3 Section "Cast-in-Place Concrete" for granular course over vapor retarder.

1.3 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Layer placed between the subbase course and paving.

C. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.

D. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.

E. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavations more than 10 feet (3 m) in width and pits more than 30 feet (9 m) in either length or width.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Government, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches (97 blows/50 mm).

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

1.4 SUBMITTALS

A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:

1.5 QUALITY ASSURANCE

A. Preexcavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 PROJECT CONDITIONS

A. Existing Subsurface Conditions: See Geotechnical Report.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. Refer to Geotechnical Report included in this manual for recommendations for materials and executions.

B. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, GM, SW, SP, and SM, or a combination of these group symbols; free of organics, particles or greater than 4 inches in diameter, frozen soil, and any other deleterious materials. The soil fill to have a plasticity index (PI) value of not more than 25 with a standard proctor maximum dry density value of not less than 90 pcf.

C. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2- inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (38-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2- inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 200 lbf (890 N); ASTM D 4632.
2. Tear Strength: 75 lbf (333 N); ASTM D 4533.
3. Puncture Resistance: 90 lbf (400 N); ASTM D 4833.
4. Water Flow Rate: 4 gpm per sq. ft. (2.7 L/s per sq. m); ASTM D 4491.
5. Apparent Opening Size: No. 30 (0.6 mm); ASTM D 4751.

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

C. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. Foundation excavations to be observed under direction of a geotechnical engineer to ensure that the soils encountered are consistent with the design bearing capacity assigned based upon the results of the geotechnical report. Dynamic Cone Penetration testing to be performed within the foundation excavations to determine the actual bearing capacity of the soils encountered in the foundation excavations. If unsuitable soils are encountered, the soils shall be undercut at the direction of the geotechnical engineer.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 APPROVAL OF SUBGRADE

A. Notify Government when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Government.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Government.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Government.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Removing concrete formwork.
3. Removing trash and debris.

3.11 FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill as required in geotechnical report.
5. Under footings and foundations, use engineered fill as required in geotechnical report.

3.12 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.13 COMPACTION OF BACKFILLS AND FILLS

A. Fill soil should be placed in loose, horizontal lifts of not more than 8 inches. The compacted thichness of each lift should be approximately 6 inches. Compaction to be performed using a vibratory compactor appropriate for the material type.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Fill soil to be aerated to within – 2% to + 2% of its optimum moisture content as determined by the standard proctor density test (ASTM D-698). Compaction of all fill soil supporting structures, sidewalks, and trail areas plus 5 feet beyond the perimeter should be performed until at least 98% of the standard proctor maximum dry density value is achieved.
1. Density testing should be performed concurrent with the soil fill placement to ensure that the proper density is achieved. The recommended minimum rate of testing is 1 test per 2500 square feet or less of fill area for each soil fill lift. Density testing to be performed by a qualified soil technician under the direction of the geotechnical engineer.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.15 SUBSURFACE DRAINAGE

A. Drainage Piping: Drainage pipe is specified in Division 2 Section "Foundation Drainage Systems."

B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench as indicated. Place a 6-inch (150-mm) course of filter material on drainage fabric to support drainage pipe. Encase drainage pipe in a minimum of 12 inches (300 mm) of filter material and wrap in drainage fabric, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 698.
2. Place and compact impervious fill material over drainage backfill to final subgrade.

3.16 DRAINAGE COURSE

A. Under slabs-on-grade, install drainage fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends. Place drainage course on drainage fabric and as follows:

B. Under slabs-on-grade, place drainage course on prepared subgrade and as follows:

1. Compact drainage course to required cross sections and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
2. When compacted thickness of drainage course is 6 inches (150 mm) or less, place materials in a single layer.
3. When compacted thickness of drainage course exceeds 6 inches (150 mm), place materials in equal layers, with no layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick when compacted.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab, but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet (30 m) or less of wall length, but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Government's property.

END OF SECTION 02300

SECTION 02740 - ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

A. Selected materials and methods for work in this section are in accordance with applicable provisions of the Virginia Department of Transportation Road and Bridge Specifications, referred to hereinafter by VDOT RBS Section. Subsections of specifications describing method of measurement and basis of payment shall not apply to this work. The term "Department" when used in the Road and Bridge Specifications shall be understood to mean the Government Representative.

1.1 SECTION INCLUDES

A. Asphalt concrete pavement.

B. Aggregate base.

1.2 REFERENCES

A. Publications listed below form part of specification to extent referenced. Publications are referenced in text by basic designation only.

1. AMERICAN SOCIETY OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

a. AASHTO T230-68 (1986) Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures

2. VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT)

a. VDOT RBS (2002) Road and Bridge Specifications

1.3 SUBMITTALS

A. SD-12, Field Test Reports

1. Density.

B. SD-13, Certificates

1. Materials.

C. Aggregate Top Seed
   1. Aggregate range of colors for Government's selection.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt Concrete Intermediate Course: Conform material to VDOT RBS Section 211 for asphalt concrete Type IM-19.0A.

B. Asphalt: Conform material to VDOT RBS Section 210. Use grade CRS-1, CRS-2, CRS-1h, or CSS-1h for tack coat. CMS-2 may be used for tack coat during the winter months. With exception of CMS-2, asphalt for tack coat may be diluted with 50-percent water provided that resulting material produces uniform application of tack.

C. Aggregate Top Seed: ¾" round with the following sieve graduation:

Size	% Passing
1"	100
3/4"	90-100
3/8"	40-60
#4	0-10
#8	0-5

1. Aggregate Color: Architect to select from range of colors.

PART 3 EXECUTION

3.1 ASPHALT CONCRETE INTERMEDIATE COURSE

A. Place base on cleaned, primed subbase or subgrade in accordance with VDOT RBS Section 315.

3.2 TACK COAT

A. Apply liquid asphalt material at 0.10 gallon per square yard in accordance with VDOT RBS Section 310.

3.3 TOP SEED AGGREGATE

A. Apply 1 layer, even coat of aggregate over binder and rake in to top course.
B. Roll seeded aggregate into top course of binder.
C. Sweep and remove excess aggregate from finished surface.

3.4 FIELD QUALITY CONTROL

A. Perform field sampling and testing under provisions of Section 01400.

B. Asphalt Pavement Samples: For determining asphalt pavement density and thickness, take samples with coring machine or cut a 12-inch square out of pavement in accordance with AASHTO T230-68. Take one set (3 samples) for every 300 tons of material placed at locations selected by the Government's Representative. Replace removed pavement with new mixture and refinish.

C. Asphalt Pavement Tolerances

1. Surface Tolerance: Conform to VDOT RBS Section 315.07,(a),3. Straightedge test.

2. Thickness Tolerance: Conform to VDOT RBS Section 315.07,(b).

3. Density Requirements: 96 percent of laboratory density as determined by AASHTO T230-68.

D. Nuclear field density testing method may be used in lieu of samples cut out of pavement.

3.5 TESTS

A. Submit certified reports of tests. Payment for costs in connection with sampling and testing shall be in accordance with Section 01400.

END OF SECTION 02740

SECTION 2920 – PERMANENT-TEMPORARY SEEDING

PART 1 - GENERAL

1.1 Description: As follows:

A. The work of this section consists of:
1. Seeding
2. Fertilizing
3. Mulching

1.2 Submittals:

A. Provide labels of grass seed bags of each type used.

1.3 Product Handling:

A. Seed: Deliver in acceptable condition in original, unopened containers with seed label attached to each container.

B. Limestone: Deliver in original, unopened containers with identifying mark and analysis attached.

C. Organic Fertilizer: Deliver in original, unopened containers with analysis, type, and trade name attached.

D. Deliver all materials to the site with their labels intact and legible. Replace materials that become wet or damaged at no additional expense to the Owner. Store in weatherproof storage area, free from the affects of the weather.

1.4 Project Conditions:

A. Seed during recommended planting period or as approved.

1. All areas of this contract are to be permanently seeded within three (3) days of finish grading, and shall be seeded within 7 days with temporary seeding if they are to be left idle in a disturbed state more than thirty (30) days.

1.5 Guarantee:

A. The Contractor shall produce dense, vigorous, well established lawns and shall maintain lawn areas until final acceptance of the work by the A/E. Any areas which fail to show a uniform stand of grass shall be reworked, and reseeded at the Contractor's expense with the same seed as originally used thereon, and such reseeding shall be replaced until all required areas area covered with a satisfactory stand of grass. A satisfactory stand of grass shall be defined as a cover of living grass in which gaps larger than 2 inches are not occurring at final acceptance.

1.6 Quality Assurance:

A. Provide only quality seeds as approved and certified by the Commonwealth of Virginia.

PART 2 - PRODUCTS

2.1 TOPSOIL: As specified in Section "Exterior Plants"

2.2 Lime: As required by soil test.

A. Agricultural limestone containing minimum of 85 percent carbonates. Minimum gradation: 100 percent passing a 10 mesh sieve; 98 percent a 20 mesh sieve; 55 percent a 60 mesh sieve; and 40 percent a 10 mesh sieve.

2.3 Fertilizer:

A. Store in weatherproof place and in a manner that will be dry and its effectiveness unimpaired.

2.4 Turf Seed:

A. FS JJJ-S-181B. All permanent Grass seed and Temporary seed specified in this section will be manufactured by a seed company that can guarantee all seed shall be free of noxious weed seeds, cleaned Grade A recent crop seed. Seed company shall provide guaranteed germination of 80 percent.

a. Seed mixture below is proportioned by weight.

Seed mixture shall consist of: 30% Greenkeeper – WAF Tall Fescue, 30% Fidelity tall fescue, 30% Coyote II tall fescue, 9% Thermal Blue Kentucky Bluegrass complying with minimum germination, purity, weed content as specified in Virginia Seed and Sod laws, VDOT Standards. Kentucky 31 is NOT acceptable. Percentages determined by weight. All seed shall be certified seed. Cast seeds at 4 pounds per thousand square feet. Seeding shall be between March 1 and May 15, or August 16 and October 31.

2.5 Tall Grass Seed Mix:

A.

Andropogon gerardii	Big Bluestem	16.61%
Elymus canadensis	Canada Wild Rye	22.58%
Elymus virginicus	Virginia Wild Rye	6.17%
Panicum virgatum	Swtich Grass	27.32%
Sorghastrum nutans	Indian Grass	27.32%
Total		**100.00%**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pennington Seed
b. Earth Source, Inc.
c. Prairie Nursery
d. Approved Equal

2.6 Temporary Seed Mix:

Temporary Cover Grasses		
Agrostis alba	Redtop	72.55%
Avena sativa	Seed Oats	6.05%
Triticum spp.	Wheat	21.40%

Total	**100.00%**

2.8 Binder:

A. Fiber mulch based tack binder such as “Enviro-Blend” by Conwed or equal. Apply at 25 lbs. per thousand square feet according to manufacturer’s recommendations.

PART 3 - EXECUTION

3.1 Preparation:

A. General: The Contractor shall prior to seeding operations, repair any ruts, depressions, eroded areas, as directed.

3.2 Grass Area Preparation:

A. Loosen soil to a depth of three inches in all areas by approved method of scarification, by either pulverizing or disking the seedbed. Remove stones or foreign matter over 2 inch in diameter from soil surface.

B. Lime deficiency of soil in grass areas shall be tested to a depth of 6 inches by a Soil Science Lab through seed contractor to determine whether lime is needed. Send results of tests to A/E.

C. Spread Fertilizer per manufacturer’s recommendations on grass seed areas. Fertilizer shall be distributed evenly, by mechanical spreader, over all areas to be seeded. Fertilizer shall be applied not more than one week prior to seeding. Fertilizer to be uniformly distributed in the top 2 inches to 4 inches of seed bed.

D. Finish Grade - immediately prior to seeding the bed shall be prepared by breaking, disking, harrowing, blading, dragging or other approved methods. The soil shall be thoroughly pulverized to minimum depth of approximately three inches and smoothed by means of raking or other approved methods. Raking shall be done by hand adjacent to structures, walks, curbing, and trees.

E. Final seed bed preparation shall be performed at such time that the seeding work will follow within three days, weather permitting.

3.3 Seeding:

A. General: Seeding and straw cover shall be done during sunny weather conditions and when wind is five miles per hour or less.

B. Method: Within three days of when the finish grading operations are performed (with no rain between operations) and after approved by the A/E the seed shall be applied at the rate specified above by means of an approved mechanical seed spreader. Seed in two directions perpendicular to each other, using half of the specified amount in each application.

C. Turf Seed rate:
1. 4 lbs/1000sf

D. Tall Grass Seed Mix rate:
1. 79 lbs/acre

E. Temporary Seed Mix rate:
   1. 79/lbs/acre

3.4 Mulching:

A. Dry Straw Mulch: Provide air-dry, clean, mildew and seed free salt hay or threshed straw of wheat, rye, oats, or barley.

3.5 Watering:

A. After mulching, water with a mist spray soaking ground to minimum depth of 2 inches. Water as necessary until final inspection.

3.6 Clean-Up

A. Upon completion of work, remove debris and leave area in clean, acceptable condition.

3.7 Maintenance and Protection:

A. Maintain lawn including the preparation and reseeding of any bare areas, proper watering, refilling of rain-washed gullies and rutted areas, refertilizing, mowing, cultivation, weeding, disease and insect control, protective spraying, and all other procedures necessary to produce a normal healthy, and vigorous lawn. Maintain lawn until final acceptance.
B. At least three mowings shall be completed in grass areas before the work will be accepted. Mower blades shall be set to 3 inches high and cutting no more than 1/3 off top of blade.
C. Water all areas which have been seeded except when natural precipitation has provided the necessary moisture as determined by the A/E. Watering shall be done in a manner which will prevent erosion due to the application of excessive quantities, and the watering equipment shall be of a type that will not damage the finished surface. A minimum amount of rainfall would be two one inch rains per week.
D. Protect seeded areas against traffic or other use by placing warning signs as approved by the A/E and protective fencing as specified.
E. Should an area receive excessive run-off and become eroded, protect area long enough to establish grass. Use jute or excelsior mat.

3.8 Inspection:

A. Contractor shall maintain grass by watering, weeding, fertilizing and re-seeding as necessary until lawn area is established and accepted. If grass and erosion mix areas are being readied for inspection, no individual area of any lawn shall have bare spots to cover more than 5 percent of individual lawn areas.
B. Re-seed gaps larger than 2 inches in lawn area prior to final acceptance. This shall be accomplished through mechanical means using a slit-seeder or a core aerator.

END OF SECTION 02920

SECTION 02930 - EXTERIOR PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Shrubs
2. Perennials

B. Related Sections include the following:

1. Division 2 Section "Site Clearing" for protection of existing trees and planting, topsoil stripping and stockpiling, and site clearing.
2. Division 2 Section "Earthwork" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.

1.3 DEFINITIONS

A. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated.

B. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

E. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

F. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:

1. Manufacturer's certified analysis for standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Qualification Data: For landscape Installer.

D. Material Test Reports: For existing surface soil and imported topsoil.

E. Planting Schedule: Indicating anticipated planting dates for exterior plants.

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when exterior planting is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of topsoil.

1. Report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory topsoil.

D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

1. Selection of exterior plants purchased under allowances will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.

E. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

F. Observation: Government may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Government of sources of planting materials 2 weeks in advance of delivery to site.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

1. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting.

B. Do not prune trees and shrubs before delivery, except as approved by Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots in water for two hours if dried out.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.7 COORDINATION

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 15 – June 15
2. Fall Planting: September 15 – November 15

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Architect.

1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

1.8 WARRANTY

A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Government, or incidents that are beyond Contractor's control.

1. Warranty Period for Trees and Shrubs: One year from date of Substantial Completion.
2. Warranty Period for Ground Cover and Plants: One year from date of Substantial Completion.
3. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.
4. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
5. A limit of one replacement of each exterior plant will be required, except for losses or replacements due to failure to comply with requirements.

1.9 MAINTENANCE

A. Trees and Shrubs: Maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Restore or replace damaged tree wrappings.

1. Maintenance Period: **12** months from date of Substantial Completion.

B. Ground Cover and Plants: Maintain for the following maintenance period by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings:

1. Maintenance Period: **12** months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name.

D. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

E. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.2 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape, and height of shrub.

1. Provide container-grown shrubs.

2.3 PERENNIALS

A. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed.

2.4 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of **6** percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

    a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

2.5 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with at least 0.15 lb (2.4 kg) of ammonium nitrate or 0.25 lb (4 kg) of ammonium sulfate per cubic foot (cubic meter) of loose sawdust or ground bark.

C. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.6 ORGANIC FERTILIZER

A. Bonemeal: Commercial, steamed, finely ground (1-13-0).

B. Blood meal: containing 13% nitrogen.

C. Potash: containing 51% soluble material.

D. Poultry based fertilizer: containing 1 % water soluble nitrogen, 4 % insoluble nitrogen.

2.7 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch (25-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

C. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:

1. Type: Rounded, smooth faced riverbed river jack
2. Size Range: Approximately 5-8" round
3. Color: Uniform tan-grey-beige color range, acceptable to Architect

2.9 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:

1. One part Loam (20% clay, 40% silt, and 40% sand) and one part soil from hole. It will have a "ph" factor between 5.5 and 7.0.

2. Add amendments and fertilizers per recommendations from soil testing agency, and products suggested rate of application per plant type.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Government''s acceptance of layout before planting. Make minor adjustments as required.

D. Lay out exterior plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING BED ESTABLISHMENT

A. Loosen subgrade of planting beds to a minimum depth as follows:

Area	Depth of Planting Soil Mix
For Perennial Beds	6” Deep for entire bed
For Shrubbery Plant Beds	12” Deep for entire bed

Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply fertilizer directly to subgrade before loosening.
2. Thoroughly blend planting soil mix off-site before spreading

    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer.

3. Spread planting soil mix to a depth as indicated above but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

    a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil mix.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.4 TREE AND SHRUB EXCAVATION

A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for container-grown stock.
2. Excavate at least 12 inches (300 mm) wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
3. If drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.

B. Subsoil removed from excavations may be used as backfill.

C. Obstructions: Notify Government if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- (150-mm-) diameter holes into free-draining strata or to a depth of 10 feet (3 m), whichever is less, and backfill with free-draining material.

D. Drainage: Notify Government if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE AND SHRUB PLANTING

A. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball **2 inch (25 mm)** above adjacent finish grades.

1. Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

B. Set container-grown stock plumb and in center of pit or trench with top of root ball **2 inch (25 mm)** above adjacent finish grades.

1. Carefully remove root ball from container without damaging root ball or plant.
2. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

C. Organic Mulching: Apply **2-inch (50-mm)** average thickness of organic mulch extending 12 inches (300 mm) beyond edge of planting pit or trench. Do not place mulch within **3 inches (75 mm)** of trunks or stems.

3.6 TREE AND SHRUB PRUNING

A. Prune, thin, and shape trees and shrubs as directed by Architect.

B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.

3.7 PERENNIAL PLANTING

A. Set out and space ground cover and plants as indicated.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.8 PLANTING BED MULCHING

B. Mulch backfilled surfaces of planting beds and other areas indicated.

1. Organic Mulch: Apply **2-inch (50-mm)** average thickness of organic mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.
2. Mineral Mulch: Apply 8-12” average thickness of mineral mulch, and finish level with adjacent finish grades.

3.9 CLEANUP AND PROTECTION

A. During exterior planting, keep adjacent pavings and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

3.10 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Government’s property.

END OF SECTION 02930

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Building walls.

B. Related Section:

1. Division 02 Section "Earthwork" for drainage fill under slabs-on-grade.
2. Division 03 Section “Formliners for Architectural Concrete” for textured finishes on exposed concrete surfaces
3. Division 09670 for staining and finishing of horizontal exposed concrete surfaces

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

    a. High-density overlay, Class 1 or better.
    b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

B. Concelaed Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

1. Exposed Void Forms: Plywood, metal, or other approved materials.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. 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.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

G. Random wooden plank and smooth style finish: Provide form facing materials as specified in Section 03350 Formliners for Architectural Concrete as indicated. Do not use form ties where these finishes are indicated.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar

supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type III.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94 and potable.

D. Aggregate

1. Fine Aggregate for Concrete: Furnish sand conforming to AASHTO M6, Class B including the reactive supplementary requirement, except as amended or supplemented by the following:

   a. Material passing No. 200 sieve (AASHTO T11) 3% max.
   b. Sand equivalent valve (AASHTO T176) alternate method No. 2, reference method, 75 min.

2. Course Aggregate for Concrete: Conform to AASHTO M 80, Class A, except as amended or supplemented by the following:

   a. Los Angeles Abrasion (AASHTO T96) 40% max.
   b. Adherent coating (ASTM D 5711) 1.0% max.
   c. Grading (AASHTO M43) all sizes except Numbers 8, 89, 9 or 10.

3. All aggregates shall be tested per sieve analysis (AASHTO T11.27) and organic impurity (AASHTO T21) at least once per 100 yds and whenever stockpile is replaced or substantially added to.
4. For decks or surface courses, do not use aggregates known to polish or carbonate aggregates containing less than 25 percent by mass of insoluble residue as determined by ASTM D 3042.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Construction Chemicals - Building Systems; Confilm.
b. Dayton Superior Corporation; Sure Film (J-74).
c. Sika Corporation; SikaFilm.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Construction Chemicals - Building Systems; Kure 1315.
b. Conspec by Dayton Superior; Sealcure 1315 WB.
c. Symons by Dayton Superior; Cure & Seal 31 Percent E.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: use elastomeric material.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids; epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.9 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. All Elements: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.49.
3. Slump Limit: 3 inches, plus or minus 1 inch.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Engineer of Record and COR shall approve mix design.

2.10 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

2.12 STORAGE AND HANDLING OF MATERIAL

A. Store and handle all material in a manner that prevents segregation, contamination, or other harmful effects. Do not use cement and fly ash containing evidence of moisture contamination.

Store and handle aggregate in a manner that ensures a uniform moisture content at the time of batching.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 75 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg 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.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Random wooden plank and smooth style Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete wall surfaces of bridge as indicated.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

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

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel and Coarse-Broom Finish: Apply a first trowel finish to surfaces. While concrete is still plastic, slightly scarify surface with a stiff broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 JOINT FILLING

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

1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Steel reinforcement placement.
2. Headed bolts and studs.
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Testing:

1. Concrete shall have a minimum 28-day breaking strength of 4000 psi when tested in accordance with ASTM C-39. For compressive tests, Contractor shall keep four extra cylinder molds (in addition to those being used for testing in progress) on the job site at all times.

2. Field sampling and testing of the concrete being placed in the work shall be accomplished by the Contractor. Concrete test methods and frequency shall be as stated below. Sampling shall be as specified in ASTM C172. Testing shall be done by a certified laboratory and technician as applicable. Allowable slump will be 3 inches plus or minus 1 inch.

Type of Test	Frequency	Acceptable Limits
Slump of Portland Cement Concrete ASTM C143	1 for each truck delivery	3" +/- 1"

3. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
4. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

5. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
6. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
8. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
9. Compression Test Specimens: ASTM C 31.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure three sets of two standard cylinder specimens for each composite sample.

10. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.

b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

11. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
12. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
13. The COR may at his discretion attend with the contractor's representative obtaining the aggregate samples to monitor sampling methods (AASHTO T2), verify the mix represents the stockpiles intended for use and to verify the stockpiles do not contain deleterious materials.

END OF SECTION 033000

SECTION 03350 - FORMLINERS FOR ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Formliners for architectural concrete.

1.2 RELATED SECTIONS

A. Section 03300 - Cast in Place Concrete: General Requirements.

B. Section 03400 - Precast Concrete.

C. Section 05120 - Structural Steel Framing

1.3 REFERENCES

A. American Concrete Institute (ACI): ACI 117 - Tolerances for Concrete Construction and Materials.

B. ASTM International (ASTM):
1. ASTM C 1088 - Standard Specification for Thin Veneer Brick Units Made From Clay or Shale; TBX Select.
2. ASTM D 256
3. ASTM D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
4. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
5. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
6. ASTM D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.
7. ASTM D 785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials.
8. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
9. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
10. ASTM D 1525 - Standard Test Method for Vicat Softening Temperature of Plastics.
11. ASTM D 2240 - Standard Test Method for Rubber Property Durometer Hardness, Shore A; A Scale Test.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Printed product data and installation guidelines for formliner system.
2. Manufacturer's installation instructions, showing required preparation and installation procedures.
3. Storage and handling requirements and recommendations.
4. Installation methods.
5. Cleaning and maintenance instructions.

C. Shop Drawings: Submit formwork panel elevations, detailing the location of architectural concrete work, including but not limited to the following:
   1. Form tie locations, end locations and other special conditions, panel sizes, joint locations, joint widths, reveal and false-joint locations and dimensions, elevations, sections and details of assembly components, attachment details, and weather sealing; indicate locations, configurations, typical details, connections, expansion joints, large scale plans.
   2. Show sequence of installation.
   3. Show location of members, other items of work and related work of other Sections to be coordinated with work of this section.
   4. Submit detail drawings depicting proper installation and flashing techniques. Coordinate locations with those found on the Contract Drawings.

D. Quality Assurance Submittals: Copies of test reports by independent laboratories verifying the performance of the system shall be submitted to the Government upon request.

E. Verification Samples: For each finish product specified, two samples, 24 inches (610 mm) by 24 inches (610 mm), representing actual products, styles, colors, patterns, and textures.
   1. Formliner samples of each type of formliner specified.
   2. Bond breaker sample on brick chip representing bond breaker specified
   3. Form release sample representing form release specified.
   4. Form ties, samples, and description, showing method of break-back when forms are removed.

F. Warranty: Copy of manufacturer's standard warranty.

1.5 QUALITY ASSURANCE

A. Single Source Requirements: Provide primary and secondary components required for installation of formliner systems shall be components of system recommended by single source.

B. Manufacturer Qualifications: Minimum 5 years experience manufacturing similar products.

C. Installer Qualifications:
   1. Experienced and competent in architectural concrete installation.
   2. If requested, submit a list of recently completed projects using similar materials.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship. Build on site 30 days prior to commencing work, using same materials, methods and work force that will be used for the project. Government will determine specific requirements and location, and whether mockup shall be incorporated as part of the final project.

   a. Size: 16 Sq. Ft. (4feet x 4feet x 8" thick) to adequately illustrate the pattern and texture selected.

   b. Include an area to demonstrate formliner butt joint and, if appropriate continuation of pattern through construction joint.

   1. The mock-up shall demonstrate the full range of specified design options and workmanship to be expected in completed work.
   2. Locate mock-up on site in location as directed by Government. Clean the sample panel installation using the same materials and tools as planned for the final construction.
   3. Obtain government’s acceptance of mock-up before start of work.
   4. Do not proceed with remaining work until workmanship, colors, styles, patterns, and textures are approved by Government.

5. Incorporate edge, reveal, formliner butt joint and, if appropriate continuation of pattern through construction joint and detail as per drawings.
6. Show clean, pressure washed concrete surface.
7. Modify mock-up area as required to produce acceptable work.
8. Maintain Mock Up for comparison with finished work.
9. Remove mock-up at the completion of the work.

B. Conduct a pre-installation meeting to verify all products, application procedures, site conditions and warranty terms. Conduct in accordance with Section 01310.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered to the location in unopened factory containers. Upon arrival, materials shall be inspected for damage and manufacturer informed of any discrepancies. Deficient materials shall not be used.

B. Materials shall be stored in a protected location and safeguarded from damage.

C. Store formliners covered and elevated off the exposed ground. Prolonged high or low temperatures will cause a permanent distortion and deterioration of physical properties.

D. Protect liquid materials from freezing temperatures and temperatures in excess of 90 degrees F (32 degrees C). Store covered, out of direct sunlight.

1.3 COORDINATION/SCHEDULING

A. Coordinate installation of formliner panel systems with related wall elements, including, windows, doors, louvers, ducts, signage, flashings, sealants, weather resistive barrier, sealant tapes and membranes, supporting wall framing and sheathing, surface mounted objects, etc.
1. Coordinate with installation of flashing, coping and sealants to ensure that materials are installed in accordance with manufacturer's instructions.
2. Coordinate with installation of surface-mounted objects to ensure that watertight seal is provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: **1**.Fitzgerald Formliners, which is located at: 1500 E. Chestnut Ave. ; Santa Ana, CA 92701; Toll Free Tel: 800-547-7760; Tel: 714-547-6710; Email: request info (info@formliners.com); Web: www.formliners.com **2**. Scott System, Inc. 10777 E. 45th Avenue, Denver, Colorado 80239 303.373.2500 Fax 303.373.2755. **3**. Spec Formliners 530 East Dyer Road, Santa Ana, CA. 92707; Phone: 888 429-9550, Fax: 714 429-1460; JessieUllerich@SpecFormliners.com

B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 FORMLINERS

A. Formed Plastic Formliners:
1. Material: high-impact styrene.
2. Compliance:
a. IZOD Impact, ASTM D 256: 2.0.

b. Tensile Strength, ASTM D 6383: 3,700 psi.
c. Heat Deflection, ASTM D 695: 188.
d. Vicat Softening, ASTM D 1525: 212.

3. Style: Random Wooden Plank Characteristics
   a. medium to heavy grained random width planks of uneven plane
   b. Liner size: min 4 feet wide by min 10 feet long
   c. Patterned Plank Widths: randomly distributed variation with a minimum 2-3/4" through maximum of 7" (plus or minus 1/2")
   d. Patterned Plank lengths: randomly distributed variations with a minimum of 2'-6" through maximum of 8' (plus or minus 1") - each striation of equal width.
   e. Pattern depth: Formed surface depths of random plane variations not to exceed 3/8"
   f. Patterned butt joints shall not form a continuous line through striations
   g. Equal lengths in pattern within the same striation shall not butt together.

PART 3- EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates are within manufacturer's specified tolerances and have been prepared in accordance with manufacturer's instructions.

B. If substrate preparation is the responsibility of another installer, do not proceed with installation. Notify government of unsatisfactory preparation immediately. Commencement of full installation represents acceptance of existing substrate conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's written instructions as applicable to each type of substrate required. Install in accordance with specified pattern and mortar.

B. Tolerances: Dimensions of the finished panel, at the time of erection in the structure, shall conform to the tolerances for precast, non prestressed elements in ACI 117, unless otherwise specified by the Architect.

3.3 CLEANING AND PROTECTION

A. Cleaning: As recommended by manufacturer. Do not begin cleaning until mortar joints are properly cured. Allow a minimum of 24 to 72 hours. Soak mortar joints before applying cleaner.
   1. Thoroughly flush wall and are after cleaning.
   2. Clean adjacent materials and surfaces of all foreign materials resulting from the work of this Section.

B. Protection:
   1. Protect installed materials from water impinging on the visible surface, chinking, sealants joints, and from behind.
   2. Protect installed materials from dust, dirt, precipitation, freezing, damaged, spilled materials, and continuous high humidity until they are fully dry.

END OF SECTION 03350

SECTION 03351 - EXPOSED AGGREGATE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exposed aggregate concrete produced by exposing the coarse aggregate of a gap graded concrete mix.

B. Related Sections: Refer to the following Sections for related work

Section 02300, “Earthwork”

Section 03300, “Cast-In-Place Concrete”

1.2 SUBMITTALS

A. General: Submit the following items in accordance with the Conditions of Contract and Section 01330, “Submittal Procedures.”

B. Product Data: Submit product data for the following materials and items.

C. Reinforcement

D. Exposed Aggregate Range of Colors

E. Forming Accessories

F. Admixtures

G. Patching Compounds

H. Sealants

I. Shop Drawings: Submit detailed shop drawings for fabrication, bending and placement of concrete reinforcement.

J. Show bar schedules, stirrup spacing, diagrams of bent bars and arrangement of reinforcement including bar overlap.

K. Include special reinforcement required for openings through concrete structures.

L. Laboratory Test Reports: Submit concrete materials test reports and mix design reports certifying that each material or item complies with or exceeds the specified requirements.

1.04 QUALITY ASSURANCE

A. Mock-up Panels: Prepare one mock-up panel at the project site to demonstrate proficiency of the workmen, and define the degree of aggregate exposure. Mock-up panels shall be a minimum of 8’-0” x 12’-0”. Contractor shall use the methods and materials proposed for used on the final installation. Uniformity in appearance of each panel shall be the responsibility of the Contractor. The approved mock-up shall serve as a standard of appearance for the final work.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

PART 2 – PRODUCTS

2.1 FORM MATERIALS

A. Unless otherwise indicated, construct formwork with plywood, metal, metal framed plywood faced or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces.

1. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

2. Provide forms that comply with US Product Standard PS 1 and the following:

a. B-B High Density Overlaid Concrete Form, Class I.

b. B-B (Concrete Form) Plywood, Class I, exterior grade or better, mill oiled and edge sealed, with each piece bearing legible inspection trademark.

B. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

C. Form Ties: Provide factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

1. Unless otherwise indicated, provide ties so portion remaining within concrete after removal is at least l/2 inch (12.7 mm) inside concrete for steel ties and l/4 inch (6.35 mm) for wire ties.

2. Unless otherwise indicated, provide form ties which will not leave holes larger than 1 inch (25 mm) diameter in concrete surface.

2.2 REINFORCING MATERIALS

A. Cold-drawn steel wire: ASTM A82.

B. Welded wire fabric: ASTM A185, welded steel wire fabric. Furnish in flat sheets, not rolls.

C. Reinforcing Bars: ASTM A615, deformed.

1. Provide Grade 40 bars No. 3 and 4 for stirrups and ties.

2. Provide Grade 60 bars No. 3 to 18, except as otherwise noted.

D. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place.

1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, stone, broken block or pieces of concrete.

2. For concrete-on-grade, use supports with sand plates or horizontal runners if base material will not adequately support chair legs.

3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected, stainless steel protected, or special stainless complying with CRSI Classes, C, D, or E respectively.

E. Shop fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not rebend or straighten reinforcement in manner that will injure or weaken material.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C150 Type III, “Low-Alkali” cement, unless otherwise specified. Use one brand of cement throughout project.

B. Aggregates: Aggregate shall be 3/4" round with the following sieve graduation:

Size	% Passing
1"	100
3/4"	90-100
3/8"	40-60
#4	0-10
#8	0-5

1. Aggregate Color: Government to select from range of colors.

C. Water: Potable, clean, fresh, free from oil, acid, organic matter or other deleterious substances.

D. Admixtures: All admixtures shall be specified in the mix design.

1. Air-Entraining Admixture: ASTM C260

2. Water-Reducing Admixture: ASTM C494, Type A.

3. Water-Reducing, Retarding Admixture: ASTM C494, Type D.

4. Chloride-containing admixtures are not permitted.

2.4 RELATED MATERIALS

A. Expansion Joint Materials

1. Typical Building: ASTM D994, preformed strips of a bituminous mastic composition.

2. Slabs-in-Ground and Sidewalks: ASTM D1751, preformed expansion joint filler having relatively little extrusion and substantial recovery after release from compression.

B. Liquid Membrane-Forming Curing Compound: ASTM C309, Type I or I-D, Class A.

C. Chemical Hardener: Hardener shall be a colorless, aqueous solution of zinc or magnesium fluosilicate. Approved proprietary hardeners shall be delivered ready for use in the manufacturer's original containers.

2.5 CONCRETE MIX DESIGN

A. All Elements: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.49.
3. Slump Limit: 3 inches, plus or minus 1 inch.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.
5. Engineer of Record and COR shall approve mix design.

2.6 PLANT, EQUIPMENT, MACHINES, AND TOOLS

A. General: Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.

1. Provide equipment with capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified.

2. Use of equipment shall be discontinued if it produces unsatisfactory results.

PART 3 – EXECUTION

3.1 FORM SETTING

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure.

B. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

C. Design and fabricate formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

D. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades.

E. Tolerances: Set forms with the upper edge true to line and grade with an allowable tolerance of 1/8 inch (3 mm) in any 10 foot (3 m) long section.

3.2 PLACING REINFORCEMENT

A. Comply with CRSI's recommended practice for “Placing Reinforcing Bars,” for details and methods of reinforcement placement and supports.

B. Clean reinforcement of loose rust and mill scale, earth, ice, oil, concrete splatter from previous pours, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Install welded wire fabric of same gage in as long of lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps of adjacent widths to prevent continuous laps in either direction.

3.3 PREPARATIONS FOR PLACING CONCRETE

A. Remove water from excavations. Before placement of concrete, remove wood chips, shavings, and hardened concrete from forms.

1. Clean all equipment.

2. Wet forms, except in freezing weather, or oil forms.

B. Earth shall be uniformly moist when concrete is placed. Sprinkling method shall not be such as to form mud or pools of water. Watering subgrade immediately prior to placing concrete is not sufficient to make the soil uniformly moist.

C. Notify other crafts to permit installation of their work. Coordinate installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

3.4 PLACING CONCRETE

A. Field Inspection: Do not place concrete until forms and reinforcing steel have been inspected and approved.

1. Place Ready-Mix concrete within specified time after batching.

Below 40 degrees F (4 degrees C)	See Cold Weather Placing
40 - 85 degrees F (4 - 29 degrees C)	90 minutes
86 - 90 degrees F (30 - 32 degrees C)	75 minutes
Above 90 degrees F (32 degrees C)	60 minutes

2. Adding Water: Do not add water after initial introduction of mixing water for batch except when slump of concrete is less than that specified upon arrival at job site, and maximum water/cement ratio for mix has not been exceeded.

   a. Add water to bring slump within specified limits. Turn drum at least 30 additional revolutions at mixing speed. Do not add water to batch at any later time.

   b. Insure that concrete strength meets specified requirements, and water does not exceed maximum amount specified in CONCRETE MIX DESIGN.

B. General: Comply with ACI 304, and as specified herein.

1. Deposit concrete continuously or in layers of such thickness that concrete will not be placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness.

2. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable to its final location to avoid segregation.

C. Placing Concrete in Forms:

1. Consolidate placed concrete by high frequency mechanical vibrating equipment, supplemented as necessary by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.

   a. Do not use vibrators to transport concrete inside forms.

   b. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine.

   c. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing segregation of mix.

D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in continuous operation, within limits of construction joints, until placement of panel or section is completed. Maintain reinforcing in proper position during concrete placement operations.

E. Placing Concrete Sidewalks: Place concrete in forms in one (1) layer of such thickness that when consolidated and finished, sidewalks will be of thickness indicated.

F. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures; comply with ACI 306.

G. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

3.5 CONCRETE FINISHING

A. General: Do not use tools such as jitterbugs that force the aggregate away from surface.

1. After screeding and consolidating concrete slabs, do not work surface until ready for floating.

2. As soon as concrete will support the mason on knee-boards, float the surface to bring grout to the surface, completely surrounding the aggregate and filling all surface voids. Float to a uniform appearance.

B. Exposing Aggregate: Proceed as soon as the surface grout can be removed by simultaneous brushing and flushing with water without overexposing or dislodging the aggregate. Avoid traffic on the concrete during this operation. High pressure water may be used if desired finish is more easily achieved without harm to the concrete. Use same method of exposure, either with or without retarder, throughout the job.

C. Liquid Chemical Hardener Finish: Apply chemical hardener finish after complete curing and drying of the concrete surface.

1. Dilute liquid hardener with water, and apply in three (3) coats; first coat, 1/3 strength; second coat, 1/2 strength; third coat, 2/3 strength. Evenly apply each coat, and allow 24 hours for drying between coats.

2. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions.

3. After final coat of chemical hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

3.6 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Immediately cut out honeycomb, rock pockets, voids over 1/4 inch (6.35 mm) in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than one (1) inch (25 mm).

1. Cut edges perpendicular to concrete surface.

2. Thoroughly clean, dampen with water, and brush coat area to be patched with neat cement grout or proprietary bonding agent before placing cement mortar or proprietary patching compound.

B. Remove and replace concrete with defective surfaces if defects cannot be repaired to satisfaction of Government.

1. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on surface, and stains and other discolorations that cannot be removed by cleaning.

a. Dampen concrete surfaces in contact with patching concrete and brush with neat cement grout, or apply concrete bonding agent.

b. Mix patching concrete of same materials to provide concrete of same type of class as original concrete.

c. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

3.7 CONCRETE TRUCK DISCHARGE

A. Excess Concrete: Discharge excess concrete in mixer trucks that cannot be immediately used to area where it will not create an obstruction or hazard during construction. Remove excess concrete from site in a timely manner to site approved by Government.

B. Wash Water Discharge: Discharge wash water from mixer trucks to ground surface in manner and at location where discharge cannot escape construction site, or be washed away to arroyos, storm sewers, or sanitary sewers by precipitation or other surface flows.

1. Prior to project completion, remove wash water residue from site to location approved by Owner.

2. Clean wash water discharge site to be free of debris.

END OF SECTION 03351

SECTION 03360 – CONCRETE FINISHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Sundial Slab Pigmented exterior coatings.

B. Exterior clear floor sealers.

1.2 RELATED SECTIONS

A. Section 03300 - Cast In-Place Concrete: Concrete mix designs and additives.

1.3 REFERENCES

A. AASHTO T260 - Standard Method of Test for Sampling and Testing for Chloride Ion In Concrete and Concrete Raw Materials.

B. AASHTO T259 - Standard Method of Test for Resistance of Concrete to Chloride Ion Penetration.

C. ASTM C78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).

D. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

E. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

F. ASTM C666 - Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.

G. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.

H. ASTM D1849 - Standard Test Method for Package Stability of Paint.

I. ASTM D3359 - Standard Test Methods for Measuring Adhesion by Tape Test.

J. ASTM D3363 - Standard Test Method for Film Hardness by Pencil Test.

K. ASTM D4946 - Standard Test Method for Blocking Resistance of Architectural Paints.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

M. ASTM G53 - Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings:

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

B. Installer Qualifications:

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Government.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish mock-up area as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: SureCrete Design Products, which is located at: 15246 Citrus Country Dr. ; Dade City, FL 33523; Toll Free Tel: 800-544-8488; Tel: 352-567-7973; Email: request info (jackthomas@surecretedesign.com); Web: www.surecretedesign.com . or equal.

B. Acrylic Sealer: SureCrete Hi-Gloss SureSeal Sealer as manufactured by SureCrete Design Products. 30 percent solids, water-based, low VOC, strong binding, "wet-look', clear acrylic sealer or equal.

1. Performance:
   a. Appearance (cured): Clear, gloss.
   b. Water Resistance: Excellent, beads water.
   c. Mechanical Stability: Excellent.

d. Light Stability: Excellent.
e. Solids: 30 percent.
f. Dilutant: Water.

2. Non-Slip Requirement: Provide broadcast or mix additive to achieve non-slip performance in compliance with The Americans with Disabilities Act guidelines

2.2 STAINS LR (LOW RESIDUE)

A. Non-Reactive Penetrating Stain: Eco-Stain by SureCrete Design Products or equal

1. Color: As selected by Government from manufacturer's 28 product colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Prepare exterior surfaces with chemical cleaner/profiler followed by rinsing with 3000-psi (20670 kPa) (minimum) pressure washer equipped with a turbo-tip to remove loose surface matrix and loose aggregate.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.4 SEALERS

A. Surface Preparation: Surface shall be dry and clean of dust, dirt, oils, and other surface contaminants. Provide surface profiling on concrete deck surfaces that are smooth, hard and dense per manufacturer's recommendations.

1. Provide chemical profiling with products compatible and manufactured by sealer manufacturer.

B. Coverage Verification:

1. Coverage is dependent upon porosity of substrate. Provide RILEM and similar test to verify application to achieve stated product performance. Adjust application, coverage and methods to comply with manufacturer's product specifications.

C. Application: Apply when air and surface temperatures are between 60 degree F (16 degrees C) and 90 degree F (32 degrees C) with relative humidity below 85 percent during application and cure

time. High humidity (above 75 percent) will slow cure rates and affect gloss. Substrate shall be a minimum of 5 degrees above dew point.

D. Abrasive Agent: Broadcast between coats of sealer on a deck surface at coverage rate recommended by manufacturer.

E. Abrasive Additive: Mix into the sealer and apply. Contractor option to broadcast additive between coats of sealer on a deck surface where multi-coat application is scheduled or required.

3.5 CONCRETE REPAIR

A. Remove all laitance, efflorescence, chemical contaminants, grease, oil, old paint, and other foreign matter. The surface shall require profiling. Sand blasting, grinding or abrasive blasting may be necessary achieve bare concrete.

B. The prepared surface shall be clean and structurally sound.

C. Substrate must be 40 degrees F (4 degrees C) and rising before installation. Surface at 90 degrees F (32 degrees C) and above shall be cooled before installation. Dampen area with fog tipped sprayer before using, leaving no puddles.

D. Mix consistency shall be maintained throughout application process. Do not apply in layers greater than 2 inches (51 mm). No tempering with additional water is allowed. Begin application immediately after mixing with water and work thoroughly into surface of area to be filled. Do not overwork. Minimize troweling.

3.6 STAMPED CONCRETE

A. Place concrete, screed, float with magnesium or wood according to industry standards. Allow bleed water to disappear and trowel with steel fresno.

B. Apply stamps, texture to affect pattern desired. Use release agents.

C. After the slab is sufficiently cured, carefully sweep up and contain excess powder release. Rinse the remaining excess with hose equipped with trigger nozzle and soft broom. Keep masking in place during clean-up. Best results are achieved by leaving the release color in the lower recesses of patterns, especially grout lines. Release shall be removed to allow the subsequent sealer to adhere to the finished product.

3.7 STAINING

A. Eco-Stain Application:

1. Apply first coat with SP sprayer on dry surface using caution to avoid track lines from the spray pattern. A circular motion with the wand is desired. Eco-Stain may be applied full strength or diluted with water to desired rate.
2. Applying additional coats is optional. Supplementary colors may be combined at desired rates and number of coats. Customarily apply lighter colors first. In addition to spraying some contractors employ mopping, sponging, and ragging, especially for accenting.
3. No clean-up or neutralization is required prior to sealing.

B. Earth Tone Application:

1. Apply first coat with SP sprayer on dry surface using caution to avoid track lines from the spray pattern. A circular motion with the wand is desired. Earth Tones may be applied full strength or diluted with water to desired rate. The first coat may be brushed or brushed into the surface. Use color-fast, acid resistant brushes or brooms. If stain is brushed, maintain a wet edge, never allow a wet broom to drag across a dry slab, as it may leave a permanent streak or brush stroke.
2. Areas that may call for brushing are sloped surfaces, slabs with "bird baths," stamped concrete, and overlays. Do not walk on the wet surface. Footprints will appear darker than the adjacent areas. If stepped on by accident, the footprints should be brushed out immediately. Allow the first coat to dry to the touch.
3. Apply second coat in the same manner as the first coat, as described above. Do not brush the second coat. Allow to dry overnight.

C. Multiple Colors

1. Colors may be layered or alternated as desired. For crisp, distinct, and separate color changes, a score line should be utilized. Chemical stain will bleed across traditional masking. Shielding or masking at a score line will prevent the bleeding of colors as long as the stain is not puddled heavily at score lines.
2. Where both Earth Tones and Vivid Tones are part of the same application, apply Earth Tones first and complete cleanup before applying Vivid Tones.

D. Translucent Highlighting Application:

1. Allow stamp overlay or stamped to cure for a minimum of 12 hours before the application of highlighting. In cooler temperatures below 50 degrees F (10 degrees C) cure times may have to be extended. After drying sufficiently to be tack-free highlighting shall be sealed as scheduled.
2. Thoroughly mix pigment to maintain suspension. Highlighting may be sprayed from a solvent resistant (Viton seals) pump-up sprayer. For very small areas, vertical surfaces, or intricate tight work highlighting may be brushed or sponged.

E. Sealer:

1. Two coats of sealer are required. The surface shall be clean, completely dry and at least 40 degrees F (4 degrees C) during the sealing application. To apply with roller use an appropriate roller sleeve. Apply one thin coat forcing the sealer into the surface. Allow sealer to dry, and then repeat the process with a second coat of sealer.

3.8 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 03360

SECTION 03400 – PRECAST CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplemental General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Wall Caps

2. Grills with integral caps

3. Stone bench seating

B. Related Sections include the following:

1. Section 03300 – Cast-in-Place Concrete.

1.3 DEFINITIONS

A. Precast Units: Architectural precast concrete wall caps, grills and stone benching.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, finishes for precast units, miscellaneous anchorage systems (dowels, wall to unit anchors) as per manufacture's requirements for securing units in place.

B. Shop Drawings: Show fabrication and installation details for precast units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include elevations showing layout of units and locations of joints and anchors.

C. Samples for Verification:

1. For each color and texture of precast required, 10 inches square in size.

D. Qualification Data: For manufacturer.

1. Include copies of material test reports for completed projects, indicating compliance of precast unit with ASTM C 1364.

E. Submittals: In addition to Product Data, submit design mixes and the following:

1. Shop Drawings: Detail fabrication and installation of precast architectural concrete units. Indicate jointing patterns, member locations, plans, elevations, dimensions, shapes, cross sections, limits of each finish, and types of reinforcement, including special reinforcement, dowels, and attachments to support structures. Show chamfers and radii on all exposed 90 deg edges as indicated.
2. Provide a comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.

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1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who assumes responsibility for engineering precast architectural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Participates in PCI's Plant Certification program and is designated a PCI-certified plant for Group A, Category A1--Architectural Cladding and Load Bearing Units or in APA's Plant Certification Program for the Production of Architectural Precast Products and is designated as an APA-certified plant.

A. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

B. Source Limitations for Precast Unit: Obtain precast units through one source from a single manufacturer.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

D. Design Standards: Comply with ACI 318 (ACI 318M) and the design recommendations in PCI MNL 120, "PCI Design Handbook--Precast and Prestressed Concrete."

E. Quality-Control Standard: Comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.4, "Structural Welding Code--Reinforcing Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of precast units to minimize the need for on-site storage and to avoid delaying the Work.

B. Pack, handle, and ship precast units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move precast units, if required, using dollies with wood supports.

2. Store precast units on wood skids or pallets with nonstaining, waterproof covers. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

B. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so markings are visible.

C. Lift and support units only at designated lifting and supporting points shown on Shop Drawings.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.7 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until precast units have dried, but not less than 7 days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 PRECAST UNIT MATERIALS

A. General: Comply with ASTM C 1364 and the following:

B. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation as needed to produce required textures and colors as needed to produce required precast unit colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation as needed to produce required textures and colors as needed to produce required precast unit colors.

E. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Do not use admixtures unless specified or approved in writing by Government.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C 260. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C 494/C 494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C 494/C 494M, Type E.

G. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of precast unit material.

1. Epoxy Coating: ASTM A 775/A 775M.
2. Galvanized Coating: ASTM A 767/A 767M.

H. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304

2.2 PRECAST UNITS

A. Provide precast units complying with ASTM C 1364 using the wet-cast method.

1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364, or are made from precast unit that has a history of successful resistance to freezing and thawing.

B. Fabricate units with dimensions and details accurately reproduced to surface finish and color indicated

C. The minimum compressive strength of all units will be 5,000 p.s.i.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

E. Cure units by one of the following methods:

1. Cure units with steam in enclosed curing room at temperature of 105 deg F (41 deg C) or above and 95 to 100 percent relative humidity for 6 hours.
2. Cure units with dense fog and water spray in enclosed warm curing room at 95 to 100 percent relative humidity for 24 hours.
3. Cure units to comply with one of the following:

    a. Not less than 5 days at mean daily temperature of 70 deg F or above.
    b. Not less than 6 days at mean daily temperature of 60 deg F or above.
    c. Not less than 7 days at mean daily temperature of 50 deg F or above.
    d. Not less than 8 days at mean daily temperature of 45 deg F or above.

F. After curing, remove cement film from surfaces to be exposed to view.

2.3 MORTAR MATERIALS

A. Section 04100.

2.4 FABRICATION

A. Anchorage Hardware: Fabricate with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations.

B. Furnish loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast architectural concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in precast architectural concrete units to receive windows, cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.

D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" and PCI MNL 117 for fabricating, placing, and supporting reinforcement.

E. Reinforce precast architectural concrete units to resist handling, transportation, and erection stresses.

F. Prestress tendons for precast architectural concrete units by either pretensioning or posttensioning methods. Comply with PCI MNL 117.

G. Mix concrete according to PCI MNL 117 and requirements in this Section. After concrete batching, no additional water may be added.

H. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 117 for measuring, mixing, transporting, and placing concrete.

1. Place backup concrete to ensure bond with face mix concrete.

I. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PCI MNL 117.

J. Comply with ACI 306.1 procedures for cold-weather concrete placement.

K. Comply with ACI 305R recommendations for hot-weather concrete placement.

L. Identify pickup points of precast architectural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast architectural concrete unit on a surface that will not show in finished structure

M. Discard precast architectural concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are approved by Government.

2.5 FINISHES

A. Finish exposed-face surfaces of precast architectural concrete units to match approved design reference sample and as follows:

1. PCI and APA's "Architectural Precast Concrete--Color and Texture Selection Guide," of plate numbers indicated.
2. Smooth-Surface Finish: Free of pockets, sand streaks, and honeycombs, with uniform color and texture.

3. Polished Finish: Use continuous mechanical abrasion with fine grit, followed by filling and rubbing procedures.

B. Finish exposed top and back and exposed sides/or end surfaces of precast architectural concrete units to match face-surface finish.

2.6 ACCESSORIES

B. Anchors: Type and size indicated, fabricated from stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666, Type 304.

C. Dowels: Round stainless-steel bars complying with ASTM A 276, Type 304, 1/2-inch diameter minimum.

D. Cleaner: As specified in Section 4 – “Stone Masonry Restoration” and expressly approved for intended use by precast unit manufacturer in addition to expressed approval of the cleaner manufacturer for use on precast units and adjacent stone masonry materials.

2.7 SOURCE QUALITY CONTROL

A. Owner will employ an independent testing agency to evaluate precast architectural concrete fabricator's quality-control and testing methods.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of precast units.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install precast architectural concrete. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.

1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

B. Anchor precast architectural concrete units in position by bolting, welding, grouting, or as otherwise indicated.

C. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.

D. Install precast architectural concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

E. Repair exposed exterior surfaces of precast architectural concrete units to match color, texture, and uniformity of surrounding precast architectural concrete if permitted by Architect.

F. Clean exposed surfaces of precast concrete units after erection to remove weld marks, other markings, dirt, and stains.

3.3 INSTALLATION TOLERANCES

B. Variation from Plumb: Do not exceed 1/8 inch in 10 feet

C. Variation from Level: Do not exceed 1/8 inch in 10 feet

D. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches mm) or one-fourth of nominal joint width, whichever is less..

E. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch except due to warpage of units within tolerances specified.

3.2 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Precast units may be repaired if methods and results are approved by government.

B. Replace units in a manner that results in precast units matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean precast units as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed precast units as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Government's approval of sample cleaning before proceeding with cleaning of precast units.

3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

5. Clean precast units by bucket-and-brush hand-cleaning method described in BIA Technical Notes No. 20.

END OF SECTION 03400

SECTION 04860 - STONE ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes stone veneer in the following applications:

1. On concrete retaining walls.
2. Anchored to concrete backup.
3. Stone benches
4. Stone cheek walls adjacent to trail at parking area to match existing

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For stone varieties proposed for use on Project, include data on physical properties

B. Stone Samples:

1. For each stone style shown on drawings, submit at least six samples of stone veneer to define the range and variability of color and show texture, dimensions, marking, facing, chipping and cracking.

C. Colored Mortar Samples: For each color required.

D. Qualification Data: For Installer.

E. Veneer Anchors

F. Veneer Anchor Ties

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An installer who employs experienced stone masons and stone fitters who are skilled in installing stone veneer assemblies similar in material, design, and extent to those indicated for this Project and whose projects have a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Stone Veneer Walls: For each wall type, prior to shipping of bulk materials, construct a full height sample wall battered corner panel 4' high and 4' feet long either side of constructed corner showing color range, texture, bond, mortar joints, facing techniques and workmanship of materials. Approved panel shall become the standard of comparison for future work and remain in place until completion of wall work.

1.4 PROJECT CONDITIONS

A. Protection of Stone Veneer Assemblies: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone veneer assemblies.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and Section 2104.3 of the Uniform Building Code.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 STONE SOURCES

A. Varieties and Sources: Subject to compliance with requirements, provide stone of the following variety and from the following source:

1. Gladeville Sandstone, with light sand to dark sand thru greyish rust tone coloration. Weathered or rust stained appearance is acceptable, rectangular and elongated, split natural cleft, length slight spotted or streaked coloration acceptable. Whitish or pure yellow color is not acceptable. Use Fieldstone for face stone and risers as required. Stone shall be sound, hard, well shaped, clean durable, free from structural defects and seams, iron rust, and dust particles.

2.2 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.

2.3 STONE

A. Sandstone material shall conform to ASTM C616 – II (Quartzitic Sandstone) with the following properties:

1. Maximum absorption rate of 3 percent when tested in accordance with ASTM C97.
2. Minimum density of 150 lb/cf (2400 kg/m3) when tested in accordance with ASTM C97.
3. Minimum compressive strength of 10,000 psi (68.9 Mpa) when tested in accordance with ASTM C170.
4. Minimum flexural strength of 2000

B. Field Stone shall conform to the following properties:

1. Match field stone to existing stone wall at parking lot. Stone shall be similar in size, shape, proportions, and color tones with a weather look. Stone with lichen and moss are preffered for exposed faces. Local source preferred.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Masonry Cement: ASTM C 91

C. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
2. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

D. Mortar Pigments: Natural or synthetic iron oxides, compounded for use in mortar mixes and with a record of satisfactory performance in stone masonry mortars.

1. Products:

a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
b. Davis Colors; True Tone Mortar Colors.
c. Lafarge Corporation; Centurion Pigments.
d. Solomon Colors; SGS Mortar Colors.

E. Water: Potable.

2.5 VENEER ANCHORS

A. Battered portion of stone walls: Corrugated buck anchors stainless steel 2 inches wide with 7 inch leg and 2 inch right angle bend with anchor holes, 12 gage. No. 345 by Hohmann and Barnard, Inc., Hauppauge, NY or equal.

B. Plumb portion of stone walls: Corrugated buck anchors stainless steel 2 inches wide with 4 inch leg and 2 inch right angle bend with anchor holes, 12 gage. No. 345 by Hohmann and Barnard, Inc., Hauppauge, NY or equal.

C. Tie anchors: Stainless Steel Self-Drilling and Self-Tapping concrete screw. Sizes: 1/4" diameter x 1-1/4" long with rated pull out resistance of 1616 pounds.

2.6 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Fabricate from the following metal complying with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim" and below:

1. Material: Copper, 16-oz./sq. ft. weight or 0.0216 inch thick elsewhere

B. Contractor's Option for Concealed Flashing: For flashing partly exposed to the exterior, use metal flashing specified above. For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 7-oz./sq. ft. sheet copper bonded with asphalt between 2 layers of glass-fiber cloth.

a. Products:

1) Advanced Building Products, Inc.; Copper Fabric Flashing.
2) AFCO Products, Inc.; Copper Fabric.
3) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
4) Phoenix Building Products; Type FCC-Fabric Covered Copper.
5) Polytite Manufacturing Corp.; Copper Fabric Flashing.
6) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
7) York Manufacturing, Inc.; York Copper Fabric Flashing.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Asphalt Dampproofing for Concrete Backup: Cut-back asphalt complying with ASTM D 4479, Type I, or asphalt emulsion complying with ASTM D 1227, Type III or IV.

2.8 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry-measure tetrasodium polyphosphate and 1/2-cup dry-measure laundry detergent dissolved in 1 gal. of water.

2.9 STONE FABRICATION

A. General: Fabricate stone in sizes and shapes necessary to comply with requirements indicated, including details on Drawings.

B. Shape stone for type of masonry (pattern) as follows:

1. Coursed rubble.
2. Uncoursed rubble (fieldstone).

C. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.

1. Finish: Mixed split face, seam face, and rock face pitched face as indicated.

2.10 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride.
2. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

B. Mortar for Stone Masonry: Comply with ASTM C 270

1. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
2. Mortar Mix: Section 04100, use natural gray color. ASTM C270-92a, Type N.
3. Mortar Mix: Section 04100, use natural gray color. ASTM C270-92a, Type N.

C. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement by weight.

PART 3 - EXECUTION

3.1 SETTING OF STONE VENEER, GENERAL

A. Do not begin installation until backing structure is plumb, bearing surfaces are level and substrates are clean and properly prepared.

B. Verify that built-in items are in proper location, and ready for roughing into masonry.

C. Notify Government of unsatisfactory preparation before proceeding.

D. Stone must be water saturated, surface-dry when placed. Water down the stone 24 hours prior to placement until saturated. Reapply water to keep stone saturated as required by weather conditions.

E. Coordinate placement of reinforcement, anchors and accessories, flashings and weep holes and other moisture control products supplied by other sections.

F. Clean all built-in items of loose rust, ice, mud, or other foreign matter before incorporating into the wall. All ferrous metal built into the wall shall be primed or galvanized.

G. Lay out work in advance and distribute color range of stone uniformly over total work area.

H. If required, provide temporary bracing during installation of masonry work. Maintain bracing in place until building structure provides permanent support.

I. Arrange stones for good fit in coursed rubble pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.

J. Protect stone faces from staining. When work is not in progress, keep tops of walls covered with approved nonstaining waterproof coverings. When work resumes, clean loose mortar from stone. Where new masonry joins partially or totally set masonry, remove loose mortar and dampen stone before laying new course.

K. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment, if any. Lay walls with joints not less than 1/4 inch at narrowest points nor more than 3/8 inch at widest points.

L. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

1. At lintels and shelf angles, extend flashing full length of angles but not less than 4 inches into masonry at each end.
2. At heads and sills, extend flashing 4 inches at ends and turn up not less than 2 inches to form a pan.
3. Extend sheet metal flashing 1/2 inch beyond face of masonry at exterior and turn flashing down to form a drip.

3.2 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet) or 1/2 inch in 40 feet or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feetor 3/4 inch in 40 feet or more.

3.3 INSTALLATION OF ANCHORED STONE VENEER ASSEMBLIES

A. Anchor stone veneer to concrete with corrugated-metal veneer anchors as follows:

1. Secure veneer anchors by self tapping concrete screws
2. Embed veneer anchors in mortar joints to within 1 inch of face.

B. Fill collar joint with mortar as stone is set.

C. Rake out joints for pointing with mortar to depth of not less than 1/2 inch. Rake joints to uniform depths with square bottoms and clean sides.

3.4 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 inch deep. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile: Smooth: flat face slightly below edges of stone

3.5 ADJUSTING AND CLEANING

A. In-Progress Cleaning: Clean stone veneer assemblies as work progresses. Remove mortar fins and smears before tooling joints.

B. Final Cleaning: After mortar is thoroughly set and cured, clean stone veneer assemblies as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone veneer assemblies by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.
6. If it is necessary to clean stonework with chemicals provide certified means and methods from stone/mortar supplier for approval by architect prior to execution.

3.6 EXCESS MATERIALS AND WASTE

A. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

END OF SECTION 04860

SECTION 05120 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.

B. Related Sections:

1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.

2. Division 09 Section “Painting” for galvanizing and painting steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.

1.5 QUALITY ASSURANCE

A. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Plate and Bar: ASTM A 36.

B. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

C. Welding Electrodes: Comply with AWS requirements.

2.2 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Fabricate beams with rolling camber up.
2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.

B. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

C. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

D. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.3 SHOP CONNECTIONS

A. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splices shall be constructed with complete penetration welds and ground smooth.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.

END OF SECTION 051200

SECTION 05720 - HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal handrails.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Handrails and Railings:

1. Comply with ASTM E 985, based on testing per ASTM E 894 and ASTM E 935.
2. Capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stresses of materials involved.
3. Capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved:

a. Top Rail of Guards: Concentrated load of 200 lbf (890 N) applied at any point and in any direction, and a uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward. Concentrated and uniform loads need not be assumed to act concurrently.
b. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf (890 N) applied at any point and in any direction, and a uniform load of 50 lbf/ft. (730 N/m) applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.

1.3 SUBMITTALS

A. Product Data: For handrails and railings, grout, anchoring cement, and paint products indicated.

B. Shop Drawings: Include plans, elevations, sections, details of installation, attachments to other Work, and structural computations.

C. Samples: For each exposed finish required.

D. Product Test Reports: Indicating handrails and railings comply with ASTM E 985.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ACI Glass Products.
2. Aluminum Tube Railings, Inc.
3. Architectural Metal Works.
4. Blum, Julius & Co., Inc.
5. Blumcraft of Pittsburgh.
6. Braun, J. G. Co.
7. Clearail, Inc.
8. Cole, C. W. & Co., Inc.
9. CraneVeyor Corp.
10. L & J Specialty Corp.
11. Livers Bronze Co., Inc.
12. Newman Brothers, Inc.
13. P & P Artec.
14. Poma Corporation.
15. Rippel Architectural Metals, Inc.
16. Sterling Fabricated Systems, Inc.
17. Superior Aluminum Products, Inc.
18. Tri Tech, Inc.
19. Wagner, R & B, Inc.
20. Wylie Systems.
21. Zephyr Metals, Inc.

2.2 METALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for use and finish indicated, and with not less than the strength and durability of the alloy and temper designated below.

1. Extruded Pipe and Tube: Alloy 6063-T52 meeting ASTM B 221.
2. Extruded Posts: Alloy 6063-T6 meeting ASTM B 221.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Same basic metal as fastened metal; concealed, unless otherwise indicated or unavoidable, and standard with systems indicated.

B. Anchors: Fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined per ASTM E 488.

C. Shop Primers: Provide primers to comply with applicable requirements in Division 9 Section "Painting."

D. Grout and Anchoring Cement: Premixed, nonshrink, nonmetallic grout complying with ASTM C 1107 or erosion-resistant, nonshrink anchoring cement; recommended by manufacturer for use indicated.

2.4 FABRICATION

A. General: Fabricate to design, dimensions, and details indicated, but not less than that required to support structural loads.

1. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

B. Form changes in direction of railing members by bending.

1. Form curves by bending in jigs to produce uniform curvature without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

C. Welded Connections: Connect handrail and railing members by welding. Cope and weld or use welded-in fittings. Weld connections continuously.

D. Nonwelded Connections: Connect handrail and railing members with concealed mechanical fasteners and fittings.

E. Brackets, Flanges, Fittings, and Anchors: Fabricate wall brackets, flanges, miscellaneous fittings, and anchors to connect handrails and railings to other construction.

1. Cast or form of same metal and finish as supported rails.

F. Close exposed ends of handrail and railing members with prefabricated end fittings.

1. Provide wall returns at ends of wall-mounted handrails.

2.5 FINISHES

A. Aluminum:

1. Class I, Clear Anodic Finish: AA-M12C22A41 complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation, General: Perform cutting, drilling, and fitting required to install handrails and railings. Set units accurately in location, alignment, and elevation.

1. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

B. Anchor posts to concrete by anchoring plates where indicated

C. Anchor posts in concrete with sleeve and grout.

C. Attach handrails to wall with wall brackets or end fittings.

D. Touch up painted surfaces and finishes after erection. Clean abraded areas and touch up paint with the same material as used for shop painting.

END OF SECTION 05720

SECTION 06166 - CEMENTITIOUS SHEATHING

PART 1 – GENERAL

1.1 SUMMARY

A. Description of Work: Provide all labor, materials and equipment necessary to properly install the site-applied or panelized USG Fortocrete® Structural Panel system or equal. This system combined with the structural framing as designed to carry the axial and shear diaphragm loads as specified in the contract documents.

B. The roof sheathing system is a non-combustible, fire restrictive assembly comprised of steel framing members with structural panels mechanically fastened to the top of the framing to form the sub-roof.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Structural Steel Framing: Division 05

B. Copper roof panels: Division 07

1.3 SUBMITTALS

A. Submit to the Government, a copy of the USG Fortocrete Sheathing System, or equal, literature, including component data, standard details, and manufacturer's specification.

B. Shop Drawings

1. For on-site construction, the Contractor shall submit complete shop drawings showing fabrication and installation of the system including plans, elevations, sections, details of components, control expansion joint locations and details, penetration locations and details, and attachments to supporting construction.
2. For panelized construction, the Contractor shall submit shop drawings showing panel construction details, panel layout on building, panel-to-building and panel-to-panel connections, panel lifting points and erection sequence.

C. Design Calculations

1. The Contractor shall submit engineering calculations showing that the roof framing complies with the maximum allowable clear span, maximum allowable uniform loads and design deflection criteria based on framing properties only as required by the contract documents.
2. The Contractor shall submit engineering calculations assessing the requirements for expansion/control joints. Location and design of control joints shall be the responsibility of the Contractor.
3. The Contractor shall submit the design of the framing and attachment to the supporting structure as well as the layout of the floor sheathing including the fastening schedule.
4. For panelized construction, the Contractor shall submit engineering calculations for panel attachment, panel framing, panel-to-panel connections, and panel lifting and erection loads.

D. Submit two samples of the USG Fortocrete Structural Panels, or equal, a minimum 4"x8".

E. Submit independent research reports or evaluation reports of model code organizations acceptable to local authorities having jurisdiction that evidence the USG Fortocrete Floor Sheathing System, or equal, is in compliance with applicable building codes or acceptance criteria.

1.4 SYSTEM REQUIREMENTS

A. Panel Exposure – USG Fortocrete Structural Panels, or equal, are water durable and dimensionally stable. They can be installed in weather conditions that include rain and snow, provided job site safety procedures permit. Installed panels shall not be exposed to weather for more than 90 days. Snow and/or ice must not be allowed to accumulate on installed panels. Care must be taken if snow and/or ice removal is required from installed panel surfaces. Snow should be broomed off whenever possible. Excessive shoveling or scraping may damage the installed panel surface. In the event accumulation of snow and ice do occur, temporary space heaters should be used to melt the affected areas. At no time should chemical de-icing agents or salt be used on the panels.

B. Fire resistive performance – For constructions requiring fire performance, materials and construction shall be provided that are identical to those tested for the following fire performance characteristics. Evaluation for fire resistive performance should be accomplished by testing and inspection agencies recognized by the code body having jurisdiction.

C. Combustibility – roof sheathing rated as non-combustible according to ASTM E-136-04.

D. Surface burning Characteristics-roof sheathing shall have a flame spread index of 0 and a smoke developed index of 5 or less, when tested in accordance with ASTME-84.

E. Fire Resistance-For constructions requiring rated fire resistance, provide materials and construction identical to those of assemblies whose fire resistance has been determined according to ASTM E119.

1.5 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer shall have experience in manufacturing sheathing products and have a record of successful in-service performance.
2. Contractor shall have successfully installed roof sheathing products of a similar type, size, and geographical location, as this project, within the last five years. These past projects shall have resulted in construction with a record of successful in-service performance.

B. Code Acceptance – The USG Fortocrete Floor Sheathing System, or equal, shall have independent research reports or a current product evaluation report acceptable to the code official having jurisdiction over the geographical area for this project.

C. Field Quality Control – At frequent intervals during construction, the job site will be visited by the Owner's representative to confirm that the USG Fortocrete Floor Sheathing System, or equal, is being installed per this specification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All materials supplied by United States Gypsum Company, or equal, shall be delivered in their original unopened packages with labels legible.

B. All materials supplied by United States Gypsum Company, or equal, shall be stored in a covered enclosure providing protection from damage or exposure to the elements (specifically rain and snow).

C. All materials supplied by others shall be delivered and stored according to their instructions.

D. Damaged or deteriorated materials shall be removed from the premises and replaced.

E. Material Safety Data Sheets shall be available for all materials.

1.7 PROJECT CONDITIONS

A. Steel framing to receive the USG Fortocrete Structural Panel, or equal, shall be structurally sound, free from bows, twists, or other malformations and in general compliance with local code requirements. Damaged framing shall be replaced before installation of structural panels.

B. During installation of the USG Fortocrete Structural Panel, or equal, the temperature shall be at least 0° F during installation if mechanically fastened and shall be at least 40° F and remain at this temperature or higher for at least 24 hours after installation if adhesive is being used, unless the adhesive manufacturer will permit the use of its product at a lower temperature. Prior to the application of finished flooring the structural panel must be conditioned to the same temperature as required for the finished flooring for at least 48 hours. Finished flooring shall not be applied over structural panels that are wet, frozen or contains frost.

1.8 SEQUENCE AND SCHEDULING

A. Sequence the installation of sheathing with related work specified in other sections to ensure that the floor assemblies are protected against damage or abuse during and after construction.

B. Provide sufficient labor and equipment to properly install all materials.

PART 2 – PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Roof sheathing – ¾” USG Fortocrete Structural Panels manufactured by United States Gypsum Company, or equal.

B. Roof Framing

1. HSS structural steel framing hot dipped galvanized with min 18 ga or equivalent wall thickness meeting AISI and ASTM specifications and requirements for use in a structural roof system.

C. Fasteners

1. Screws - Stainless steel, Self drilling tapping, self counter sinking screws meeting the SAE standard J78. 1013-1022 steel wire, 8-18 x 1 5/8” with a minimum 0.36” bugle head design.
2. Screws must be capable of bending 15° without sign of fracture, have a torsion strength of 42 inch-lbs per SAE J81, meet SAE J78 for hardness.
3. Screws must have a corrosion resistance that sustains 250 hours of ASTM B117 salt spray test prior to development of white corrosion products.

PART 3 – EXECUTION

3.1 FRAMING

A. Joists and other roof framing components must be designed to meet the strength and deflection criteria specified in the contract documents. The attachment flange or bearing edge must be a minimum of 1.625” wide. Metal framing must be a minimum of 18 gauge.

B. All blocking or bridging must be installed prior to the installation of the USG Fortocrete Structural Panel.

C. Framing must be of good quality, free of bows, twists, or other malformations.

3.2 STRUCTURAL PANEL SHEATHING APPLICATION

A. The panels shall be cut to size with a circular saw equipped with carbide-tipped cutting blade and a dry dust collection device or a water-dispensing device that limits the amount of airborne dust. Wear safety glasses and a NIOSH approved dust mask when cutting the panel. Collected dust shall be disposed in a safe manner and in compliance with local, state and federal ordinances.

B. USG Fortocrete Structural Panel sheathing, or equal, shall be installed in a horizontal (long edges perpendicular to the framing) manner. Panels may be installed with either surface against the framing. However, because the panel markings that facilitate fastening are on one side only, applying the board with the marking toward the installer is the preferred orientation.

C. The use of adhesives in the connection of the USG Fortocrete Structural Panels, or equal, to the framing or to adjacent USG Fortocrete Structural Panels, or equal, is optional. The fire, sound and structural ratings of the USG Fortocrete Floor/Ceiling System, or equal, are based on mechanical attachment only.

D. If the specification calls for an adhesive/mechanical connection, only apply adhesive to the top of the joists that can be covered by one panel at a time.

E. Place the cut edge or tongue along the rim joist. Place each panel across three or more supports. Cut panels to length as needed to ensure that the butt end of the panel is centered on the framing member. Install panels in a direction that ensures that the butt end falls over the open side of the joist. This will help keep adjacent ends in the same place.

F. Fasten each panel after it has been placed following the fastening schedule listed in the contract documents. Being fastening at one end and fan out across the panel. Do not fasten all the corners first. After the installation of one complete row, begin the next row. Slide panels together so that the tongue of the panel being installed fits into the groove of the installed panel. No gaps are required between panels. If adhesives or sealants are specified in the joints, carefully apply a ¼-3/8" diameter bead of adhesive to the bottom of the grooves of the installed panels. Only apply enough adhesive to cover the joint that will be covered by the first panel in the second row. Install the second panel and all subsequent panels in a similar manner to complete the row. Install all rows in a running bond pattern so that end joints fall over the center of the framing members and are staggered by at least two supports from where the end joints fall in the adjacent rows.

G. Cutouts in the panels should be made before installing the panel whenever possible. If a cutout is required after the panel is installed, set the depth of the saw blade to ensure that the framing is not scored. Support the ends and edges of cutouts with framing if they are larger than 6" in either direction (refer to USG Fortocrete Tech Note #081101-Allowable Floor Penetrations).

H. Drive fasteners so the heads are flush with the surface of the board. See the above section for the correct fastener to be used.

3.3 CLEAN UP

A. Left over material shall be removed from the job site.

B. Remove all foreign material from the floor surface and vacuum all dust from the surface.

END OF SECTION 06166

SECTION 07610 – PREFORMED COPPER ROOFING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes standing seam, uninsulated copper roof panels.

1.2 RELATED SECTIONS

A. Division 6 Section “Cementitious Sheathing”

1.3 REFERENCES:

A. Document ASCE 7-95. For determining wind speed

B. ASTM E-1592. Test method for wind uplift for roofing.

C. ASTM B32 – Solder

D. ASTM B370 – Copper Sheet and Strip for Building Construction.

E. ASTM D226 – Asphalt Saturated Roofing Felt.

F. ASTM E283 – Test Method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.

G. ASTM E330 – Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Pressure Difference.

H. FS FFS-325 – Shield Expansion; Nail, expansion and Nail, drive screw.

I. SMACNA – Architectural Sheet Metal Manual, Fifth Edition, 1993.

J. Copper Development Association – Copper in Architecture.

K. Revere Copper Products, Inc. – Copper and Common Sense.

1.4 PERFORMANCE REQUIREMENTS

A. Wind-Uplift Resistance: UL 580, Class 90.

B. Structural Performance: Capable of safely supporting design loads indicated under in-service conditions based on testing manufacturer's standard units according to ASTM E 1592 by a qualified independent testing and inspecting agency.

1. Design Loads: As indicated
2. Maximum Deflection: 1/180 of span.

1.5 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Submit in accordance with Section 01330. Include the following details and information:

1. Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings.
2. Elevations and plan view, with keyed reference to termination points.
3. Details of termination points and assemblies.
4. Indicate where fixed point of roofing sheet occurs and how cleats and clips will handle expansion and contraction of materials.
5. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Seam and panel dimensions.
7. Eave, ridge, valley, rake, cricket and counterflashing.
8. Interfaces of metal roofing material to adjoining materials.
9. Show transverse seam patterns and locations.
10. Sufficient technical data to demonstrate compliance with the specific requirements.
11. Fastener, clip and attachment layout, with load carrying capacity to meet these specifications and pullout data on fastener into the designed substrate.

C. Samples: For each exposed finish and for each color and texture required PROVIDE A 12" x 6" panel

D. Product test reports.

1.6 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Where indicated, provide products identical to those tested for fire resistance per ASTM E 119 by a testing agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
2. Identify products with appropriate markings of applicable testing and inspecting agency.

B. Applicator: Minimum of 5 years experience in application of similar types of copper roofing.

C. Design Criteria:

1. Provisions of Thermal Movement: Fabricate and install metal roofing systems to provide for expansion and contraction of component materials without buckling, hole elongation, fastener failure or excess stress loading loping at any time during temperature cycle. Allowance shall be set for ambient temperature at time of installation. Design and install clips to resist rotation and to avoid shear stress when roofing material expands and contracts.
2. Uplift Resistance: Fabricate and install copper roofing system to resist design negative pressure of (90 lbs.). Clips, fasteners and clip spacing shall correspond to required design negative pressure with a minimum factor of safety of 3.
3. Performance of the system shall be determined through use of ASTM E-1592 Test Method for Wind Uplift for Roofing.

4. Water infiltration: Fabricate and install metal roof system so as not to allow any infiltration of water. Laps of metal flashing and connections of roof panels shall be installed to allow moisture to run over and off material.

1.7 WARRANTY

A. Special Weathertight Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace roof panels that fail to remain weathertight within 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Provide Copper Architectural 5 ply double lock (DL-5) standing seam roof panel system as manufactured by CopperCraft, Inc. (PH 800-486-2723), or roofing systems providing equal materials, performance, appearance, and guarantees. Roofing system shall be tested and certified by Underwriters Laboratories, Inc. for Class 90 wind uplift.

2.2 MATERIALS

A. Copper Roof Panels: 99.9% pure copper, CDA 110, ASTM B370 cold rolled temper, weighing not less than 20oz per square foot. Panels to be rollformed in continuous lengths to the greatest extent possible to handle expansion and minimize transverse seams. Standing seams to be 1” high double lock seams (12”-21”) on centers.

B. Sheet copper for related flashings, edge strips and cladding shall be minimum (16 oz., 20 oz.) cold rolled, CDA 110, copper conforming to ASTM Standard B370.

C. Concealed Cleats: 16 oz. copper or .018 stainless steel, fixed or expansion type, as required. Cleats shall be designed to prevent hook unwind.

D. Fasteners: All fasteners in contact with copper shall be copper, brass or series 300 stainless steel. (Fasteners for concealed cleats to be stainless steel screws – nails are not acceptable.) Exposed fasteners shall be copper.

E. Solder: ASTM B32, composition 50% pig lead and 50% block tin.

F. Flux: Rosin, muriatic acid neutralized with zinc, or an approved soldering paste.

G. Underlayment:

1. Self-adhering, Polyethylene-Faced Sheet: ASTM 1970, 40 mils (1.0 mm) thick minimum, consisting of slip-resisting polyethylene-film reinforcing and top surfaces laminated to SBS-modified asphalt adhesive, with release paper backing. Cold applied.

2. Self-Adhering, High temperature Sheet: 30 to 40 mil (0.76 to 1 mm) thick minimum. Consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt

adhesive, with release-paper backing. Cold Applied. Provide primer when recommended by the manufacturer.

H. Slip Sheet: Rosin sized building paper, weighing approximately 14 lbs. per 100 square feet, minimum.

I. Sealant: ASTM C920, one component silicone based material, movement capability of +/- 50%. Color as selected by Government.

J. Protective Coatings:

1. Alkyd type Zinc Chromate: FS TTP641, Type II
2. Bituminous Coating Compound: FS TTC494, Type II

2.3 FABRICATION

A. Panels:

1. Factory formed panels. Width of (12 – 21) inches with seams formed to receive field seaming to double lock profile. (Provide factory tapered and/or factory curved panels as required.)
2. Fabricate panels to longest lengths practical, not to exceed 35 feet.
3. Fabricate panels to use concealed fasteners. Exposed fasteners in roofing panels are prohibited.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine roof deck for conditions that would prevent proper application of roofing. Immediately notify Contractor of defects, and do not proceed with roofing operation until defects are corrected.

B. Verify that surfaces to receive roofing are smooth, sound, clean and dry.

C. Before fabricating sheet metal, field verify shapes and dimensions of surfaces to be covered.

3.2 WORKMANSHIP

A. Form to shapes and dimensions shown, free from defects which impair strength or mar appearance.

B. Form planes and lines to true alignment.

3.3 INSTALLATION

A. General:

1. Install metal roofing using skilled workman, in strict accordance with manufacturers recommendations and approved shop drawings. Details shown on drawings shall be considered typical and apply for similar features where not particularly detailed.
2. Incorporate adequate and approved provision in the work to compensate for thermal expansion and contraction.

B. Underlayment:

1. Secure to roof deck with minimum anchorage.
2. Lap joints 4” minimum, beginning at bottom of roof so that felt overlaps in direction of waterflow.

C. Slip sheets:

1. Install over underlayment and secure with copper nails. Take care to insure that slip sheet completely isolates the underlayment from the copper.
2. Lap joints 2 inches minimum.
3. Remove and replace wet rosin paper.

D. Roof panels:

1. Install over slip sheets using cleats at 18” on centers, minimum or as required by approved engineer tests.
2. Stagger transverse seams in adjacent panels.
3. Flash roof penetrations with material matching roof panels and make watertight by soldering.

E. Seams:

1. Mechanically seam to 5 ply double lock, finished 1” high.
2. Transverse seams:

    a. Four-ply common lock with capillary breaks, two inch width, minimum.
    b. Low pitch: (Less than 6 in 12, but more than 3 in 12). Fold top edge of lower panels over _”. Solder 1 _” wide continuous locking strip parallel to and 4” below top edge. Fold bottom edge of upper panel under _” and engage locking strip.

3. Ridge treatment: Interlocked standing seams or ridge cap.

F. Soldering:

1. Clean and flux material prior to soldering.
2. Perform soldering slowly with well heated coppers and thoroughly heat the seam and sweat the solder through its full width.

3.4 CLEANING

A. As work progresses, neutralize excess flux with 5% to 10% washing soda solution and thoroughly rinse.
B. Leave work clean, and free of stains, scrap and debris.

END OF SECTION 07610

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes sheet metal flashing and trim for the following:

1. Exposed trim and fasciae.
2. Metal flashing.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.

C. Samples: For each exposed finish.

PART 2 - PRODUCTS

2.1 METALS

A. Copper: ASTM B 370; temper H00, cold rolled except where temper 060 is required for forming; not less than 16 oz./sq. ft. (0.55 mm thick).

2.2 FABRICATION, GENERAL

A. Sheet Metal Fabrication Standard: Fabricate units to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, material, metal thickness, and other characteristics of item indicated.

B. Fabricate units that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Form exposed sheet metal without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Expansion Provisions: Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form

expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.

G. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.

I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual."
2. Anchor units of Work securely in place, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed units that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

C. Install units to fit substrates and to result in waterproof and weather-resistant performance.

D. Expansion Provisions: Accommodate thermal expansion of exposed sheet metal. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.

1. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.

1. Use joint adhesive for nonmoving joints specified not to be soldered.

G. Seams: Install flat-lock seams at nonmoving seams. Tin edges to be seamed, form seams, and solder.

H. Seams: Install flat-lock seams at nonmoving seams in aluminum. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

I. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.

K. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches (50 mm) and bed with sealant.

L. Immediately after installation, clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

END OF SECTION 07620

SECTION 09670 - HORIZONTAL SEALERS

PART 1- GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Horizontal floor sealer for Observation Deck, Bridge and Abuttment.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete: Concrete Surface coordination and curing provisions.

1.3 REFERENCES

A. ASTM D 2369 - Standard Test Method for. Volatile Content of Coatings.

B. ASTM D 3359 - Standard Test Methods for Measuring Adhesion by Tape Test.

C. ASTM D 3363 - Standard Test Method for Film Hardness by Pencil Test.

D. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

E. ASTM C 355 - Test Methods for Test for Water Vapor Transmission of Thick Materials.

F. ASTM G 23 - Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials

G. OTC Compliant - Ozone Transport Commission (OTC) Volatile Organic Compounds Regulations for Paints.

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Product shall comply with federal, state, and local volatile organic compounds (VOC) regulations.

B. Manufacturer Qualifications: All products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.

C. Installer Qualifications: All products to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Government.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Government.
3. Refinish mock-up area as required to produce acceptable work.
4. Accepted mock-ups shall be comparison standard for remaining Work

E. Pre-Installation Meeting:

1. Convene at job site seven calendar days prior to scheduled beginning of construction activities of this section to review requirements of this section.
2. Require attendance by representatives of the following:
   a. Coating manufacturer.
   b. Installer of this section.
   c. Other entities directly affecting, or affected by, construction activities of this section.
3. Notify Government 5 calendar days in advance of scheduled meeting date.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of materials in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Do not apply coatings to surfaces below 50 degrees F (10 degrees C) or above 95 degrees F (48 degrees C) unless recommended by the manufacturer.

C. Do not apply when rain is predicted within 24 hours or less than 1 day after surface has been wet.

D. Do not apply in high or gusty winds.

1.8 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver materials to the Government.

C. Quantity: Furnish Owner with an addition three percent, but not less than 1 gallon (3.8 l) or one case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 Multi-Surface Water Repellent acrylic sealer designed to provide protection for a variety of horizontal and vertical surfaces and non slip coating which conforms to ADA requirements for accessibility

1. Technical Data:
   a. Finish: Flat.
   b. Color: Clear.
   c. Weight Solids: 20 percent, ASTM D 2369.
   d. VOC Actual: Less than 100 g/L, ASTM D 3960.
   e. Odor: Low.
   f. OTC Compliant.
   g. Resists chlorine, salt, chemicals
   h. UV Resistant, ASTM G 23.
   i. Water Vapor Transmission: 10.9 perms, ASTM C 355.
   j. Chemical Resistance when tested in accordance with ASTM D 1308 (1 hour spot test).
      1) Water Resistant.
      2) Gasoline Resistant.
      3) Motor Oil Resistant.
      4) Salt Resistant.
      5) Chlorine Resistant.

PART 3- EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify that substrates are prepared in accordance with manufacturer's instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the materials specified and for the substrate under the project conditions.

C. Protect adjacent surfaces to prevent accidental application to surfaces not indicated to receive sealer; remove accidental applications from surfaces immediately, following manufacturer's instructions.

D. Surfaces must be structurally sound, thoroughly cleaned, dry and free from dust, dirt, oils, glossy or loose paint, glue, surface sealer and other contaminants.

E. Previously sealed, stained or painted concrete: Remove loose or peeling paint. Follow with a general cleaning. Rinse thoroughly and let dry. Remove oil stains with approved cleaner.

F. Bare metal must be primed using a direct-to-metal primer.

3.3 APPLICATION

A. Apply coating in accordance with manufacturer's instructions.

B. Apply each coat to uniform appearance.

C. Spray apply each coat as recommended by the manufacturer.

D. Roller apply each coat as recommended by the manufacturer.

E. Allow each coat to dry thoroughly prior to applying a second or finish coat

3.4 CLEAN-UP

A. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

B. Remove temporary coverings and protection of surrounding areas and surfaces.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged surfaces before Substantial Completion.

3.6 SCOPE

A. Abutment Slab, Bridge Slab, Tower Slab.

END OF SECTION 09670

SECTION 09960 - PAINTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface preparation and painting of exposed structural and non-structural steel fabrications.

B. Hot dipped galvanizing: ASTM - 123, ASTM -A563, ASTM -A385 guidelines.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM) D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

B. Steel Structures Painting Council (SSPC) SP6 - Commercial Blast Cleaning Procedures.

C. Steel Structures Painting Council (SSPC) SP10 - Near White Blast Cleaning Procedure.

1.3 DEFINITIONS

A. General: Standard coating terms defined within Masters Painters Institute (MPI) manual.

1. Gloss level 1 - Flat with a gloss range below 5 when measured at a 60-degree meter and 10 when measured at an 85-degree meter.
2. Gloss level 5 - Semi-Gloss with a gloss range between 50 and 55 when measured at a 60 degree meter.

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Preparation instructions and recommendations.
3. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in

applications with a record of successful in-service performance.

B. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Government will select from standard colors and finishes available.

D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

E. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect.
2. Do not proceed with remaining work until workmanship, color, and sheen are approved by government.
3. Refinish mock-up area as required to produce acceptable work.

F. Galvanizing: A firm experienced and equipped in galvanizing steeel assemblies in modules that are sufficient for applying complete and even galvanized coating to structural shapes and sizes indicated. Firm shall be experienced and able to coordinate with steel fabricator to achieve pre-assembly modules and detailing as required.

1.7 WORK CONDITIONS

A. Work Limitations. Apply the prime coat to new structural steel inside permanent buildings at the fabricator's facility. If inside permanent buildings, the fabricator may perform year-round abrasive blasting and painting. Perform abrasive blasting and painting in the field from April 1 to October 31. A time extension will not be permitted due to adverse weather during the month of April.

1. Temperature. Except for inorganic zinc, apply paint when the steel, air, or paint temperature is 50 °F (10 °C) or higher and expected to remain higher than 50 °F (10 °C) for the cure times listed below. Apply inorganic zinc when the steel, air, or paint is 40 °F (4 °C) or higher. Cure inorganic zinc according to the minimum curing time and temperatures specified in the paint manufacture's printed instructions.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. High-Performance Coatings: Full, unused containers equal to 3 percent of each material and color applied, but not less than 1 gal. (3.785 L) or 1 case, as appropriate.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.

B. Products of the following manufacturers are listed in other Part 2 articles and use the abbreviated names shown in parentheses:

1. Carboline Company (Carboline).
2. DuPont Company; High Performance Coatings (DuPont).
3. ICI Dulux Paints; Devoe Coatings (ICI).
4. International Protective Coatings; Courtaulds Coatings (International).
5. Moore, Benjamin & Co. (Moore).
6. Pittsburgh Paint; PPG Industries, Inc. (PPG).
7. Rust-Oleum Corporation (R-O).
8. Sherwin Williams; Industrial and Marine Coatings (S-W).
9. Tnemec Company, Inc. (Tnemec).

2.2 MATERIALS, GENERAL

A. Hot Dipped Galvanizing.
1. Galvanizing shall be performed in strict accordance to ASTM 123
2. Prevent warping with acceptable means
3. preassembly shall be performed to the greatest extent possible prior to application of process.
4. Quenching is prohibited wherever steel is to recieve additional finish coating systems.
5. Coordinate tapping and threading as per ASTM -A563, indicate affected borings and taps on shop drawings prior to shop drawing review for approval.
6. Avoid uncoated localized areas by adhering to ASTM -A385 guidelines
7. Locate venting an drain holes as required for complete uniform coverage of assembly with galvanizing materials.
8. Continuous weld overlapping pieces - welds will not form gaps that impede complete and uniform coverage of assembly with galvanizing materials.

B. 3-Coat Paint System: On new steel, apply a three-coat paint system consisting of an inorganic zinc prime coat, an epoxy intermediate coat, and a urethane finish coat. The prime coat shall conform to 708.01, and the intermediate and finish coats shall conform to 708.02. Supply the intermediate and finish coats from the same manufacturer. The Contractor may supply the prime coat from a manufacturer other than the manufacturer of the intermediate and finish coats. For caulking, use a two-component, non-sag, nonshrink 100 percent solids epoxy capable of filling voids up to 1 inch (25 mm) wide.

C. Material Compatibility: For each finish indicated, provide separate component coat materials of one manufacturer that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

D. Material Quality: Provide manufacturer's best-quality material for each coating material specified.

E. Colors: Match samples.

F. Block Filler: Acrylic or epoxy block filler of topcoat manufacturer.

G. Primer: Acrylic or epoxy primer of topcoat manufacturer recommended in writing by manufacturer for use with intermediate and topcoats and substrate indicated under environmental conditions indicated.

H. Intermediate Coat: Epoxy intermediate coat of topcoat manufacturer recommended in writing for use with primer, and topcoat, and substrate indicated under environmental conditions indicated.

I. Intermediate Coat: Severe-Environment, Semigloss Epoxy:

1. Products:

a. Carboline; 888 2-Component Polyamide Epoxy.
b. DuPont; 25P High Solids Epoxy Mastic.
c. ICI; Devran 224HS High Build Epoxy.
d. International; Intergard 345 DTM Semi-Gloss Epoxy.
e. Moore; M36/M38 Polyamide Epoxy Semi-Gloss Coating.
f. PPG; 97-1XXX Series Aquapon High Build Semi-Gloss Polyamide Epoxy Coating.
g. R-O; 9500 System High Build Polyamide Epoxy at 5.0- to 8.0-mil (0.127- to 0.203-mm) dry film thickness.
h. S-W; Epolon II Multi-Mil Epoxy Series B62V800.
i. Tnemec; Series 66 Hi-Build Epoxoline Polamidoamine Epoxy.

J. Top Coat Semigloss Polyurethane: Semigloss, aliphatic polyurethane enamel.

1. Products:

a. Carboline; 133-HB 2-Component Aliphatic Polyurethane.
b. DuPont; Imron 326 (13P) Semi-Gloss Polyurethane Enamel.
c. ICI; Devthane 378 Aliphatic Urethane Semi-Gloss Enamel.
d. Moore; M73/M75 Aliphatic Acrylic Urethane Semi-Gloss.
e. PPG; 97-8XXX Series Pitthane High Build Acrylic-Aliphatic Urethane, unless otherwise indicated.

1) Concrete Masonry Unit and Metal Substrates: 97-84XX Series.

f. S-W; Corothane II Low VOC Satin Finish B65W200 Series, unless otherwise indicated.

1) Ferrous Metal Substrates: Corothane II Satin B65W400 Series.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: Application of coatings indicates Applicator's acceptance of surfaces and conditions.

B. Coordination of Work: Review other Sections in which primers or other coatings are provided to ensure compatibility of total systems for various substrates. On request, furnish information on characteristics of specified finish materials to ensure compatible primers.

1. If a potential incompatibility of primers applied by others exists, obtain the following from primer Applicator before proceeding:

    a. Confirmation of primer's suitability for expected service conditions.
    b. Confirmation of primer's ability to be topcoated with materials specified.

2. Notify Government about anticipated problems before using coatings specified over substrates primed by others.

C. Preparation:

1. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.

    a. After completing coating operations, reinstall items that were removed; use workers skilled in the trades involved.

2. Surface Cleanliness: All surfaces to be painted shall be free of dust, dirt, grease, oil, moisture, overspray, and other contaminants. If the surface is degraded or contaminated, restore the surface before applying paint. In order to prevent or minimize degradation or contamination of cleaned surface in the field, the prime coat of paint shall be applied within 12 hours of the high pressure wash operation as required in surface preparation above, for steel which is cleaned and painted in the shop, the prime coat of paint shall be applied within 12 hours of the beginning of the high pressure wash. Schedule cleaning and painting when dust or other contaminants will not fall on wet, newly painted surfaces. Protect surfaces that do not receive paint or have already been painted from the effects of cleaning and painting operations. Before applying the next coat, remove overspray and pigeon droppings with a water wash with sufficient pressure to remove overspray and pigeon droppings without damaging the paint. Before applying the next coat, remove all abrasives and residue from painted surfaces with a vacuum system equipped with a brush type cleaning tool.

3. Ferrous-Metal Substrates: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC recommendations.

    a. Clean steel surfaces as recommended by coating manufacturer and according to SSPC-SP 10/NACE No. 2.
    b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    c. Touch up bare areas and shop-applied prime coats that have been damaged. Solvent clean, and touch up with same primer as the shop coat.

4. Nonferrous-Metal Substrates: Clean nonferrous and galvanized surfaces. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation:

1. Maintain containers used in mixing and applying coatings in a clean condition, free of foreign materials and residue.
2. Stir materials before applying to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into the material. Remove film and, if necessary, strain coating material before using.
3. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

E. Coating Application:

1. Do not apply high-performance coatings over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to forming a durable coating film.

F. Scheduling Coating: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for coating as soon as practicable after preparation and before subsequent surface deterioration.

1. Omit primer on metal surfaces that have been shop primed and touchup painted.
2. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
3. Where manufacturer's written instructions require sanding, sand between applications to produce a smooth, even surface.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until coating has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat does not cause undercoat to lift or lose adhesion.
5. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance. Give special attention to edges, corners, crevices, welds, exposed fasteners, and similar surfaces to ensure that they receive a dry film thickness equivalent to that of flat surfaces.

G. Application Procedures: Apply coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

1. Brush Application: Use brushes best suited for material applied and of appropriate size for the surface or item being coated.

    a. Apply primers and first coats by brush unless manufacturer's written instructions permit using roller or mechanical applicators.
    b. Brush out and work brush coats into surfaces in an even film.
    c. Apply the paint to produce a smooth coat. Work the paint into all crevices, corners, and around all bolt and rivet heads. Apply additional paint as necessary to produce the required coating thickness.
    d. Eliminate cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Neatly draw glass lines and color breaks.

2. Spray Equipment: Use mechanical methods to apply coating if permitted by manufacturer's written instructions and governing regulations.

    a. Use spray equipment with orifice size recommended by manufacturer for material and texture required.
    b. Apply paint in a uniform layer with overlapping at the edges of the spray pattern. Paint the border of the spray pattern first, followed by painting the interior of the spray pattern. Complete painting a spray pattern before moving to the next spray pattern area. Within a spray pattern area, hold the gun perpendicular to the surface and at a distance that will ensure a wet layer of paint is deposited on the surface. Release the trigger of the gun at the end of each stroke. To ensure coverage, spray all bolts and rivet heads from at least two directions or apply the paint to bolts and rivet heads using a brush. If mud cracking occurs, the affected area shall be cleaned to bare metal in accordance with surface preparation above and repainted. Fill all gaps and crevices 1/8 inch (3 mm) or less with primer. Use spray equipment recommended by the manufacturer and suitable for use with the specified paint. Provide adequately sized traps or separators to remove oil and condensed water from the air. Periodically drain the traps during operations. To ensure that the traps or separators are working properly, blow air from the spray gun for 30 seconds onto a white cloth or blotter held in a rigid frame. Verify the test results by inspecting the white cloth or blotter. If the cloth or blotter retains oil, water, or other contaminants, suspend painting until retests verify the problem was corrected. Perform this test at the start of each shift and at 4-hour intervals. This is not required for an airless sprayer. Do not use spray application unless the operation is totally enclosed as required for abrasive blasting, to prevent overspray damage to the ground, public and private property, vegetation, streams, lakes, and other surfaces not to be painted.
    c. Apply each coat to provide the equivalent hiding of brush-applied coats.
    d. Do not double back with spray equipment building-up film thickness of two coats in one pass, unless recommended by manufacturer.

H. Minimum Coating Thickness: Apply each material no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.

I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

J. Prime Coats: Before applying topcoats, apply a prime coat of material, as recommended by manufacturer, to material required to be coated or finished that has not been prime coated by others.

1. Apply paint as a continuous film of uniform thickness, free of all defects such as holidays, runs, and sags. Repaint all thin spots or areas missed before the next coat of paint is applied. Ensure that each coat of paint is properly cured before applying the next coat. Comply with the manufacturer’s written instructions for the time interval between coats and apply the next coat when an additional coat will not cause detrimental film irregularities, such as lifting, wrinkling, or loss of adhesion of the undercoat. Do not exceed the following time intervals. If the prime coat is organic zinc, the maximum time between the prime and intermediate coats is 30 days. There is no maximum time between the prime and intermediate coats for an

inorganic zinc primer. The maximum time interval between intermediate and finish coats is 13 days. These maximum recoat times include adverse weather days.

2. Recoat primed and sealed substrates if there is evidence of suction spots or unsealed areas in first coat, to ensure a topcoat with no burn-through or other defects caused by insufficient sealing.

K. Completed Work: Match approved Samples for color, texture, and coverage. Remove, refinish, or recoat work that does not comply with specified requirements.

L. Cleanup: At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

M. Protect work of other trades, whether being coated or not, against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

1. Provide "Wet Paint" signs to protect newly coated finishes. After completing coating operations, remove temporary protective wrappings provided by others to protect their work.
2. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

N. Repair Procedures: Remove paint and correct defects or damaged areas, including areas damaged by welding, and in areas that do not comply with the requirements of this specification. Correct defects and damaged areas using the same paint as originally applied
1. Apply the prime coat only to the surface of the bare steel and the existing prime coat exposed by feathering. Do not apply the prime coat to the adjacent intermediate coat.
2. Apply the intermediate coat only to the new prime coat and the existing intermediate coat exposed by feathering. Do not apply the intermediate coat to the adjacent finish coat.
3. Apply the finish coat only to the new intermediate coat and the existing finish coat that was feathered or lightly sanded. Do not apply the finish coat beyond areas that were feathered or lightly sanded.

At the perimeter of the repair area, apply the prime and intermediate coats using a brush. Apply the finish coat using either brush or spray. The Contractor may need to several applications to obtain the proper thickness for each coat. During the application of the prime coat, the paint shall be continuously mixed.

END OF SECTION 09960

SECTION 09970 - HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Clear Coats on Sundial

1.2 RELATED SECTIONS

A. Section 03300 Cast-in-Place Concrete

B. Section 09900 Painting

1.3 REFERENCES

A. ASTM D4541-95 Pull Off Adhesion Tests.

B. ASTM-F-510 Wear Testing.

C. ASTM-D-2794 Impact Resistance.

D. ASTM-F-609 Coefficient of Friction Test.

E. South Coast Air Quality Management District (SCAQMD)

1.4 SUBMITTALS

A. Submit under provisions of Section 01330.

B. Product Data: Manufacturer's data sheets including;

1. Installation Guide
2. Product Data Sheet
3. MSDS

C. Selection Samples: Provide (2) sets of applicable color charts or chips representing all standard colors available from the manufacturer.

D. Verification Samples: Provide verification samples of each product specified on a minimum size of 6" square showing actual products, colors, and texture.

E. Installer Qualifications: Submit list of successfully completed projects with references of same or similar scope of work.

1.5 QUALITY ASSURANCE

A. Qualifications: Successful experience with other projects of the scope and scale of the work described in this section.

B. Training: Confirmation by manufacturer that the installer has successfully completed an authorized training workshop of the flooring system(s).

C. Mock-up: Provide a mock-up demonstrating actual surface preparation methods to be used then produce actual finishes to confirm acceptable appearance and workmanship.

D. Area to be determined by architect.

E. Approvals of each completed phase must be accepted prior to proceeding.

F. Refinish, if applicable to receive final approvals.

1.6 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage & Protection: Store materials protected from exposure to harmful environmental conditions and at a minimum temperature of 50 degrees F and at a maximum temperature of 90 degrees F. Do not freeze!

C. Handling: All containers must be tightly closed when not in use to prevent accidental contamination by foreign elements.

1.7 PROJECT/SITE CONDITIONS

Maintain environmental conditions (temperature, humidity, ventilation) according to the manufacturer's instructions. Do not install an exterior project when rain is imminent within the first 24 hours.

1.8 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit for Owners acceptance, manufacturer's standard limited warranty against manufacturer defects executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

Acceptable Manufacturers:
Eco Safety, Inc. d/b/a Eco Safety Products
2921 W Culver Street, #4B, Phoenix, AZ. 85009
Telephone: 602.305.9397 Fax: 602.305.6431
Email: info@buildwithesp.com Website: www.buildwithesp.com or equal.

2.6 W.B. ACRYLIC-URETHANE HIGH TRAFFIC CLEAR COAT

A. Product: Eco-Tuff High Traffic Clear Coat or equal

1. Formulation Options: Standard (concrete) and AQ (submersible)

B. Description: A high performance interior/exterior 0 VOC water-based acrylic-urethane clear coat for concrete and masonry surfaces engineered for high traffic and extreme weather environments.

C. Surface Preparation: Remove all bond breakers and prepare substrate for optimum bonding and penetration by mechanical grinding and/or chemical etching and cleaning.
   1. EE3-8000 Eco-Etch Pro Etch & Clean Concentrate or equal

D. Primer/Sealer: Required for optimum moisture protection and bonding of topcoats for all high traffic, weathering, and submersible applications.

   1. ET2-6500-10 Eco-Tuff W.B. 2-Part Epoxy Primer/Sealer or equal

E. Finish Material: ET2-6030-25CC Eco-Tuff High Traffic Clear Coat or equal, Standard

F. Finish Material: ET2-6032-25AQCC Eco-Tuff High Traffic Clear Coat or equal, AQ

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with the instructions and recommendations of the flooring surface manufacturer.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions are suitable for installation of the flooring surface system.

B. Do not proceed with installation until unsuitable conditions are corrected.

3.3 SURFACE PREPARATION

A. Degreasing: It is very important when using a degreaser that the clean up is absolutely thorough and complete and that no dissolved residue, fat, oils, grease, dust, etc. is left on the surface. This is further achieved by repeating rinses of water.

   1. STE-4002-5 Soy-It Industrial Degreaser Concentrate
   2. EE3-8000 Eco-Etch Pro Etch & Clean Concentrate

B. Concrete: The concrete surface should be hand troweled or with a brush/broom finish to ensure optimum porosity for adhesion. Otherwise proper surface profiling is required. New concrete needs at least 28 days to cure properly, prior to primer application. Unless the new concrete is dry, adhesion problems will be experienced.

   1. Profile and clean the concrete for maximum bonding and penetration by using Eco Etch Pro Concentrate in full strength or 1:1. If performing mechanical abrasion, be sure the surface texture does not alter expected results. Very dense surface still may require an Eco Etch Pro application to open the pores adequately. Test for optimum porosity prior to proceeding.
   2. Concrete should be completely clean and dry.
   3. Patch all imperfections, cracks, etc with concrete patch filler and flexible joint fillers. DO NOT USE SILICONE PRODUCTS. The product will not adhere to silicone.

4. Prime with ET2-6500-10 as per manufacturer instructions. When primer has properly cured, perform test patch to ensure adhesion.

3.4 INSTALLATION

A. Types of Applications

1. Roller Application

a. Use only the Foam Textured Rollers available from Eco Safety Products or equal when applying the Eco-Tuff Rubberized Non Skid Coating. Other rollers will not pick up and spread the product evenly. The roller must be capable of lifting the rubber crumb within the product to the surface. All other products are suitable use traditional and applicable sized nap for the intended substrate and texture.
b. Soak roller in water – remove excess water prior to application.
c. Pour product into paint tray or hang roller grid into 5 gallon bucket. Make sure to completely saturate roller with product, leaving no bare spots on roller.
d. Apply the first coat as a thin coat. Resaturate roller after each pass. Make 4-5 consecutive passes in the same direction, with each pass right next to the other. When applying, roll in one direction first, then roll in the opposite direction in order to properly blend the product and create a uniform surface.
e. Once an area is covered, run the roller very lightly over it to ensure even distribution of color and rubber crumb if applicable.
f. When dry to the touch, apply 2nd coat. Repeat if a 3rd coat is desired.

2. Spray Applications

a. Mask off areas as needed

i. When spray applying Eco-Tuff Rubberized Non Skid or equal, use a hopper type Graco brand “Tex-Spray Compact” or equivalent.
ii. When spray applying Eco-Tuff Industrial or Eco-Tuff Clear Coats or equal, use a standard airless with a #13-#17 tip.

b. Attach spray gun to a compressor air line giving pressure of at least 40 psi.
c. Spray all water out of the gun to prime.
d. Before starting the job, spray a few short bursts away from the surface to test that everything is working properly.
e. Holding gun approximately 12-24” away from surface, spray an even, light coat over the entire surface. DO NOT APPLY TOO THICK.
f. Keep spray gun at a 90 degree angle to the surface.
g. The hopper spray gun should make a slight “spitting” sound. This is a characteristic of the guns and is necessary for an even texture. The product will self level.
h. When surface becomes touch dry, spray subsequent coats.
i. While spraying the Eco-Tuff Rubberized Non Skid, be careful not to blow rubber crumb away from the area you are working on as this can accumulate in other areas of the job that will prevent the coating from bonding with the substrate.
j. If the rubber crumb is bouncing back at you, lower the pressure or hold gun further from the surface. The further away from the surface you hold the gun, the greater the texture, the closer, the finer.
k. Remove any over spray immediately with cloth and water.

3. Application Temperature and Curing Time

a. Under normal working conditions, the product will be dry to the touch within 1 hour and can be subjected to light foot traffic within 24 hours. Full curing time only affects the amount of time required to wait before subjecting the surface to cleaning, heavy loads and chemical exposure. Surface can be subjected to normal loads well before this minimum time requirement.
b. The coating should not be subjected to cleaning, heavy loads, or chemical exposure until fully cured after 7 days, less in hot-humid conditions, more in cold, dry weather. Dry times in this manual are based on a temperature of 77 degrees F and 50% humidity. The product should not be used under 40 degrees F. Do not allow product to freeze.
c. DO NOT USE ANY SOLVENTS, SOLVENT BASED ALCOHOLS, THINNERS OR LACQUERS TO THIN PRODUCT.

3.5 PROTECTION

A. Protect the installed surface from damage resulting from subsequent construction activity on the site.

3.6 STORAGE AND REPAIR

A. To store partially used cans, seal can well (airtight) and place in cool, dry place. The contents should be useable for at least 12 months.
B. The evaporation of the water within the product will cause the product to cure. If some water content has evaporated, reconstitution with clean water may restore product viability if the curing process within the can is not too advanced.

3.7 REPAIRING

In the event that the product is damaged, it can easily be repaired or over-coated, due to self bonding.

A. Remove all damaged product. Use a sharp knife such as a utility knife to make a well-defined area such as a square and eliminate uneven edges.

B. Sand area with 36 or 40 grit sandpaper so that the new application can get a good grip. Slightly bevel the edges of the existing product so that the new product can fill in the cutout area and go slightly onto the existing.

C. Clean area with water.

D. Test for adhesion first, before completing job. Then apply the product to the affected area.

3.8 MAINTENANCE

A. Most general neutral pH floor cleaners have been tested and will work well. We recommend Soy-It Degreaser Concentrate.

B. DO NOT USE BLEACH, BLEACH PRODUCTS OR CAUSTICS.

C. For best results on the Eco-Tuff Rubberized Non Skid textured coating, use a stiff bristle deck brush to agitate cleaner on the surface. Rinse thoroughly to remove all residue. All others use a wet/dry microfiber mop.

D. Surfaces can also be cleaned with the use of automatic scrubbers. These are machines which, in one pass, put down the washing solution, scrub the floor with a light pad, and vacuum up the dirty water. It should be pointed out that the pad pressure used in the scrubber must be light and need only be sufficient for the pad to make light contact with the floor.

E. Heavy scrubbing will negatively affect the coated surface over time.

END OF SECTION 09970

SECTION 10436 - POST AND PANEL SIGNS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following post and panels signs:

1. Nonilluminated single-panel type.

1.2 SUBMITTALS

A. Product Data: For each product indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: The design for post and panel signs is based on MUTCD Standards. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Andco Industries Corporation.
2. Apco Graphics Inc.
3. ASI Sign System, Inc.
4. Best Manufacturing Company.
5. Charleston Industries, Inc.
6. Nelson-Harkins Industries.
7. Spanjer Brothers, Inc.
8. Supersine Company (The).
9. Vomar Products, Inc.

2.2 MATERIALS

A. Aluminum Sheet or Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for use and finish indicated with at least the strength and durability properties of alloy 5005-H15.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for use and finish indicated with at least the strength and durability properties of alloy 6063-T5.

C. Steel Tubing: Cold-formed, ASTM A 500, Grade B.

1. Finish: Hot-dip galvanized after fabrication per ASTM A 123.

D. Concrete for Post Holes: ASTM C 150 portland cement, ASTM C 33 aggregate, and clean water for concrete mix with minimum 28-day compressive strength of 2500 psi (17 MPa).

1. Mix: Minimum 4 sacks of cement/cu. yd. (225 kg of cement/cu. m), 1-inch (25-mm) maximum-size aggregate, maximum 3-inch (75-mm) slump, and 2 to 4 percent entrained air.

E. Concrete for Post Holes: Specified in Division 3 Section "Cast-in-Place Concrete."

2.3 COMPONENTS

A. Colors and Textures, General: For exposed material that requires selection of materials with integral or applied colors, textures, or other appearance characteristics, provide colors and textures as selected from manufacturer's full range, unless otherwise indicated.

B. Steel Posts: 0.120-inch- (3.0-mm-), galvanized, square steel posts. Include post caps, fillers, spacers, junction boxes, access panels, and related accessories required for complete installation.

1. Post Size: **2 inches (50 mm)** round.
2. Post Finish: unfinished.
3. Post Mounting Method: embedded in concrete footing.

C. Unframed Single-Sheet Sign Panels: With smooth, mechanically finished edges.

1. Material: **0.125-inch- (3.2-mm-)** thick aluminum plate
2. Edge Condition: Rounded.
3. Corner Condition: Rounded.

N. Accessories:

1. Fasteners: Use concealed fasteners fabricated from metals that are noncorrosive to sign material and mounting surface.
2. Anchors and Inserts: Use nonferrous metal or hot-dip galvanized anchors and inserts. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete.

2.4 FABRICATION

A. General: Manufacturer's standard panel-type signs with message panel supported between two posts.

1. Exterior Post and Panel Signs:

a. Wind-Velocity Criteria: Fabricate to withstand wind velocity of **110 mph (177 km/h)** on total sign area, in every direction.
b. Temperature Change (Range): Accommodate **110 deg F (38 deg C)** ambient to prevent buckling, opening up of joints, and overstressing of welds and fasteners.

1) Base design on actual surface temperatures of metals due to both solar heat gain and nighttime-sky heat loss.

2. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress on exposed and contact surfaces.
3. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
4. Preassemble signs in shop to the greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
5. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

B. Posts:

1. Direct Burial: For permanent sign installation, fabricate posts 36 inches (900 mm) longer than height of sign to permit direct embedment in concrete foundations.

C. Panels:

1. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in relationship indicated.
2. Increase thickness or reinforce with stiffeners or backing materials as required to produce surfaces without distortion, buckles, warp, or other surface deformations.
3. Metal Joints: Continuously weld joints and seams, unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Excavation: In firm, undisturbed or compacted soil, drill or (using post-hole digger) hand-excavate holes for posts to minimum diameter recommended by sign manufacturer, but at least four times largest post cross-section.

1. Excavate hole depths approximately 3 inches (75 mm) lower than required post bottom, with bottom of posts set at least 36 inches (900 mm) below finished grade.

B. Setting Posts: Center and align posts in holes 3 inches (75 mm) above bottom of excavation.

1. Protect portion of posts aboveground from concrete splatter. Place concrete around posts and vibrate or tamp for consolidation. Check posts for vertical and top alignment and hold in position until concrete has achieved its initial set.

D. Install signs level, plumb, and at height indicated, with surfaces free from distortion or other defects in appearance.

END OF SECTION 10436

SECTION 13100 – LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a complete lightning protection system for the tower structure included on the contract drawings. The system shall provide safety for the building tower and occupants by preventing damage caused by lightning. The design of this system is to be in strict accordance with this section of the specifications and all contract drawings that apply.

B. The lightning protection system shall be installed by a firm actively engaged in the installation of Master Labeled Lightning Protection Systems and shall be so listed by Underwriters Laboratories, Inc. The completed system shall comply with the latest editions of the Installation Requirements for Lightning Protection Systems, UL96A and of the National Fire Protection Association's Lightning Protection Standard, NFPA 780.

C. The work covered under this section of the specification consists of furnishing labor, materials and services required for the completion of a functional and unobtrusive lightning protection system approved by the Government and Underwriters Laboratories, Inc.

1.2 REFERENCES: The completed lightning protection system shall comply with the latest issue of the following standards and form a part of this specification.

A. NFPA 780, Standard for the Installation of Lightning Protection Systems.

B. UL 96A, Installation Requirements for Lightning Protection Systems.

1.3 SUBMITTALS

A. Shop drawings shall be submitted to the government for approval prior to commencement of the installation. Shop drawing are to show the extent of the system layout designed specifically for the building(s) or structures included in the contract drawings along with details of the products to be used in the installation.

1.4 QUALITY ASSURANCE

A. The installing contractor shall furnish a UL Master Label or Letter of Findings upon completion of the installation.

PART 2 - PRODUCTS

2.1 STANDARD

A. All materials used in the installation shall be new and shall comply in weight, size and composition as required by UL 96A and NFPA 780 and shall be labeled or listed by Underwriters Laboratories Inc. for use in lightning protection systems. The system furnished under this specification shall be the standard product of a manufacturer regularly engaged in the production of lightning protection equipment. The manufacturer shall be listed by UL as a recognized manufacturer of lightning protection components.

2.2 MATERIALS

A. Class I materials shall be used on structures that do not exceed 75 feet in height and Class II materials shall be used on structures that are 75 feet or higher above average grade.

B. Copper materials shall not be mounted on aluminum surfaces including Galvalume, galvanized steel and zinc; this includes these materials that have been painted.

C. Aluminum materials shall not come into contact with earth or where rapid deterioration is possible. Aluminum materials shall not come into contact with copper surfaces.

2.3 AIR TERMINALS

A. Air terminals shall project a minimum of ten inches above the object or area it is to protect and shall be located at intervals not exceeding 20'-0" along ridges.

B. Air terminals shall be installed on stacks, flues, mechanical units and other metallic objects not located within a zone of protection and which have an exposed metal thickness less than 3/16 of an inch. Objects having an exposed metal thickness 3/16 of an inch or greater shall be connected to the lightning protection system as required by the specified standards using main size conductor and bonding plates having a minimum of 3 square inches of surface contact area.

C. Air terminal bases shall be securely fastened to the structure in accordance the specified standards including the use of adhesive that is compatible with the surface it is to be used on or stainless steel fasteners.

D. Main conductors shall be sized in accordance with the specified standards for class I or Class II structures and shall provide a two way horizontal or downward path from each air terminal to connections with the ground system. Conductors shall be free of excessive splices and no bend of a conductor shall form a final included angle of less than neither 90 degrees nor have a radius of bend less than 8 inches.

E. Down conductors shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor. Down conductors shall be spaced at intervals averaging not more than 100 feet around the perimeter of the structure. In no case shall a structure have fewer than two down conductors. Down conductors shall be installed on the interior of the structre and shall not be exposed to the exterior.

F. In case of structural steel frame construction, down conductors may be omitted and roof conductors shall be connected to the structural steel frame at intervals not exceeding 100 feet along the perimeter of the structure.

G. Coordinate location of down conductors, if needed with the Government.

2.4 ROOF PENETRATIONS

A. Roof penetrations required for down conductors or for connection to structural steel framework shall be made using thru-roof assemblies with solid riser bars and appropriate roof flashing. Conductors shall not pass directly through the roof. The roofing contractor shall furnish and install the materials

required to properly seal all roof penetrations of the lightning protection components and any additional roofing materials or preparations required by the roofing manufacturer for lightning conductor runs to assure compatibility with the warranty for the roof including roof pads that may be required to protect the roof under each of the lightning protection components.

2.5 GROUND TERMINATIONS

A. Ground electrodes shall be copper clad steel and a minimum 5/8" diameter and 10 feet long. A ground electrode shall be provided for each down conductor. The down conductor shall be connected to the ground electrode using a bronze ground rod clamp having a minimum of 1 ½" contact between the ground electrode and the conductor measured parallel to the axis of the ground electrode, or by an Ultraweld exothermically welded connection. Ground electrodes shall be located a minimum of 2 feet below grade and shall be installed below the frost line where possible (excluding shallow topsoil conditions).

B. Where the structural steel framework is utilized as the down conductor for the system, ground terminals shall be connected to columns around the perimeter of the structure at intervals averaging not more than 60 feet apart. Columns shall be grounded using either bonding plates having 8 square inches of surface contact area or by Ultraweld exothermically welded connections.

C. A ground loop conductor shall be installed to protect the subject structure. All down conductors, structural steel and ground rods shall be connected to the ground loop conductor. The ground loop conductor shall be sized in accordance with the specified standards and in no case shall be smaller than the main roof conductor.

D. The Contractor shall provide a report from an independent qualified testing agency, not affiliated with the installer, verifying final installed system ground resistance.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation shall be installed by an UL listed lightning protection installation company.

3.2 COORDINATION

A. Coordinate the installation of the lightning protection system with other trades.

B. Coordinate all roof penetrations, fasteners and adhesive with the roofing contractor and the Government prior to installing any materials on the roof.

3.3 INSPECTION AND CERTIFICATION

A. New Structures:

1. Upon completion of the installation of the lightning protection system the contractor shall furnish the UL Master Label issued by Underwriters Laboratories Inc.

END OF SECTION 13100

SUBMITTAL REGISTER

HIGH KNOB OBSERVATION TOWER AND SITE DESIGN
Hill Studio Project # 1016
11/8/2010

Specification Section	Deliverable	Submittal Log for Owner Actions				Actions
		Received	Response	Received Resubmittal	Response Resubmittal	
02300	Material Test Reports					
03300	Design Mixtures					
03300	Steel Reinfocement Shop Drawings					
03300	Welding Certificates					
03300	Form Facing Materials - Smooth Form					
03300	Form Facing Materials - Rough Form					
03400	Product data for each stain					
03400	Shop Drawings					
03400	Samples					
03400	Qualification Data					
03400	Design Mixes					
03400	Engineering Analysis					
04860	Product data					
04860	Stone Samples					
04860	Colored Mortar Samples					
04860	Qualification Data					
04860	Veneer Anchors					
04860	Veneer Anchor Ties					
04860	Partial Wall Mock-up					
05120	Shop Drawings					
06166	Product Literature					
06166	Shop Drawings					
06166	Design Calculations					
06166	Samples					
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EROSION & SEDIMENT CONTROL PLAN

FOR THE

HIGH KNOB OBSERVATION TOWER AND SITE DESIGN

NORTON, VIRGINIA

T&L Project No.: 10427-02

November 2010

EROSION & SEDIMENT CONTROL PLAN

FOR THE

HIGH KNOB OBSERVATION TOWER AND SITE DESIGN

NORTON, VIRGINIA

PREPARED FOR THE

USDA FOREST SERVICE

THOMPSON & LITTON

WISE, VIRGINIA 24293

COMMISSION NO. 10427-02

NOVEMBER 2010

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INTRODUCTION

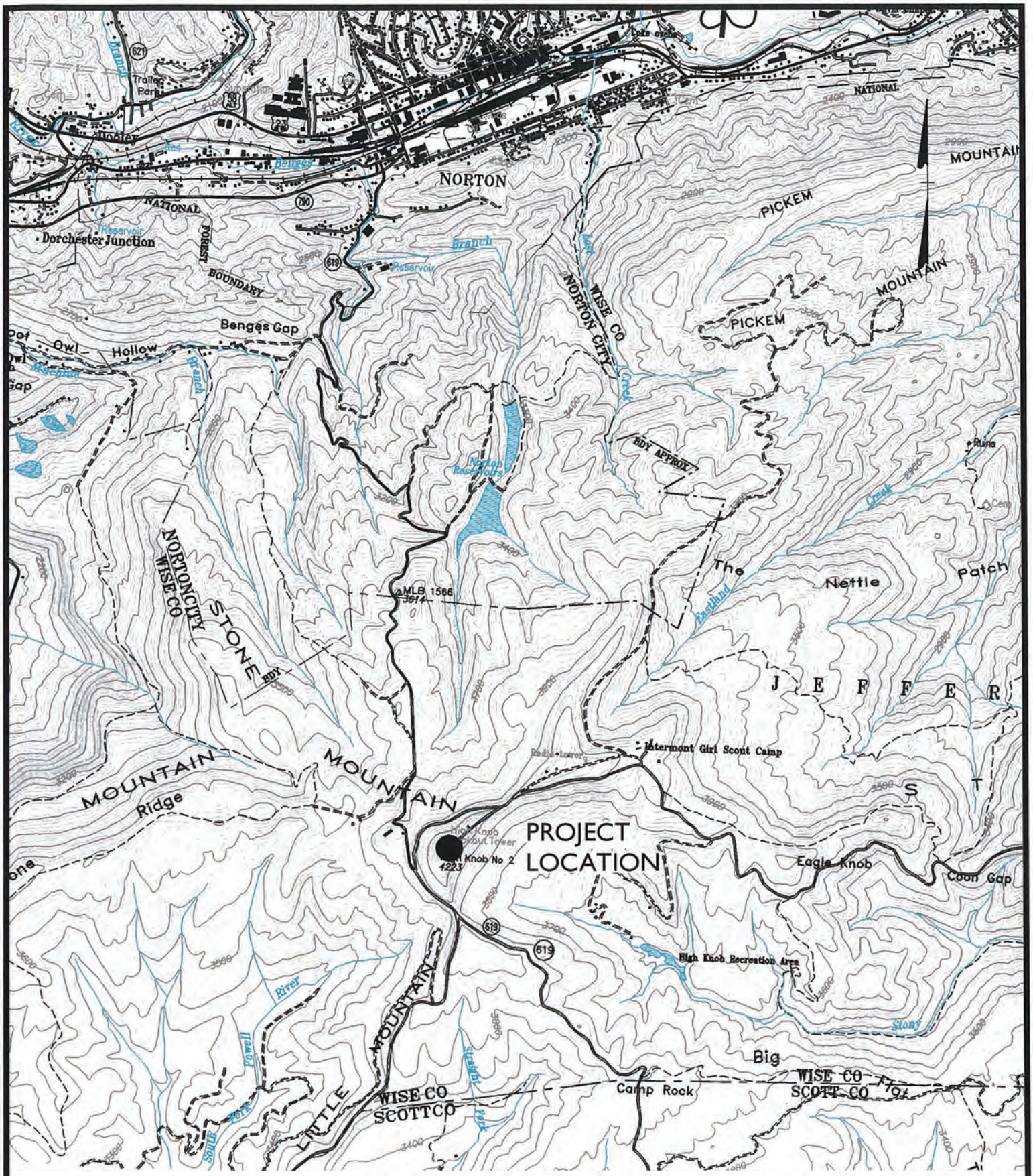
Project Description

The High Knob Observation Tower and Site Design project will be constructed on land owned by the USDA Forest Service. The project site is located approximately 2 miles south of the City of Norton in the Jefferson National Forest. Access to the site will be off of High Knob Road. The project will include the construction of a new observation tower and pedestrian trails/paths and associated items. A location map depicting the project location is presented in Exhibit I.

Existing Site Conditions

The existing site is the location of the previous High Knob Observation Tower which was destroyed by fire in 2007. The project site is located on a natural high spot with all of the surface runoff from the site flowing towards the perimeter of the site where it ultimately discharges into natural drainageways which convey the flow to Benges Branch and Stony Creek. Topographic relief on the site where grading will take place varies from an elevation of 4218 near the center of the site to an elevation of 4170 near the northeastern portion of the site.

Exhibit I: Location Map



PROJECT LOCATION MAP

SOURCE: NORTON & WISE, VIRGINIA
U.S.G.S. QUADARNGLES

DESIGNED BY	SCALE 1" = 2500'
DRAWN BY	DATE NOVEMBER 2010
PROJECT NO. 10427-02	

HIGH KNOB OBSERVATION TOWER AND SITE DESIGN
NORTON, VIRGINIA

THOMPSON & LITTON

SHEET
EXHIBIT
1

Off-site Areas

All construction activities for the project will be conducted within the property boundary of the land owned by the Forest Service. All fill materials will be obtained from on-site excavation or approved borrow areas. Should any off-site fill material be needed, the fill material will be obtained from an area used for such purposes. The Contractor will be required to implement proper erosion and sediment control procedures for any off-property fill material obtained for use on this project.

Soils

No geotechnical study has been performed for this project.

EROSION AND SEDIMENT CONTROL MEASURES

The erosion and sediment control plan contained herein has been developed in accordance with applicable provisions of the Virginia *Erosion and Sediment Control Handbook*, Third Edition, 1992 (as amended), by the Virginia Department of Conservation and Recreation and the *Road and Bridge Standards* and *Road and Bridge Specifications* by the Virginia Department of Transportation. As such, the plan includes provisions for erosion and sediment control for the High Knob Observation Tower and Site Design project. These measures are capable of minimizing or eliminating, where possible, potentially adverse effects of the development. These measures are intended to provide adequate protection for the environment, the project site, and to downstream properties which could be affected by sedimentation and changes in runoff during and after grading of the High Knob Observation Tower and Site Design project. This erosion and sediment control plan is a viable contract document and its implementation is required for successful completion of the project.

In accordance with the Virginia Erosion and Sediment Control Law, an individual holding a certificate of competence issued by the Virginia Department of Conservation and Recreation is required to be in charge of, and responsible for, carrying out the land disturbing activities associated with this project. For the High Knob Observation Tower and Design Project, this individual will be a representative of the Contractor and, therefore, will be named upon the award of a construction contract for the project.

Site Specific Practices

The erosion and sediment control measures for the High Knob Observation Tower and

Site Design project will include the use of a construction entrance, silt fence, surface roughening, topsoiling, temporary and permanent vegetation, and mulching. The construction entrance and silt fence will be installed prior to commencement of earthmoving activities. Temporary and permanent vegetation will be installed when needed and as construction progress allows. Appendix A of this erosion and sediment control plan contains plates and tables for the erosion and sediment control facilities as presented herein. An Erosion and Sediment Control Plan, which delineates the erosion and sediment control facilities for the project, is included in Appendix B.

Silt fence will be provided to intercept and detain small amounts of sediment from the fill areas and other isolated areas of the project site. The flow of runoff to each of these facilities will be controlled by grading of the site. The means of diversion may change as the grading operations take place and will often be dictated by field circumstances. However, the site grading and diversion methods will always be maintained to provide positive drainage toward one of the erosion and sediment control facilities.

A construction entrance will be provided for removing sediment from vehicle tires to prevent tracking onto paved roads. Where sediment is tracked onto a public road surface, the road will be cleaned thoroughly at the end of each day. Sediment will be removed from the road by shoveling or sweeping and transported to a sediment control disposal area. Street washing will only be allowed after sediment is removed in this manner.

During the construction of the project, soil material stockpiles will be protected with silt fence. Stockpiles that are to remain unworked for more than 30 days will be stabilized with

temporary seeding within 7 days after the completion of stockpiling.

If the site remains dormant for a period of 30 days or more between grading and final stabilization, temporary seeding will be utilized to reduce the erosive effects of storm events and to reduce the amount of sediment that leaves the site. Areas that will be denuded for more than 30 days will be seeded in accordance with the provisions of this plan.

The aforementioned erosion and sediment control facilities for the High Knob Observation Tower and Site Design project will be installed and maintained by the Contractor, as presented herein, during the construction of the project. The Contractor will be responsible for the installation of any additional erosion and sediment control facilities necessary to prevent erosion and sedimentation on-site or off-site as determined by the plan approving authority. All temporary erosion and sediment control facilities (i.e., the construction entrance and silt fence) will be removed by the Contractor upon the completion of construction when a permanent stand of vegetation has been established. Any remedial work which may be required prior to final site stabilization will be performed by the Contractor.

Construction Methods and Maintenance

The following is a list of design criteria, construction specifications, and maintenance requirements obtained from the Virginia *Erosion and Sediment Control Handbook* for the measures which will be utilized to control erosion and sedimentation during construction of the High Knob Observation Tower and Site Design project.

A. Construction Entrance:

(Design Criteria)

Aggregate Size

VDOT No. 1 coarse aggregate (2-3-inch stone) should be used.

Entrance Dimensions

The aggregate layer must be at least 6-inches thick. It must extend the full width of the vehicular ingress and egress area. The length of the entrance must be at least 70 feet. (See Plate 3.02-1.)

Washing

If conditions on the site are such that the majority of the mud is not removed by the vehicles traveling over the gravel, then the tires of the vehicles must be washed before entering a public road. Washwater must be carried away from the entrance to a settling area to remove sediment. A wash rack may also be used to make washing more convenient and effective. (See Plate 3.02-1.)

Location

See Construction Drawings.

(Construction Specifications)

The area of the entrance should be excavated a minimum of 3-inches and should be cleared of all vegetation, roots, and other objectionable material. A filter fabric underliner should be used

as a "separator" to minimize the dissipation of aggregate into the underlying soil due to construction traffic loads. The filter fabric underliner should be placed the full width and length of the construction entrance. The filter cloth utilized shall be a woven or nonwoven fabric consisting only of continuous chain polymeric filaments or yarns of polyester. The fabric shall be inert to commonly encountered chemicals and hydrocarbons, shall be mildew and rot resistant, and shall conform to the physical properties noted in Table 3.02-A which is included in Appendix A. The gravel shall be placed to the specified dimensions. Any drainage facilities required because of washing should be constructed according to specifications. If wash racks are used, they should be installed according to manufacturer's specifications.

(Maintenance)

The entrance shall be maintained in a condition which will prevent tracking or flow of mud onto public rights-of-way. This may require periodic top dressing with 2-inch stone, as conditions demand, and repair and/or cleanout of any structures used to trap sediment. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately.

B. <u>Silt Fence:</u>

(Design Criteria)

1. No formal design is required.

2. Silt fences, because they have a much lower permeability than burlap filter barriers, have

their applicability limited to situations in which only sheet or overland flows are expected. They normally cannot filter the volumes of water generated by channel flows, and many of the fabrics do not have sufficient structural strength to support the weight of water ponded behind the fence line. Their expected usable life is 6 months.

(Construction Specifications)

Materials

1. Synthetic filter fabric shall be a pervious sheet of propylene, nylon, polyester, or ethylene yarn and shall be certified by the manufacturer or supplier as conforming to the following requirements:

PHYSICAL PROPERTY	TEST	REQUIREMENTS
Filtering Efficiency	ASTM 5141	75% (min.)
Tensile Strength at 20% (max.) Elongation*	VTM-52	Extra Strength - 50 lbs./linear in. (min.) Standard Strength - 30 lbs./linear in. (min.)
Flow Rate	ASTM 5141	0.2 gal./sq. ft./min.(min.)
Ultraviolet Radiation Stability %	ASTM G 26	90% (min.)

*Requirements reduced by 50 percent after 6 months of installation.

2. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0° F to

120° F.

3. If wooden stakes are utilized for silt fence construction, they must have a diameter of 2-inches when oak is used and 4-inches when pine is used. Wooden stakes must have a minimum length of 5 feet.

4. If steel posts (standard "U" or "T" section) are utilized for silt fence construction, they must have a minimum weight of 1.33 pounds per linear foot and shall have a minimum length of 5 feet.

5. Wire fence reinforcement for silt fences using standard-strength filter cloth shall be a minimum of 14 gauge and shall have a maximum mesh spacing of 6-inches.

(Installation)

1. The height of a silt fence shall be a minimum of 16-inches above the original ground surface and shall not exceed 34-inches above ground elevation.

2. The filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter cloth shall be spliced together only at a support post, with a minimum 6-inch overlap, and securely sealed.

3. A trench shall be excavated approximately 4-inches wide and 4-inches deep on the upslope side of the proposed location of the measure.

4. When wire support is used, standard-strength filter cloth may be used. Posts for this type of installation shall be placed a maximum of 10 feet apart (see Plate 3.05-1). The wire mesh fence must be fastened securely to the upslope side of the posts using heavy-duty wire

staples at least one-inch long, tie wires, or hog rings. The wire shall extend into the trench a minimum of two-inches and shall not extend more than 34-inches above the original ground surface. The standard-strength fabric shall be stapled or wired to the wire fence, and 8-inches of the fabric shall be extended into the trench. The fabric shall not be stapled to existing trees.

5. When wire support is not used, extra-strength filter cloth shall be used. Posts for this type of fabric shall be placed a maximum of 6 feet apart (see Plate 3.05-2). The filter fabric shall be fastened securely to the upslope side of the posts using one-inch long (minimum) heavy-duty wire staples or tie wires and eight-inches of the fabric shall be extended into the trench. The fabric shall not be stapled to existing trees. This method of installation has been found to be more commonplace than #4.

6. If a silt fence is to be constructed across a ditch line or swale, the measure must be of sufficient length to eliminate endflow, and the plan configuration shall resemble an arc or horseshoe with the ends oriented upslope (see Plate 3.05-2). Extra-strength filter fabric shall be used for this application with a maximum 3-foot spacing of posts.

   All other installation requirements noted in #5 apply.

7. The 4-inch by 4-inch trench shall be backfilled and the soil compacted over the filter fabric.

8. Silt fences shall be removed when they have served their useful purpose, as determined by the local plan-approving authority.

(Maintenance)

1. Silt fences and filter barriers shall be inspected immediately after each rainfall and at least

daily during prolonged rainfall. Any required repairs shall be made immediately.

2. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting.

3. Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the expected usable life and the barrier still be necessary, the fabric shall be replaced promptly.

4. Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.

5. Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, prepared, and seeded.

C. Surface Roughening:

(Specifications)

Cut Slope Applications For Areas Which Will Not Be Mowed

Cut slopes with a gradient steeper than 3:1 shall be stair-step graded or grooved (Plates 3.29-1 and 3.29-2).

1. Stair-step grading may be carried out on any material soft enough to be ripped with a bulldozer. Slopes consisting of soft rock with some subsoil are particularly suited to stair-step grading.

The ratio of the vertical cut distance to the horizontal distance shall be less than 1:1 and

the horizontal portion of the step shall slope toward the vertical wall.

Individual vertical cuts shall not be more than 30-inches on soft soil materials and not more than 40-inches in rocky materials.

2. Grooving consists of using machinery to create a series of ridges and depressions which run perpendicular to the slope (on the contour).

Grooves may be made with any appropriate implement which can be safely operated on the slope and which will not cause undue compaction. Suggested implements include discs, tillers, spring arrows, and the teeth on a front-end loader bucket. Such grooves shall not be less than 3-inches deep nor further than 15-inches apart.

Fill Slope Applications For Areas Which Will Not Be Mowed

Fill slopes with a gradient steeper than 3:1 shall be grooved or allowed to remain rough as they are constructed. Method (1) or (2) below may be used.

1. Groove according to #2 above.
2. As lifts of the fill are constructed, soil and rock materials may be allowed to fall naturally onto the slope surface (Plate 3.29-3).

   Colluvial materials (soil deposits at the base of slopes or from old stream beds) shall not be used in fills as they flow when saturated.

At no time shall slopes be bladed or scraped to produce a smooth, hard surface.

Cuts, Fills and Graded Areas Which Will Be Mowed

Mowed slopes should not be steeper than 3:1. Excessive roughness is undesirable where

mowing is planned. These areas may be roughened with shallow grooves such as remain after tilling, discing, harrowing, raking, or use of a cultipacker-seeder. The final pass of any such tillage implement shall be on the contour (perpendicular to the slope).

Grooves formed by such implements shall not be less than 1-inch deep and not further than 12-inches apart. Fill slopes which are left rough as constructed may not be smoothed with a dragline or pickchain to facilitate mowing.

Roughening With Track Machinery (see Plate 3.29-4)

Roughening with tracked machinery on clayey soils is not recommended unless no alternatives are available. Undue compaction of surface soil results from this practice. Sandy soils do not compact severely, and may be tracked. In no case is tracking as effective as the other roughening methods discussed.

When tracking machinery is the chosen surface roughening technique, it shall be done by operating tracked machinery up and down the slope to leave horizontal depressions in the soil. As few passes of the machinery should be made as possible to minimize compaction.

Seeding

Roughened areas shall be seeded and mulched as soon as possible to obtain optimum seed germination and seedling growth.

D. Topsoiling:

(Specifications)

Materials

Field exploration of the site shall be made to determine if there is sufficient surface soil of good quality to justify stripping. Topsoil shall be friable and loamy (loam, sandy loam, silt loam, sandy clay loam, clay loam). It shall be free of debris, trash, stumps, rocks, roots, and noxious weeds, and shall give evidence of being able to support healthy vegetation. It shall contain no substance that is potentially toxic to plant growth.

All topsoil shall meet the following criteria:

Organic Matter content shall be not less than 1.5% by weight.

pH range shall be from 6.0-7.5. If pH is less than 6.0, lime shall be added in accordance with test results or in accordance with the recommendations of the vegetative establishment practice being used.

Soluble salts shall not exceed 500 ppm.

If additional off-site topsoil is needed, it must meet the standards stated above.

Stripping

Topsoil operations shall not be performed when the soil is wet or frozen. Stripping shall be confined to the immediate construction area. A 4-to 6-inch stripping depth is common, but depth may vary depending on the particular soil. All perimeter dikes. basins. and other sediment controls shall be in place prior to stripping.

Stockpiling

Topsoil shall be stockpiled in such a manner that natural drainage is not obstructed and no off-site sediment damage shall result. Silt fence shall be installed around the perimeter of the stockpiles. Stockpiles that are to remain unworked for more than 30 days shall be stabilized with temporary seeding within 7 days after the completion of stockpiling. The location of topsoil stockpiles will be restricted to the soil material stockpile areas designated on the Erosion and Sediment Control Site Plan.

Side slopes of the stockpile shall not exceed 2:1.

Perimeter controls must be placed around the stockpile immediately; seeding of stockpiles shall be completed within 7 days of the formation of the stockpile, in accordance with Std. & Spec. 3.31, TEMPORARY SEEDING if it is to remain dormant for longer than 30 days.

Site Preparation Prior to and Maintenance During Topsoiling

Before topsoiling, establish needed erosion and sediment control practices such as diversions, grade stabilization structures, berms, dikes, level spreaders, waterways, sediment basins, etc. These practices must be maintained during topsoiling.

Grading: Previously established grades on the areas to be topsoiled shall be maintained according to the approved plan.

Liming: Where the pH of the subsoil is 6.0 or less, or the soil is composed of heavy clays, agricultural limestone shall be spread in accordance with the soil test of the vegetative establishment practice being used.

Bonding: After the areas to be topsoiled have been brought to grade, and immediately prior to dumping and spreading the topsoil, the subgrade shall be loosened by discing or scarifying to a depth of at least 2-inches to ensure bonding of the topsoil and subsoil.

Applying Topsoil

Topsoil shall not be placed while in a frozen or muddy condition, when topsoil or subgrade is excessively wet, or in a condition that may otherwise be detrimental to proper grading or proposed sodding or seeding. The topsoil shall be uniformly distributed to a minimum compacted depth of 2-inches on 3:1 or steeper slopes and 4-inches on flatter slopes. 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.

It is necessary to compact the topsoil enough to ensure good contact with the underlying soil and to obtain a level seedbed for the establishment of high maintenance turf. However, undue compaction is to be avoided as it increases runoff velocity and volume, and deters seed germination. Special consideration shall be given to the types of equipment used to place topsoil in areas to receive fine turf. Avoid unnecessary compaction by heavy machinery whenever possible. In areas which are not going to be mowed, the surface shall be left rough.

Soil Sterilants

No sod or seed shall be placed on soil which has been treated with soil sterilants until sufficient time has elapsed to permit dissipation of toxic materials.

E. Temporary Seeding:

(Specifications)

Prior to seeding, install all necessary erosion and sediment control structures for this project.

Plant Selection

Select plants appropriate to the season and site conditions from Tables 3.31-B and 3.31-C. Note that Table 3.31-B presents plants which can be used without extensive evaluation of site conditions; and that Table 3.31-C presents more in-depth information on the plant materials.

Seedbed Preparation

To control erosion on bare soil surfaces, plants must be able to germinate and grow. Seedbed preparation is essential.

1. Liming: Where test results of soils indicate a pH below 4.2, lime should be applied at the rate of three tons of pulverized agricultural limestone per acre; where test results of soils indicate a pH of 4.2 to 5.2, lime should be applied at the rate of two tons of pulverized agricultural limestone per acre; where test results of soils indicate a pH of 5.2 to 6, lime should be applied at the rate of 1 ton of pulverized agricultural limestone per acre.
2. Fertilizer: Shall be applied at 600 lbs./acre of 10-20-10 (14 lbs./1,000 sq. ft.) or equivalent. Lime and fertilizer shall be incorporated into the top 2-to 4-inches of the soil.

3. Surface Roughening: If the area has been recently loosened or disturbed, no further roughening is required. When the area is compacted, crusted, or hardened, the soil surface shall be loosened by discing, raking, harrowing, or other acceptable means.
4. Tracking: Tracking with bulldozer cleats is most effective on sandy soils. This practice often causes undue compaction of the soil surface, especially in clayey soils, and does not aid plant growth as effectively as other methods of surface roughening.

Seeding

Seed shall be evenly applied with a broadcast seeder, drill, cultipacker seeder, or hydroseeder. Small grains shall be planted no more than one and one-half inches deep. Small seeds, such as Kentucky Bluegrass, should be planted no more than one-quarter inch deep. Grasses and legumes shall be planted from one-quarter to one-half inch deep.

Mulching

1. Seedings made in fall for winter cover and during hot and dry summer months shall be mulched. Straw mulch should be used during these periods. Hydromulches (fiber mulch) will not be considered adequate.
2. Seedings made during optimum spring and summer seeding dates, with favorable soil and site conditions, will not require mulch.

Re-Seeding

Areas which fail to establish vegetative cover adequate to prevent rill erosion will be re-seeded as soon as such areas are identified.

F. Permanent Seeding:

(Specifications)

Selection of Plant Materials

1. Selection of plant materials is based on climate, topography, soils, land use, and planting season. To determine which plant materials are best adapted to a specific site, use Tables 3.32-A and 3.32-B, which describe plant characteristics and list recommended varieties. (See Plates section of this plan.)
2. Appropriate seeding mixtures for the Appalachian/Mountain Area in Virginia are given in Table 3.32-C. (See Plates section of this plan.) These mixtures are designed for general use and are known to perform well on the sites described. Check Tables 3.32-A and 3-32-B for recommended varieties.
3. Virginia Crop Improvement Association recommended turfgrass mixtures may also be used. These will bear a label indicating that they are approved by the association. They are designed to be used in high-maintenance turf areas.
4. Permanent seeding should take place between the dates of March 15 and April 15 or August 15 and September 15.

Seedbed Requirements

Vegetation should not be established on slopes that are unsuitable due to inappropriate soil texture, poor internal structure or internal drainage, volume of overland flow. or excessive steepness, until measures have been taken to correct these problems.

To maintain a good stand of vegetation, the soil must meet certain minimum requirements as a growth medium. The existing soil must have these criteria:

1. Enough fine-grained material to maintain adequate moisture and nutrient supply.
2. Sufficient pore space to permit root penetration. A bulk density of 1.2 to 1.5 indicates that sufficient pore space is present. A fine granular or crumb-like structure is also favorable.
3. Sufficient depth of soil to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans shall be 12-inches or more, except on slopes steeper than 2:1 where the addition of soil is not feasible.
4. A favorable pH range for plant growth. If the soil is so acid that a pH range of 6.0 - 7.0 cannot be attained by addition of pH-modifying materials, then the soil is considered an unsuitable environment for plant roots and further soil modification would be required.
5. Freedom from toxic amounts of materials harmful to plant growth.
6. Freedom from excessive quantities of roots, branches, large stones, large clods of earth, or trash of any kind. Clods and stones may be left on slopes steeper than 3:1 if they do not significantly impede good seed soil contact.

If any of the above criteria cannot be met, i.e., if the existing soil is too coarse, dense, shallow, acidic, or contaminated to foster vegetation, then topsoil shall be applied.

Necessary structural erosion and sediment control practices will be installed prior to seeding. Grading will be carried out according to the approved plan.

Soil Conditioners

In order to modify the texture, structure, or drainage characteristics of a soil, the following materials may be added to the soil:

1. Peat is a very costly conditioner, but works well. If added, it shall be sphagnum moss peat, hypnum moss peat, reed-sedge peat or peat humus, from fresh-water sources. Peat shall be shredded and conditioned in storage piles for at least six months after excavation.
2. Sand shall be clean and free of toxic materials. Sand modification is ineffective unless you are adding 80 to 90% sand on a volume basis. This is extremely difficult to do on-site. If this practice is considered, consult a professional authority to ensure that it is done properly.
3. Vermiculite shall be horticultural grade and free of toxic substances.
4. Raw manure is more commonly used in agricultural applications. However, when stored properly and allowed to compost, it will stabilize nitrogen and other nutrients. Manure, in its composted form, is a viable soil conditioner; however, its used should be based on site-specific recommendations offered by a professional in this field.
5. Thoroughly rotted sawdust shall have 6 pounds of nitrogen added to each cubic yard and shall be free of stones, sticks, and toxic substances.

Lime and Fertilizer

Lime and fertilizer needs should be determined by soil tests. Soil tests may be performed

by the Cooperative Extension Service Soil Testing Laboratory at VPI & SU, or by a reputable commercial laboratory. Information concerning the State Soil Testing Laboratory is available from county extension agents. Reference Table 3.32-F for liming applications (in lbs.) needed to correct undesirable pH for various soil types.

Under normal conditions where it is not possible to obtain a soil test, the following soil amendments will be applied:

Lime

2.2 tons/acre pulverized agricultural grade limestone

(100) lbs./1000 ft.^{2}).

NOTE: An agricultural grade of limestone should always be used.

Fertilizer

Mixed grasses and legumes:	1000 lbs./acre 10-20-10 or equivalent nutrients (23 lbs./1000 ft.^{2})
Legume stands only:	1000 lbs./acre 5-20-10 (23 lbs./1000 ft.^{2}) is preferred; however, 1000 lbs./acre of 10-20-10 or equivalent may be used.
Grass stands only:	1000 lbs./acre 10-20-10 or equivalent nutrients, (23 lbs./1000 ft.^{2}).

Other fertilizer formulations, including slow-release sources of nitrogen (preferred from a water quality standpoint), may be used provided they can supply the same amounts and proportions of plant nutrients.

Incorporation - Lime and fertilizer shall be incorporated into the top 4-6 inches of the soil

by discing or other means whenever possible. For erosion control, when applying lime and fertilizer with a hydroseeder, apply a rough, loose surface.

Seeding

1. Certified seed will be used for all permanent seeding whenever possible. Certified seed is inspected by the Virginia Crop Improvement Association or the certifying agency in other states. The seed must meet published state standards and bear an official "Certified Seed" label (See Appendix 3.32-a, included in Appendix A of this plan.)
2. Legume seed should be inoculated with the inoculant appropriate to the species. Seed of the Lespedezas, the Cloves and Crown Vetch should be scarified to promote uniform germination.
3. Apply seed uniformly with a broadcast seeder, drill, culti-packer seeder, or hydroseeder on a firm, friable seedbed. Seeding depth should be 1/4- to ½-inch.
4. To avoid poor germination rates as a result of seed damage during hydroseeding, it is recommended that if a machinery breakdown of 30 minutes to 2 hours occurs, 50% more seed be added to the tank, based on the proportion of the slurry remaining in the tank. Beyond 2 hours, a full rate of new seed may be necessary.

   Often hydroseeding contractors prefer not to apply lime in their rigs as it is abrasive. In inaccessible areas, lime may have to be applied separately in pelletized or liquid form. Surface roughening is particularly important when hydroseeding, as a roughened slope

will provide some natural coverage of lime, fertilizer and seed.

Legume inoculants should be applied at five times the recommended rate when inoculant is included in the hydroseeder slurry.

Mulching

All permanent seeding must be mulched immediately upon completion of seed application. Refer to the section entitled "Mulching" of this plan.

Maintenance of New Seedings

In general, a stand of vegetation cannot be determined to be fully established until it has been maintained for one full year after planting.

Irrigation: New seedings should be supplied with adequate moisture. Supply water as needed, especially late in the season, in abnormally hot or dry weather, or on adverse sites. Water application rates should be controlled to prevent excessive runoff. Inadequate amounts of water may be more harmful than no water.

Re-seeding: Inspect seeded areas for failure and make necessary repairs and reseedings within the same season, if possible.

a. If vegetative cover is inadequate to prevent rill erosion, over-seed and fertilize in accordance with soil test results.

b. If a stand has less than 40% cover, re-evaluate choice of plant materials and quantities of lime and fertilizer. The soil must be tested to determine if acidity or nutrient imbalances are responsible. Re-establish the stand following seedbed

preparation and seeding recommendations.

Fertilization: Cool season grasses should begin to be fertilized 90 days after planting to ensure proper stand and density. Warm season fertilization should begin at 30 days after planting.

Apply maintenance levels of fertilizer as determined by a soil test. In the absence of a soil test, fertilization should be as follows:

Cool Season Grasses

4 lbs. nitrogen (N)

1 lb. phosphorus (P) Per 1000 $ft.^2$ per year

2 lbs. potash (K)

Seventy-five percent of the total requirements should be applied between September 1 and December 31. The balance should be applied during the remainder of the year.

More than 1 lb. of soluble nitrogen per 1000 $ft.^2$ should not be applied at any one time.

Warm Season Grasses

Apply 4-5 lbs. nitrogen (N) between May 1 and August 15th per 1000 $ft.^2$ per year. Phosphorus (P) and Potash (K) should only be applied according to a soil test.

Note: The use of slow-release fertilizer formulations for maintenance of turf is encouraged to reduce the number of applications and the impact on groundwater.

G. Mulching:

(Specifications)

Organic Mulches

Organic mulches may be used in any area where mulch is required, subject to the restrictions noted in Table 3.35-A.

Materials

Select mulch material based on site requirements, availability of materials, and availability of labor and equipment. Table 3.35-A lists the most commonly used organic mulches. Other materials, such as peanut hulls and cotton burs, may be used with the permission of the local Plan-Approving Authority.

Prior to mulching

Complete the required grading and install needed sediment control practices. Lime and fertilizer should be incorporated and surface roughening accomplished as needed. Seed should be applied prior to mulching except in the following cases:

a. Where seed is to applied as part of a hydroseeder slurry containing fiber mulch.

b. Where seed is to be applied following a straw mulch spread during winter months.

Application

Mulch materials shall be spread uniformly, by hand or machine.

When spreading straw mulch by hand, divide the area to be mulched into approximately 1,000 sq. ft. sections and place 70-90 lbs. (1½ to 2 bales) of straw in each section to

facilitate uniform distribution.

Mulch Anchoring

Straw mulch must be anchored immediately after spreading to prevent displacement. Other organic mulches listed in Table 3.35-A do not require anchoring. The following methods of anchoring straw may be used:

1. Mulch anchoring tool (often referred to as a Krimper or Krimper Tool): This is a tractor-drawn implement designed to punch mulch into the soil surface. This method provides good erosion control with straw. It is limited to use on slopes no steeper than 3:1, where equipment can operate safely. Machinery shall be operated on the contour.
2. Fiber Mulch: Apply fiber mulch by means of a hydroseeder at a rate of 500-750 lbs./acre over top of straw mulch or hay. It is an added benefit of providing additional mulch to the newly seeded area.
3. Liquid mulch binders: Application of liquid mulch binders and tackifiers shall be heaviest at edges of areas and at crests of ridges and banks, to prevent displacement. The remainder of the area should have binder applied uniformly. Binders may be applied after mulch is spread or may be sprayed into the mulch as it is being blown onto the soil.

   The following types of binders may be used:

   a. Synthetic binders - Formulated binders or organically formulated products may

be used as recommended by the manufacturer to anchor mulch.

b. Asphalt - Any type of asphalt thin enough to be blown from spray equipment is satisfactory. Recommended for use are rapid curing (RC-70, RC-250, RC-800), medium curing (MC-250, MC-800) and emulsified asphalt (SS-1, CSS-1, CMS-2, MS-2, RS-1, RS-2, CRS-1, and CRS-2).

Apply asphalt at 0.10 gallon per square yard (10 gal./1000 sq. ft. or 430 gal./acre). Do not use heavier applications as it may cause the straw to "perch" over rills. All asphalt designations are from the Asphalt Institute Specifications.

4. Mulch nettings: Lightweight plastic, cotton, or paper nets may be stapled over the mulch according to manufacturer's recommendations.

5. Peg and twine: Drive 8- to 10-inch wooden pegs to within 3-inches of the soil surface, every 4 feet in all directions. Stakes may be driven before or after straw is spread. Secure mulch by stretching twine between pegs in a criss-cross-within-a-square pattern. Turn twine 2 or more times around each peg.

Chemical Mulches

Chemical mulches* may be used alone only in the following situations:

a. Where no other mulching material is available.

b. In conjunction with temporary seeding during the times when mulch is not required for that practice.

c. From March 15 to May 1 and August 15 to September 30, provided that they are

used on areas with slopes no steeper than 4:1, which have been roughened. If rill erosion occurs, another mulch material shall be applied immediately.

* Note: Chemical mulches may be used to bind other mulches or with fiber mulch in a hydroseeded slurry at any time. Manufacturer's recommendations for application of chemical mulches shall be followed.

(Maintenance)

All mulches and soil coverings should be inspected periodically (particularly after rainstorms) to check for erosion. Where erosion is observed in mulched areas, additional mulch should be applied. Nets and mats should be inspected after rainstorms for dislocation or failure. If washouts or breakage occur, re-install netting or matting as necessary after repairing damage to the slope or ditch. Inspections should take place until grasses are firmly established. Where mulch is used in conjunction with ornamental plantings, inspect periodically throughout the year to determine if mulch is maintaining coverage of the soil surface; if not, repair these areas as needed.

STORMWATER MANAGEMENT

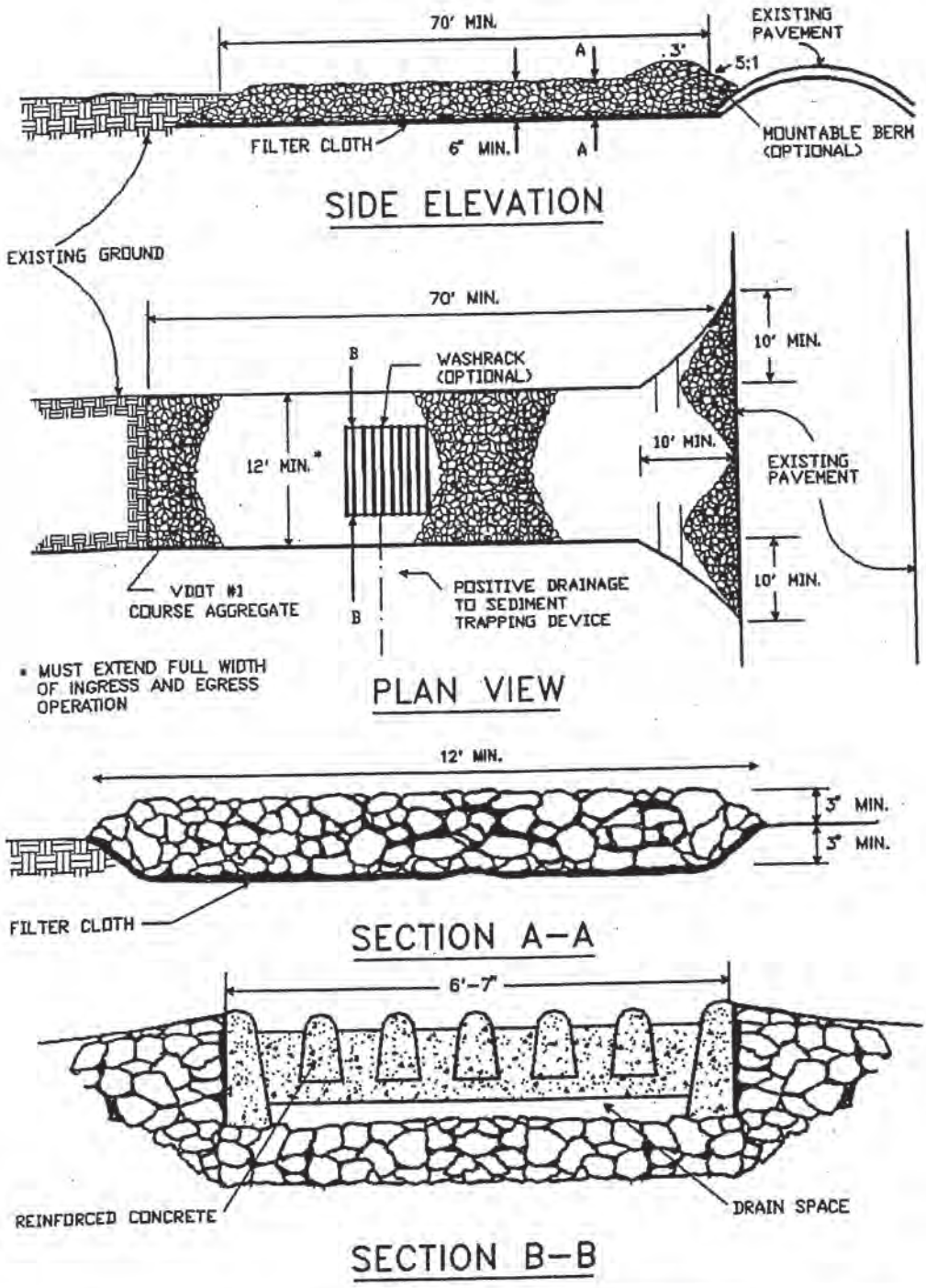
The post-development drainage patterns associated with this project will be similar to the pre-development drainage patterns that exist at the site. The stormwater runoff will continue to be directed by sheet flow to the perimeter of the site, where it discharges into hollows which convey the flow to Benges Branch and Stony Creek. Additionally, since the overall grading of the site will result in similar topography to the pre-developed condition and the run-off characteristics of the entire site will be similar to the pre-developed condition, there should be no significant increase in runoff resulting from the High Knob Observation Tower and Site Design project.

APPENDIX

APPENDIX A

PLATES AND TABLES

STONE CONSTRUCTION ENTRANCE



Source: Adapted from 1983 Maryland Standards for Soil Erosion and Sediment Control, and Va. DSWC

Plate 3.02-1

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.02-A

CONSTRUCTION SPECIFICATIONS FOR FILTER CLOTH UNDERLINER

Fabric Properties[1]	Light-Duty Entrance[2] (Graded Subgrade)	Heavy-Duty Entrance[3] (Rough Graded)	Test Method
Grab Tensile Strength (lbs.)	200	220	ASTM D1682
Elongation at Failure (%)	50	220	ASTM D1682
Mullen Burst Strength (lbs.)	190	430	ASTM D3786
Puncture Strength (lbs.)	40	125	ASTM D751 (modified)
Equivalent Opening Size (mm)	40-80	40-80	U.S. Standard Sieve CW-02215

[1] Fabrics not meeting these specifications may be used only when design procedure and supporting documentation are supplied to determine aggregate depth and fabric strength.

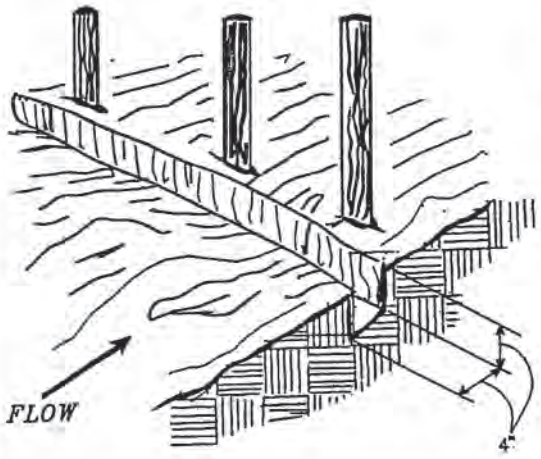
[2] Light Duty Entrance: Sites that have been graded to subgrade and where most travel would be single axle vehicles and an occasional multi-axle truck. Examples of fabrics which can be used are: Trevira Spunbond 1115, Mirafi 100X, Typar 3401, or equivalent.

[3] Heavy Duty Entrance: Sites with only rough grading and where most travel would be multi-axle vehicles. Examples of fabrics which can be used are: Trevira Spunbond 1135, Mirafi 600X, or equivalent.

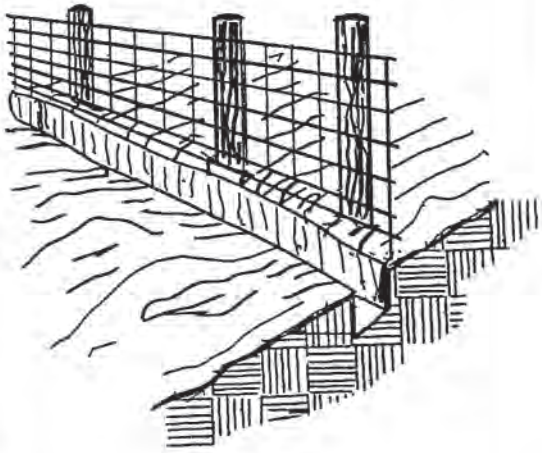
Source: Virginia Highway and Transportation Research Council (VHTRC)

CONSTRUCTION OF A SILT FENCE (WITH WIRE SUPPORT)

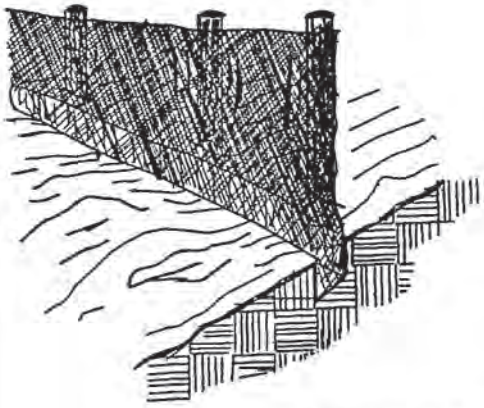
1. SET POSTS AND EXCAVATE A 4"X4" TRENCH UPSLOPE ALONG THE LINE OF POSTS.



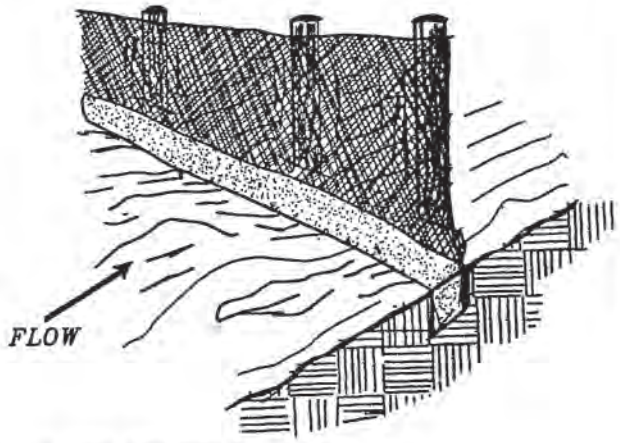
2. STAPLE WIRE FENCING TO THE POSTS.



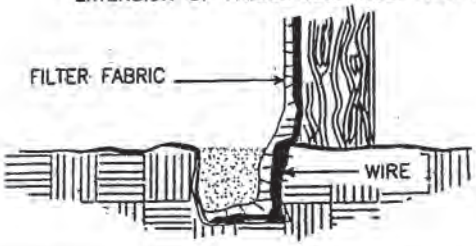
3. ATTACH THE FILTER FABRIC TO THE WIRE FENCE AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.



EXTENSION OF FABRIC AND WIRE INTO THE TRENCH.



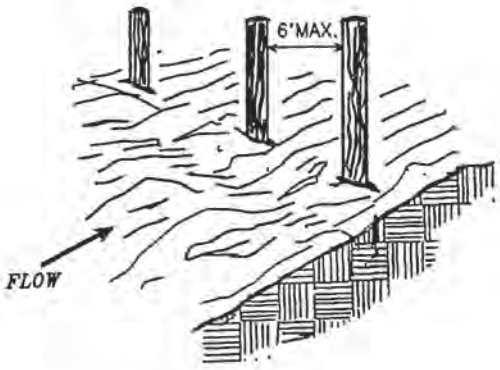
Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant

Plate 3.05-1

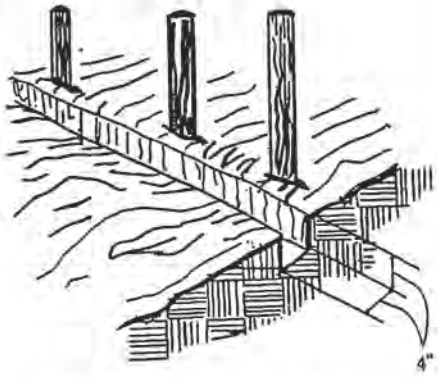
SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

CONSTRUCTION OF A SILT FENCE (WITHOUT WIRE SUPPORT)

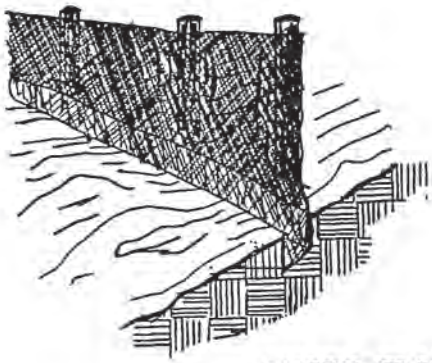
1. SET THE STAKES.



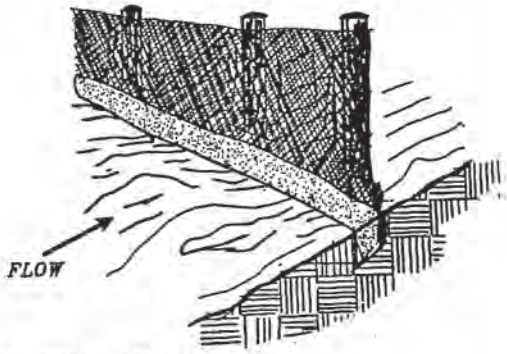
2. EXCAVATE A 4"X 4" TRENCH UPSLOPE ALONG THE LINE OF STAKES.



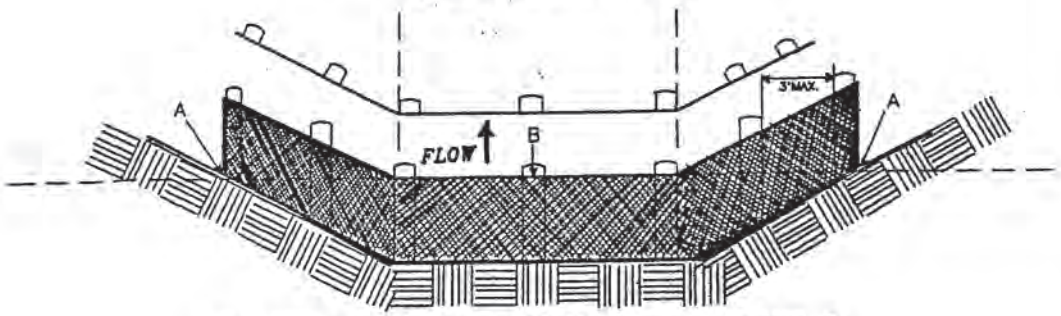
3. STAPLE FILTER MATERIAL TO STAKES AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.



SHEET FLOW INSTALLATION
(PERSPECTIVE VIEW)



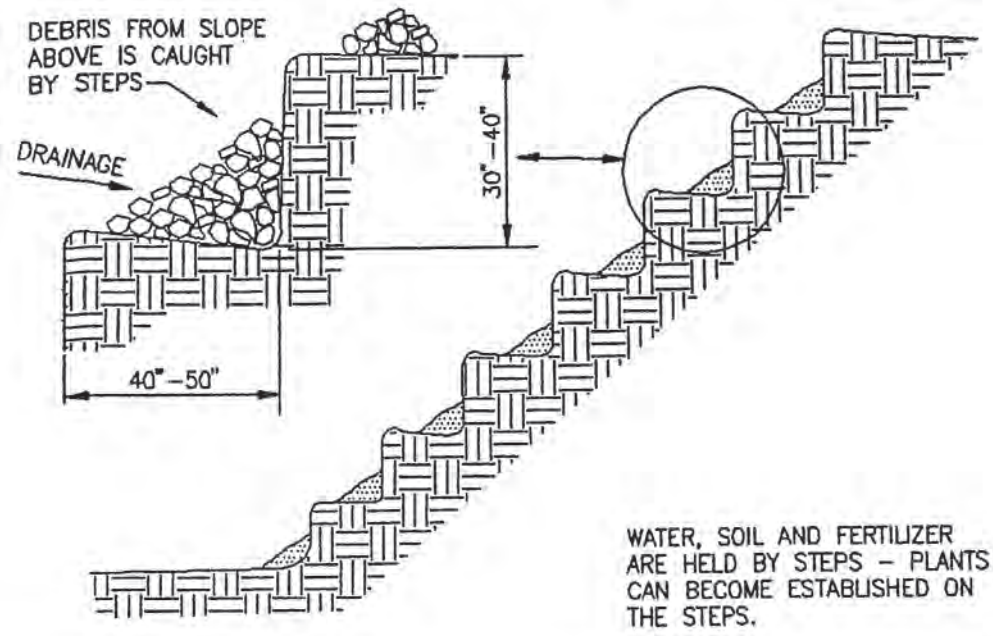
POINTS A SHOULD BE HIGHER THAN POINT B.

DRAINAGEWAY INSTALLATION
(FRONT ELEVATION)

Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant

Plate 3.05-2

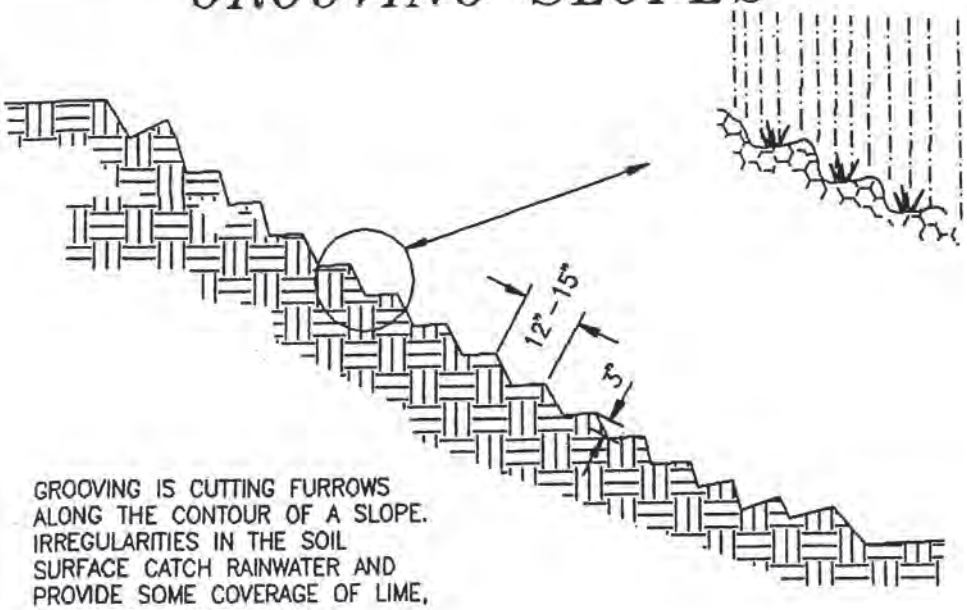
STAIR STEPPING CUT SLOPES



Source: Va. DSWC

Plate 3.29-1

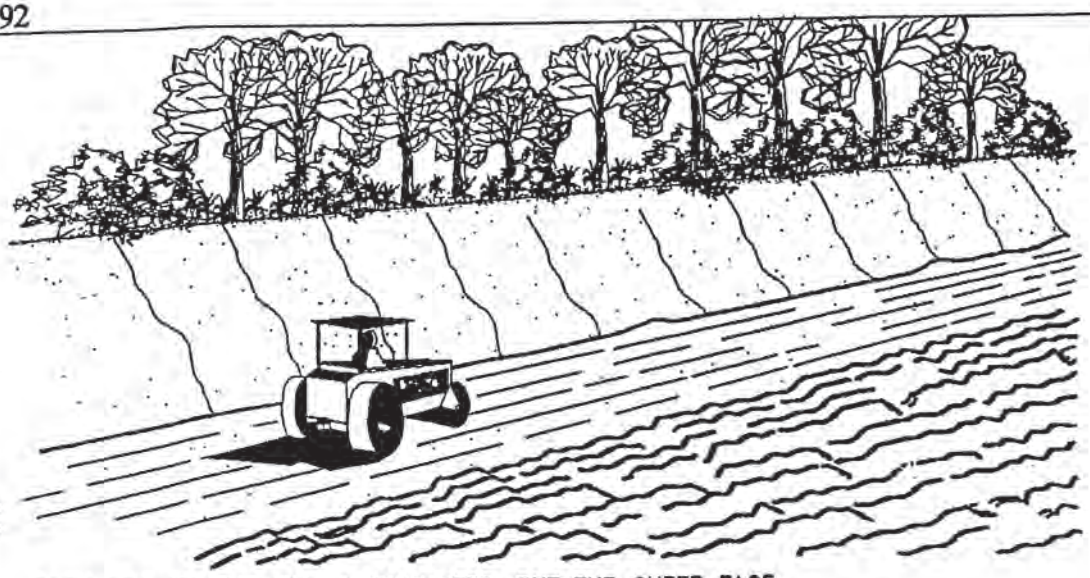
GROOVING SLOPES



Source: Va. DSWC

Plate 3.29-2

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

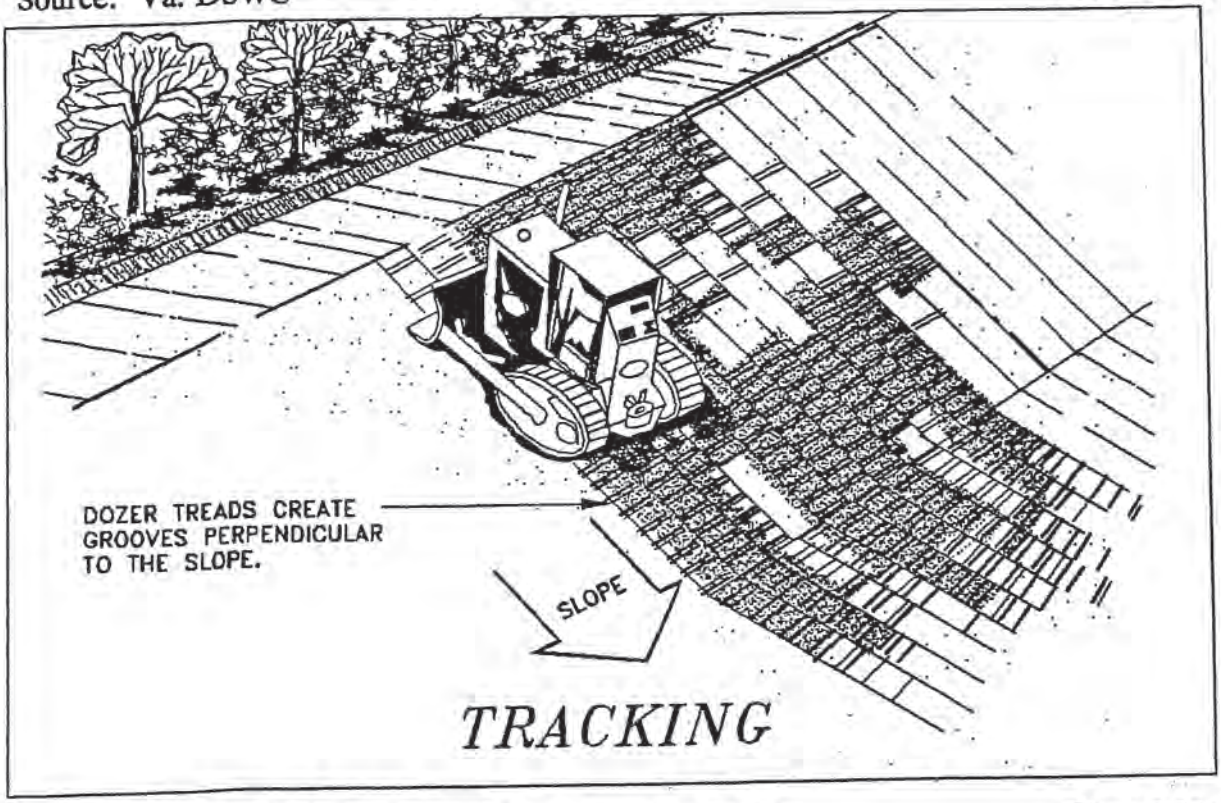


EACH LIFT OF THE FILL IS COMPACTED, BUT THE OUTER FACE OF THE SLOPE IS ALLOWED TO REMAIN LOOSE SO THAT THE ROCKS, CLODS, ETC. REACH THE NATURAL ANGLE OF REPOSE.

FILL SLOPE TREATMENT

Source: Va. DSWC

Plate 3.29-3



TRACKING

Source: Michigan Soil Erosion and Sedimentation Guide

Plate 3.29-4

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.31-B

ACCEPTABLE TEMPORARY SEEDING PLANT MATERIALS

"QUICK REFERENCE FOR ALL REGIONS"

Planting Dates	Species	Rate (lbs./acre)
Sept. 1 - Feb. 15	50/50 Mix of Annual Ryegrass (Lolium multi-florum) & Cereal (Winter) Rye (Secale cereale)	50 - 100
Feb. 16 - Apr. 30	Annual Ryegrass (Lolium multi-florum)	60 - 100
May 1 - Aug 31	German Millet (Setaria italica)	50

Source: Va. DSWC

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.31-C

TEMPORARY SEEDING PLANT MATERIALS, SEEDING RATES, AND DATES

SPECIES	SEEDING RATE		NORTH[a]			SOUTH[b]			PLANT CHARACTERISTICS
	Acre	1000 ft^2	3/1 to 4/30	5/1 to 8/15	8/15 to 11/1	2/15 to 4/30	5/1 to 9/1	9/1 to 11/15	
OATS (Avena sativa)	3 bu. (up to 100 lbs., not less than 50 lbs.)	2 lbs.	X	-	-	X	-	-	Use spring varieties (e.g., Noble).
RYE[d] (Secale cereale)	2 bu. (up to 110 lbs., not less than 50 lbs.)	2.5 lbs.	X	-	X	X	-	X	Use for late fall seedings, winter cover. Tolerates cold and low moisture.
GERMAN MILLET (Setaria italica)	50 lbs.	approx. 1 lb.	-	X	-	-	X	-	Warm-season annual. Dies at first frost. May be added to summer mixes.
ANNUAL RYEGRASS[c] (Lolium multi-florum)	60 lbs.	1½ lbs.	X	-	X	X	-	X	May be added in mixes. Will mow out of most stands.
WEEPING LOVEGRASS (Eragrostis curvula)	15 lbs.	5½ ozs.	-	X	-	-	X	-	Warm-season perennial. May bunch. Tolerates hot, dry slopes and acid, infertile soils. May be added to mixes.
KOREAN LESPEDEZA[c] (Lespedeza stipulacea)	25 lbs.	approx. 1½ lbs.	X	X	-	X	X	-	Warm season annual legume. Tolerates acid soils. May be added to mixes.

[a] Northern Piedmont and Mountain region. See Plates 3.22-1 and 3.22-2.
[b] Southern Piedmont and Coastal Plain.
[c] May be used as a cover crop with spring seeding.
[d] May be used as a cover crop with fall seeding.
X May be planted between these dates.
- May not be planted between these dates.

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.32-A
CHARACTERISTICS OF COMMONLY SELECTED GRASSES

COMMON NAME (Botanical Name)	Life Cycle	Season	pH Range	Germination Time In Days	Optimum Germination Temperature (°F)	Winter Hardiness	Drought Tolerance	Fertility	Soil Drainage Tolerance	Seeds Per Pound	MAINTENANCE REQUIREMENTS	REMARKS	Suggested Varieties for Virginia
TALL FESCUE (Festuca arundinacea)	P	C	5.5-6.2	10-14	60-85	F	F	M	SPD	225K	Low when used for erosion control; high when used in lawn	Better suited for erosion control and rough turf application.	Ky 31
TALL FESCUES (Improved)	P	C	5.5-6.2	10-14	60-85	F	G	M	SPD	220K	Responds well to high maintenance.	Excellent for lawn and fine turf.	See current VCIA list.
KENTUCKY BLUEGRASS (Poa pratense)	P	C	6.0-6.5	14	60-75	G	P	M	SPD	2.2m	Needs fertile soil, favorable moisture. Requires several years to become well established.	Excellent for fine turfs-takes traffic, mowing. Poor drought/heat tolerance.	See current VCIA list.
PERENNIAL RYEGRASS (Lolium perenne)	P	C	5.8-6.2	7-10	60-75	F	F	M-H	SPD	227K	Will tolerate traffic.	May be added to mixes. * Improved varieties will perform well all year.	See current VCIA list.

KEY

A = Annual P = Perennial C = Cool Season Plant W = Warm Season Plant G = Good F = Fair P = Poor VP = Very Poor H = High
M = Medium L = Low SPD = Somewhat Poorly Drained MPD = Moderately Poorly Drained PD = Poorly Drained VPD = Very Poorly Drained

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.32-A (Continued)
CHARACTERISTICS OF COMMONLY SELECTED GRASSES

COMMON NAME (Botanical Name)		Life Cycle	Season	pH Range	Germination Time, In Days	Optimum Germination Temperature (°F)	Winter Hardiness	Drought Tolerance	Fertility	Soil Drainage Tolerance	Seeds Per Pound	MAINTENANCE REQUIREMENTS	REMARKS	Suggested Varieties for Virginia
FINE FESCUES	HARD FESCUE (Festuca Longifolia)	P	C	5.0-6.2	10-14	60-80	VG	G	L	MWD	400K	Grows well in sun or shade and will tolerate infertile soils; improved disease resistance.	Exceeds all fine fescues in most tests. Excellent for low-maintenance situations.	Reliant, Spartan, Aurora
	CHEWINGS FESCUE	P	C	5.0-6.2	10-14	60-80	VG	G	L	MWD	400K	Tolerates shade, dry infertile soils.	Poor traffic tolerance, less thatch than other fine fescues.	Flyer
	RED FESCUE (Festuca Rubra)	P	C	5.0-6.2	10-14	60-80	VG	G	L	MWD	400K	Low to medium fertility requirements. Requires well-drained soil.	Spreads by rhizomes, tillers and stolons. Will not take traffic - very shade tolerant.	Long-fellow, Victory
REED CANARYGRASS (Phalaris arundinacea)		P	C	5.8-6.2	21	70-85	G	G	M-H	VPD	530K	Do not mow closely or often.	Conservation cover in wet areas.	No named varieties

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SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.32-A (Continued)
CHARACTERISTICS OF COMMONLY SELECTED GRASSES

COMMON NAME (Botanical Name)	Life Cycle	Season	pH Range	Germination Time, In Days	Optimum Germination Temperature (°F)	Winter Hardiness	Drought Tolerance	Fertility	Soil Drainage Tolerance	Seeds Per Pound	MAINTENANCE REQUIREMENTS	REMARKS	Suggested Varieties for Virginia
REDTOP (Agrostis alba)	P	C	5.8-6.2	10	65-85	G	F	L	PD	5m	Will tolerate poor, infertile soils; deep rooted.	Does well in erosion control mixes - not for lawns.	No named varieties.
WEEPING LOVEGRASS (Evagrostis curvula)	P	W	4.5-6.2	14	65-85	F-P	G	L-M	SPD	1.5m	Low-fertility requirements; excellent drought tolerance.	Fast-growing, warm-season bunch grass. Excellent cover for erosion control.	No named varieties.
BERMUDAGRASS (Cynodon dactylon)	P	W	5.8-6.2	21	70-95	P	G	M-H	SPD	1.8m hulled	High nitrogen utilization, excellent drought tolerance. Some varieties adapted to western VA.	Common varieties used for erosion control. Hybrids used for fine turf.	See current VCIA list.
ORCHARDGRASS (Dactylis glomerata)	P	C	5.8-6.2	18	60-75	F	F	M	SPD	625K	Does best on well-drained, loamy soil.	Good pasture selection - may be grazed.	Virginia origin or Potomac

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SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.32-A (Continued)
CHARACTERISTICS OF COMMONLY SELECTED GRASSES

COMMON NAME (Botanical Name)	Life Cycle	Season	pH Range	Germination Time In Days	Optimum Germination Temperature (°F)	Winter Hardiness	Drought Tolerance	Fertility	Soil Drainage Tolerance	Seeds Per Pound	MAINTENANCE REQUIREMENTS	REMARKS	Suggested Varieties for Virginia
ANNUAL RYEGRASS (Lolium multiflorum)	A	C	5.8-6.2	7	60-70	G	P	M-H	SPD	227K	Will grow on most Virginia Soils. Do not use in fine-turf areas.	May be added into mixes or established alone as temporary cover in spring and fall.	No named varieties.
RYE (Secale cereale)	A	C	5.8-6.2	7	55-70	VG	G	L-M	SPD	18K	Will establish in most all Virginia soils. Do not use in fine-turf areas.	May be added into mixes or established alone for late fall/winter cover.	Abruzzi, Balboa
FOXTAIL MILLET (Setaria italica)	A	W	5.8-6.2	10	65-85	VP	G	M	MWD	220K	Establishes well during summer. Very low moisture requirements.	May be added to erosion-control mixes or established alone.	Common, German

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M = Medium L = Low SPD = Somewhat Poorly Drained MPD = Moderately Poorly Drained PD = Poorly Drained VPD = Very Poorly Drained

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.32-B
CHARACTERISTICS OF LEGUMES APPROPRIATE FOR EROSION CONTROL

COMMON NAME (Botanical Name)	Life Cycle	Season	pH Range	Germination Time In Days	Optimum Germination Temperature (°F)	Winter Hardiness	Drought Tolerance	Fertility	Soil Drainage Tolerance	Seeds Per Pound	MAINTENANCE REQUIREMENTS	REMARKS	Suggested Varieties for Virginia
CROWNVETCH (Coronilla varia)	P	C	6.0-6.5	14-21	70	G	VG	M	MWD	110K	Does best on well-drained soils. Minimum maintenance when established. May need phosphorus. Inoculation is essential.	Excellent for steep, rocky slopes. Produces colorful blooms in May/June. Slow to establish. Does best when seeded in spring.	Penngift Chemung Emerald
SERICEA LESPEDEZA (Lespedeza cuneata)	P	W	5.8-6.2	21-28	70-85	F	VG	L	MWD	335K	Grows in most well-drained soils. Low fertility requirements. Inoculation is essential.	Use hulled seed in spring; unhulled in fall. Very deep-rooted legume. Excellent choice for eastern Va.	Serecia Interstate
FLATPEA (Lathyrus silvestrus)	P	C	5.0-7.0	14-28	65-75	G	G	L	PD	15K	Needs lime and high phosphorus. Good shade tolerance.	Tolerates acidic and wetter soils better than other legumes.	Lathco
BIRDSFOOT TREFOIL (Lotus corniculatus)	P	C	6.0-6.5	7	65-70	G	F	M	SPD	375K	Inoculation is essential. Grows in medium-fertile, slightly acid soils.	Grows better on poorly drained soils than most legumes. Poor drought/ heat tolerance.	No named varieties.

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M = Medium L = Low SPD = Somewhat Poorly Drained MPD = Moderately Poorly Drained PD = Poorly Drained VPD = Very Poorly Drained

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.32-B (Continued)
CHARACTERISTICS OF LEGUMES APPROPRIATE FOR EROSION CONTROL

COMMON NAME (Botanical Name)	Life Cycle	Season	pH Range	Germination Time In Days	Optimum Germination Temperature (°F)	Winter Hardiness	Drought Tolerance	Fertility	Soil Drainage Tolerance	Seeds Per Pound	MAINTENANCE REQUIREMENTS	REMARKS	Suggested Varieties for Virginia
ANNUAL LESPEDEZAS (Lespedeza striata, L. stipulacea)	A	W	5.8-6.2	14	70-85	F	VG	L	MWD	200K	Will grow on almost any well-drained soil.	Choose Kobe for southeastern Va.; needs almost no nitrogen to survive.	Kobe, Korean
RED CLOVER (Trifolium pratense)	P	C	6.0-6.5	7-14	70	G	F	M	SPD	275K	Needs high levels of phosphorus and potassium.	Acts as a biennial. Can be added to low-maintenance mixes.	Kenstar, Kenland
WHITE CLOVER (Trifolium repens)	P	C	6.0-6.5	10	70	G	P	M	PD	700K	Requires favorable moisture, fertile soils, high pH.	Spreads by soil surface stolons, white flowers.	Common, White Dutch

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SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.32-C
SITE SPECIFIC SEEDING MIXTURES
FOR APPALACHIAN/MOUNTAIN AREA

	Total Lbs. Per Acre
Minimum Care Lawn	
- Commercial or Residential	200-250 lbs.
- Kentucky 31 or Turf-Type Tall Fescue	90-100%
- Improved Perennial Ryegrass *	0-10%
- Kentucky Bluegrass	0-10%
High-Maintenance Lawn	
Minimum of three (3) up to five (5) varieties of bluegrass from approved list for use in Virginia.	125 lbs.
General Slope (3:1 or less)	
- Kentucky 31 Fescue	128 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop **	20 lbs.
	150 lbs.
Low-Maintenance Slope (Steeper than 3:1)	
- Kentucky 31 Fescue	108 lbs.
- Red Top Grass	2 lbs.
- Seasonal Nurse Crop **	20 lbs.
- Crownvetch ***	20 lbs.
	150 lbs.

* Perennial Ryegrass will germinate faster and at lower soil temperatures than fescue, thereby providing cover and erosion resistance for seedbed.

** Use seasonal nurse crop in accordance with seeding dates as stated below:

March, April through May 15th	Annual Rye
May 16th through August 15th	Foxtail Millet
August 16th through September, October	Annual Rye
November through February	Winter Rye

*** If Flatpea is used, increase to 30 lbs./acre. All legume seed must be properly inoculated. Weeping Lovegrass may also be included in any slope or low-maintenance mixture during warmer seeding periods; add 10-20 lbs/acre in mixes.

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

APPENDIX 3.32-d

TABLE 3.32-F

LBS. OF GROUND AGRICULTURAL LIMESTONE* PER THOUSAND SQUARE FEET NEEDED TO CORRECT pH LEVEL OF ACID SOILS TO 6.5

Existing pH	Soil Texture		
	Sandy Loam	Loam	Clay Loam
6.2	20	35	40
6.0	40	55	70
5.8	55	65	85
5.6	70	80	105
5.4	90	100	125
5.2	105	120	140
5.0	120	140	160
4.8	125	180	205
4.6	155	210	230
4.0	200	250	300

* Lime should always be applied in accordance with the results of a soil test, such as may be obtained through the soil testing laboratory at VPI&SU or through a reputable commercial laboratory.

Source: DSWC's Basic Urban E&S in Virginia

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

APPENDIX 3.32-a

SEED QUALITY CRITERIA

Where certified seed is not available, the minimum requirements for grass and legume seed used in vegetative establishment are as follows:

a. All tags on containers of seed shall be labeled to meet the requirements of the State Seed Law.

b. All seed shall be subject to re-testing by a recognized seed laboratory that employs a registered seed technologist or by a state seed lab.

c. All seed used shall have been tested within twelve (12) months.

d. Inoculant - the inoculant added to legume seed in the seed mixtures shall be a pure culture of nitrogen-fixing bacteria prepared for the species. Inoculants shall not be used later than the date indicated on the container. Twice the supplier's recommended rate of inoculant will be used on dry seedings; five times the recommended rate if hydroseeded.

e. The quality of the seed used shall be shown on the bag tags to conform to the guidelines in Table 3.32-E.

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

TABLE 3.35-A

ORGANIC MULCH MATERIALS AND APPLICATION RATES

MULCHES:	RATES:		NOTES:
	Per Acre	Per 1000 sq. ft.	
Straw or Hay	1½ - 2 tons (Minimum 2 tons for winter cover)	70 - 90 lbs.	Free from weeds and coarse matter. Must be anchored. Spread with mulch blower or by hand.
Fiber Mulch	Minimum 1500 lbs.	35 lbs.	Do not use as mulch for winter cover or during hot, dry periods.* Apply as slurry.
Corn Stalks	4 - 6 tons	185 - 275 lbs.	Cut or shredded in 4-6" lengths. Air-dried. Do not use in fine turf areas. Apply with mulch blower or by hand.
Wood Chips	4 - 6 tons	185 - 275 lbs.	Free of coarse matter. Air-dried. Treat with 12 lbs nitrogen per ton. Do not use in fine turf areas. Apply with mulch blower, chip handler, or by hand.
Bark Chips or Shredded Bark	50 - 70 cu. yds.	1-2 cu. yds.	Free of coarse matter. Air-dried. Do not use in fine turf areas. Apply with mulch blower, chip handler, or by hand.

* When fiber mulch is the only available mulch during periods when straw should be used, apply at a minimum rate of 2000 lbs./ac. or 45 lbs./1000 sq. ft.

Source: Va. DSWC

SOURCE: VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK

APPENDIX B

EROSION AND SEDIMENT CONTROL SITE PLAN

Report of Geotechnical Subsurface Exploration
Proposed High Knob Tower
Wise County, Virginia

October 25, 2010

Prepared For:

Thompson & Litton, Inc.
PO Box 1307
Wise, Virginia 24293

COMMONWEALTH OF VIRGINIA
ERIC C. HESS
No.040226
10-25-2010
PROFESSIONAL ENGINEER

Prepared By:

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October 25, 2010

Mr. Dick Houchins, AIA
Thompson & Litton, Inc.
P. O. Box 1307
Wise, Virginia 24293

RE: GEOTECHNICAL SUBSURFACE EXPLORATION
PROPOSED OBSERVATION TOWER
HIGH KNOB
WISE COUNTY, VIRGINIA
LEC FILE NO.: 2010-036

Dear Mr. Houchins:

As per the authorization of LEC Proposal No. 2010-09, we have performed a geotechnical subsurface exploration for the above referenced project. Please find enclosed one (1) copy of the Geotechnical Exploration Report. In an effort to conserve resources we have sent one (1) hard copy and one (1) pdf digital version of the report; extra hard copies may be sent upon request. The report presents our conclusions and recommendations based on the findings of the subsurface exploration.

We sincerely appreciate the opportunity to provide our services on this project. If you have any questions or we can be of further assistance to you, please feel free to contact us via telephone at (276) 964-6047 or email at eric@lighthouseengineeringconsultants.com.

Sincerely,
Lighthouse Engineering Consultants, LLC

Eric C. Hess

Eric C. Hess, PE
President

ECH/mah

Enclosure

Contents

EXECUTIVE SUMMARY

The site of the proposed High Knob Observation Tower is located at the highest point of Stone Mountain in Wise County, Virginia. The site is located on a section of property that is primarily grassed. The area surrounding the site is wooded. The project site is shown on the *Site Location Plan* included with this report.

The exploration was performed using a track-mounted drilling rig. The test boring locations encountered approximately 6 inches of topsoil and root matter across the site. Beneath the topsoil, residual soil was encountered to depths varying from 6½ feet to 8½ feet below the ground surface. The residual soils typically consisted of yellow and tan clayey sand or silty sand with broken rock fragments. The residual soil existed in a medium dense to dense or very dense condition. The moisture content of the residual soil typically ranged from moist to dry. The residual materials typically increased in density with depth.

It is our understanding that the proposed tower will consist of a combination masonry, concrete and steel structure with a total height of approximately 25 feet. The structure is planned for support on shallow concrete foundations.

Based on the results of the subsurface exploration, the proposed tower could be supported using shallow concrete foundations. The foundations should bear on the residual soil or the very soft, very weathered bedrock materials. A design bearing capacity of 3000 psf may be used for the foundation design. The geotechnical engineer or a qualified soil technician under the direction of a geotechnical engineer should observe the foundation excavation at the time of construction. Dynamic Cone Penetration (DCP) testing should be performed in the foundation excavations to ensure that the materials encountered are sufficient to provide the recommended design bearing capacity.

SCOPE OF SERVICES

Site Reconnaissance: The site reconnaissance consisted of walking over the subject site. The site was observed for topographic features, drainage patterns, ground surface cover, exposed rock and signs of ground instability.

Information Review: A review of published USGS topographic mapping of the Norton, Virginia quadrangle was performed. A review of published geologic mapping of the Norton, Virginia quadrangle was also conducted to determine the underlying bedrock conditions.

Soil Test Borings: The test borings were located in the field with the assistance of a survey drawing provided by Eric W. Price, PLS, PE Survey Manager of Thompson & Litton, Inc. The borings were located using scaled distances from existing structures. Measuring tapes were used to locate and mark the boring locations. The approximate soil test boring locations are shown on the *Boring Location Plan* included with this report.

Four (4) test boring locations were placed on the proposed site. The test borings were drilled using a track-mounted drilling rig. Standard Penetration testing was performed concurrent with the test boring. The Standard Penetration test is a field test used to evaluate the consistency of the soils encountered.

Split spoon samples of the soils encountered were collected and transported to the laboratory for visual observation. Rock Coring was not performed. A description of the soils encountered is included in the attached *Test Boring Records.*

Laboratory Testing: The split spoon samples were transported to the laboratory for visual observation. Due to the shallow rock encountered at the site, laboratory testing was not performed. The split spoon samples were predominantly broken and very weathered rock materials rather than soil.

Engineering Analyses: Engineering analysis of the data obtained during the subsurface evaluation was performed in order to provide recommendations for foundation construction. The analyses performed considered such items as seismic design, soil bearing capacity and settlement potential.

PROJECT DESCRIPTION

The proposed High Knob Observation Tower structure will consist of a combination of construction materials including masonry, concrete, and steel. The structure will be supported using shallow concrete foundations. The planned observation tower will have a height of approximately 15 feet at the observation deck and a height of 25 feet at the top of the tower.

Associated walking trails, a sundial, and a small pedestrian bridge connected to the observation tower will also be constructed as part of the project. Up to approximately 12 feet of fill placement will be required to reach the planned finished grade elevations.

SITE DESCRIPTION

Location: The proposed High Knob Observation Tower site is located in a grassed area along the top of Stone Mountain in Wise County, Virginia. The surrounding area is primarily wooded. The project site is shown on the *Site Location Plan* included with this report.

Usage: The site is currently a grassed area where a previous observation tower was located. It is our understanding that the previous tower was destroyed via fire and therefore, a new observation tower is being constructed to replace the previous observation tower.

Ground Cover: The ground surface is currently covered with grass growth. The surrounding area is primarily wooded.

SUBSURFACE DESCRIPTION

Four (4) test boring locations were placed on the site using a track-mounted drilling rig. Standard Penetration testing was performed concurrent with the drilling operations. The Standard Penetration test is a field test that evaluates the consistency of the soils encountered. Split spoon samples of the soils encountered were obtained and transported to the laboratory for visual observation. Based on observation of the soil samples obtained, a description of the soils encountered is included in the attached *Test Boring Records*.

The test borings were located in the field with the assistance of a survey drawing obtained from Thompson & Litton, Inc. The approximate test boring locations are shown on the *Boring Location Plan* included with this report.

Surface Materials: All of the test boring locations encountered topsoil and root matter at the ground surface. The surface materials existed with a thickness of approximately 4 to 6 inches at the test boring locations. The surface materials will vary in thickness between test locations.

Residual Soil: Residual soil was encountered beneath the topsoil materials. Residual soil is soil that has been derived from the weathering of the underlying bedrock material. The residual soil consisted of yellow and tan clayey sand and silty sand soils with broken rock fragments. The residual soils existed in a generally medium dense to dense or very dense condition with a moist to dry water content. The residual soil was encountered to depths of approximately 6½ to 8½ feet below the existing ground surface.

Bedrock/Groundwater: Auger refusal was encountered on the underlying bedrock materials at depths varying from 6½ feet to 8½ feet below the existing ground surface. The bedrock consists of very weathered sandstone. Excavations of deeper than 3 feet should anticipate chipping or blasting for removal of bedrock. Groundwater was not encountered at the test boring locations at the time of drilling.

AREA GEOLOGY/TOPOGRAPHY

A review was performed of published topographic mapping and published geologic mapping of the site vicinity.

Geology: The *Geology of the Norton Quadrangle, Virginia* was obtained from the Virginia DMME, Division of Mineral Resources (DMR). The geologic mapping was published in 1986. The subject site is located in the Valley and Ridge physiographic province of Virginia.

This area has been highly folded and faulted due to past tectonic activity. Review of the mapping indicates that the site is underlain by the Bluestone Formation. This formation is described as clay shale and sandstone bedrock with some interbeds of siltstone and slightly calcareous shale. The formation generally strikes in a northeast to southwest direction with a dip angle of approximately 4 to 8 degrees in the southeast direction.

Topography: The topographic mapping of the Norton, Virginia quadrangle was obtained from the U.S. Geologic Survey (USGS). The topographic mapping was performed in 1957 and photo-revised in 1991. The mapping was performed using 20 feet contour intervals. The topographic mapping indicates that the site exists along the top of the mountain feature known as Stone Mountain. The mapping does not indicate the presence of unstable soils or rock in the site vicinity.

Observation of the site during the site reconnaissance indicated no signs of ground instability on the subject tower site location.

LABORATORY TESTING

Due to the shallow rock encountered at the site, laboratory testing was not performed. Visual observation of the split spoon samples was performed to provide the written descriptions shown on the *Test Boring Records.* The split spoon samples consisted predominantly of broken and very weathered rock materials rather than soil suitable for testing.

RECOMMENDATIONS

Based on the results of the geotechnical subsurface exploration and our review of the information provided, we provide the following recommendations for final design and construction of the proposed High Knob Observation Tower structure.

Site Preparation

The planned structures and fill areas plus an additional five (5) feet beyond the perimeter should be stripped of all vegetation, topsoil, organics, building debris, frozen or soft, wet soils, and all other deleterious materials.

Once clearing and grubbing has been performed, the planned structure and fill areas should be proofrolled using a loaded tandem axle dump truck driving in a criss-cross pattern. Proofrolling should be performed using a minimum load of 15 tons. Proofroll testing should be performed under the observation of a geotechnical engineer. Soft, or unsuitable, areas of soil should undercut and stabilized at the direction of the engineer.

Soil Fill Placement

All soil fill materials should consist of soil free of organics, particles of greater than 4 inches in diameter, frozen soil, and any other deleterious materials. The soil fill should have a Plasticity Index (PI) value of not more than 25 with a Standard Proctor Maximum Dry Density value of not less than 90 pcf.

Fill soil should be placed in loose, horizontal lifts of not more than 8 inches. The compacted thickness of each lift should be approximately 6 inches. Compaction should be performed using a vibratory compactor (sheepsfoot or smoothdrum) appropriate for the material type. The sheepsfoot compactor is appropriate for use with fine-grained soils such as shaley clays, clays and silts. The smoothdrum is appropriate for use with coarse-grained soils such as sands and gravels.

The fill soil should be aerated to within - 2% to + 2% of its optimum moisture content as determined by the Standard Proctor Density Test (ASTM D-698). Compaction of all fill soil supporting structures, sidewalks, and trail areas plus 5 feet beyond the perimeter should be performed until at least 98% of the Standard Proctor (ASTM D-698) maximum dry density value is achieved.

Density testing should be performed concurrent with the soil fill placement to ensure that the proper density is achieved. The recommended minimum rate of testing is 1 test per 2500 square feet or less of fill area for each soil fill lift. Density testing should be performed by a qualified soil technician under the direction of the project geotechnical engineer.

Site Drainage

Surface water drainage should be controlled during construction and once the site is completed to prevent ponding of water in the tower area. If necessary, pumps, ditches or other grading methods should be used to prevent the surface water from ponding on the site.

Seismic Considerations

The International Building Code (IBC) Seismic Design Procedure considers the average material properties of the soil and rock within the upper 100 feet of the ground surface. Based on our review of the IBC Seismic Design Procedures, the results of the subsurface exploration and the proposed method of site preparation, it is our opinion that the structure should be designed using a Site Class B designation.

Excavated Slopes

Temporary construction excavations should be sloped or shored in accordance with local, state and federal regulations including OSHA (29 CFR Part 1926) excavation and trench safety. For the purposes of excavated slopes and trenches, all soil on the site should be classified as Class C material.

Based on review of the conceptual site grading plan, excavated slopes will not be required. However, should the project require excavated slopes, all excavated slopes should be constructed with a geometry of no steeper than 2H:1V for slope heights of less than 10 feet. For slope heights of greater than 10 feet, the project geotechnical engineer should evaluate each slope on a case-by-case basis.

For slopes that will require regular mowing and maintenance, we recommend a geometry of no steeper than 3H:1V.

Fill Embankments

Fill slopes are anticipated for this project. All fill slopes should have a geometry of no steeper than 2H:1V. For slopes that will be permanently maintained by mowing, the slope geometery should not be any steeper than 3H:1V.

Benching should be performed for all fill soil placed on a sloping surface. The existing ground should be notched or benched prior to fill placement to properly tie the new fill into the existing ground.

Foundations

For support of the proposed tower structure, we recommend the use of shallow foundations bearing on the underlying residual soil/rock materials. We recommend that an allowable bearing capacity of 3,000 psf should be used for the foundation design. The foundations should be designed with sufficient size, mass and strength to resist the overturning moment forces of the planned tower structure. Continuous foundations should have a minimum plan width of 2 feet. Pier foundations should have minimum plan dimensions of 3 feet by 3 feet. In addition, vertical building expansion joints should also be used for masonry structures. Building expansion joints should be spaced at not more than 25 feet on center.

Exterior foundations should bear a minimum of 30 inches below the planned finish grade elevation to prevent frost and moisture related movements of the foundations. Foundation excavations of more than 3 feet below the existing ground surface should anticipate encountering soft bedrock materials. These materials may require light chipping or ripping to remove the bedrock. The bedrock will likely increase in strength and become less weathered with depth below the ground surface.

Foundation excavations should be observed by a geotechnical engineer or a qualified soils technician working under the direction of a geotechnical engineer to ensure that the soils encountered are consistent with the design bearing capacity assigned based upon the results of this subsurface exploration. Dynamic Cone Penetration (DCP) testing should be performed within the foundation excavations to determine the actual bearing capacity of the soils encountered in the foundation excavations. If unsuitable soils are encountered, the soils shall be undercut at the direction of the geotechnical engineer.

Settlement

On the prepared site, the anticipated amount of total foundation consolidation settlement is approximately ½ inch. The expected amount of differential settlement is estimated to be approximately ¼ inch.

Below Grade/Retaining Walls

We recommend that constrained retaining wall and below grade building/structure walls be designed based on "at rest" conditions (no movement of the wall is allowed). We recommend that freestanding retaining walls be designed for active conditions (the tops of the walls are able to rotate and develop the shear strength of the soil).

An allowable soil bearing capacity of 3000 psf should be used for the wall foundation design. A friction factor of 0.35 should be used for a soil to concrete interface.

The following values may be used for design. Equivalent fluid pressure values are based on a compacted unit weight of 100 pcf for ASTM C-33, Size No. 57, crushed, graded, limestone gravel and a compacted unit weight of 115 pcf for compacted off site soils.

TABLE I – Lateral Earth Pressures

	No. 57 Stone		Compacted Off Site Soil	
Lateral Earth Pressure Coefficient	**Coefficient Values**	**Equivalent Fluid Pressure (pcf)**	**Coefficient Values**	**Equivalent Fluid Pressure (pcf)**
K_o	0.43	45	0.66	76
K_a	0.27	28	0.49	56
K_p	3.69	369	2.04	235

The above values are based on level, drained backfill conditions. If the backfill is not drained (positive drainage is not provided) then hydrostatic pressures should be used. At least one foot of No. 57 gravel should be placed behind below grade walls with soil backfill to maintain drained conditions.

ASTM C-33 size No. 57 stone used as backfill material behind below grade and retaining walls should be 1 foot wide at the base of the wall/structure and extend 1 foot horizontally for each foot of wall height. The stone fill should be placed up to the level of two feet below finished subgrade elevation. The top two feet of material should consist of silty clay soil. The ground surface should be sloped to provide positive surface drainage away from the building area.

The No. 57 stone should be compacted to a minimum of 90% relative density. Backfill lift thickness should be limited to a maximum of 12 inches loose. All fill should be placed and compacted in horizontal lifts. In-place density testing should be performed concurrent with placement of all fill.

Off site soil fill placed as backfill to below grade walls should be compacted to a minimum of 98% of its maximum dry density as determined by the Standard Proctor test, ASTM D 698. Backfill lift thickness should be limited to a maximum of 6 inches loose. Un-weathered shale or high plasticity (i.e. plasticity index greater than 25%) silt or clay soils should not be used as a backfill material for the below grade and retaining walls.

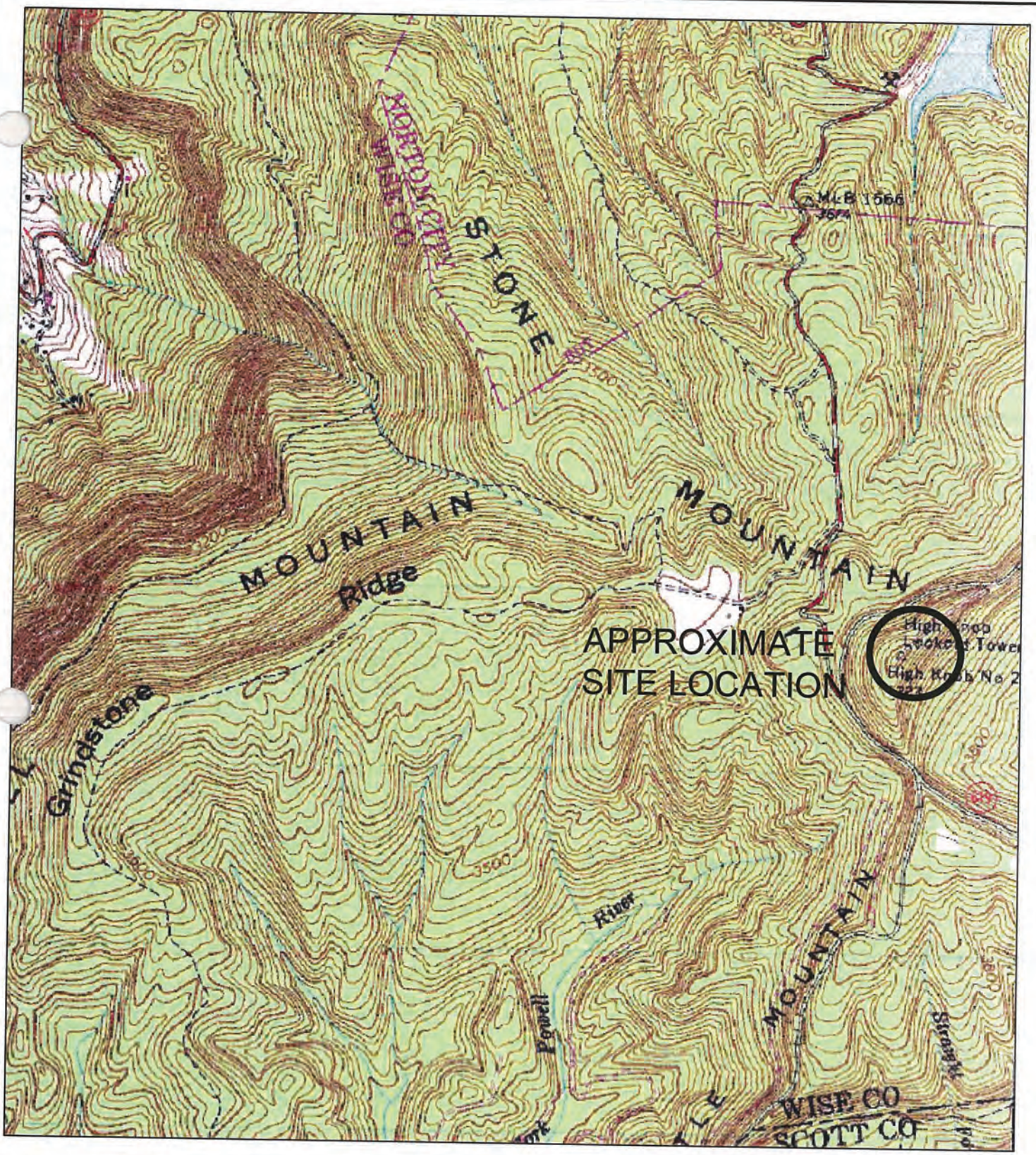
For the design of segmental block retaining walls, we recommend the use of select stone backfill materials with a unit weight of 100 pcf and an internal friction angle of 45 degrees. If the use of an offsite soil is desired, we recommend soil-specific testing to determine the strength parameters of the materials to be utilized during the wall construction. However, the offsite soils should not have an internal friction angle of less than 25 degrees or a wet unit weight of less than 110 pcf.

REPORT LIMITATIONS

This report has been prepared for exclusive use of Thompson & Littion, Inc., to design and construct the proposed High Knob Observation Tower in Wise County, Virginia. This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, expressed or implied, is made. Lighthouse Engineering Consultants, LLC, is not responsible for any claims, damages, or liability associated with any other party's interpretation of this report's subsurface data or reuse of this report's subsurface data or engineering analysis without our express written authorization.

The analyses and professional opinions submitted herein are based, in part, upon the data obtained from the subsurface exploration. The nature and extent of subsurface variations between the test boring locations will not become evident until construction. We strongly recommend that the services of a licensed geotechnical engineer, such as Lighthouse Engineering Consultants, LLC, be obtained for the construction phase of the project to provide engineering evaluation and testing services.

Appendix A
Site Location Plan



Lighthouse Engineering Consultants, LLC

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Website: www.lighthouseengineeringconsultants.com

SITE LOCATION PLAN
PROPOSED OBSERVATION TOWER
HIGH KNOB - WISE COUNTY, VIRGINIA

FOR: THOMPSON & LITTON, INC.

DRAWN BY:	NOTES: ADAPTED FROM PUBLISHED USGS MAPPING
ECH	LOCATIONS ARE APPROXIMATE

SCALE: NONE	DATE: 10–25–2010	DWG #: 2010–036A

Appendix B
Boring Logs
&
Boring Location Plan

B-1

High Knob Tower		High Knob	Wise, VA
Project Number	2010-036	Drill Rig	CME 55
Geologist	Eric. C. Hess	Ground Elevation	Feet
Date Drilled	10/13/10	Total Depth of Borehole	Feet
Borehole Diameter	2.25 Inches	Depth to Water	None Feet

Graphic Log	Description	Depth	Sample	Undefined	Blow Counts	Completion
	Topsoil Residual, Medium dense, Moist, Yellow and Tan, Silty sand with broken rock fragments				40	
	Residual, Very Soft to Soft, very weathered Sandstone	5			50 = 4"	
	Auger refusal @ 7.0' No groundwater encountered at time of drilling	10 15 20 25 30 35				

C:\Program Files...se Media\Well Logger\High Knob Tower.wl2

B-2

High Knob Tower	High Knob		Wise, VA
Project Number	2010-036	Drill Rig	CME 55
Geologist	Eric C. Hess, PE	Ground Elevation	Feet
Date Drilled	10/13/10	Total Depth of Borehole	Feet
Borehole Diameter	2.25 Inches	Depth to Water	None Feet

Graphic Log	Description	Depth	Sample	Undefined	Blow Counts	Completion
	Topsoil					
	Residual, Dense to Very Dense, Moist to Dry, Yellow and Tan, Silty sand with broken rock fragments				50 = 5"	
	Residual, Very Soft to Soft, very weathered Sandstone	5			50 = 3"	
	Auger refusal @ 7.5'				50 = 3"	
	No groundwater encountered at time of drilling	10				
		15				
		20				
		25				
		30				
		35				

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B-3

High Knob Tower		High Knob	Wise, VA
Project Number	2010-036	Drill Rig	CME 55
Geologist	Eric C. Hess, PE	Ground Elevation	Feet
Date Drilled	10/13/10	Total Depth of Borehole	Feet
Borehole Diameter	2.25 Inches	Depth to Water	None Feet

Graphic Log	Description	Depth	Sample	Undefined	Blow Counts	Completion
	Topsoil					
	Residual, Very Dense, Dry, Yellow and Tan, Clayey sand with broken rock fragments				50 = 6"	
	Residual, Very Soft to Soft, very weathered Sandstone				50 = 5"	
	Auger refusal @ 6.5'	5				
	No groundwater encountered at time of drilling	10				
		15				
		20				
		25				
		30				
		35				

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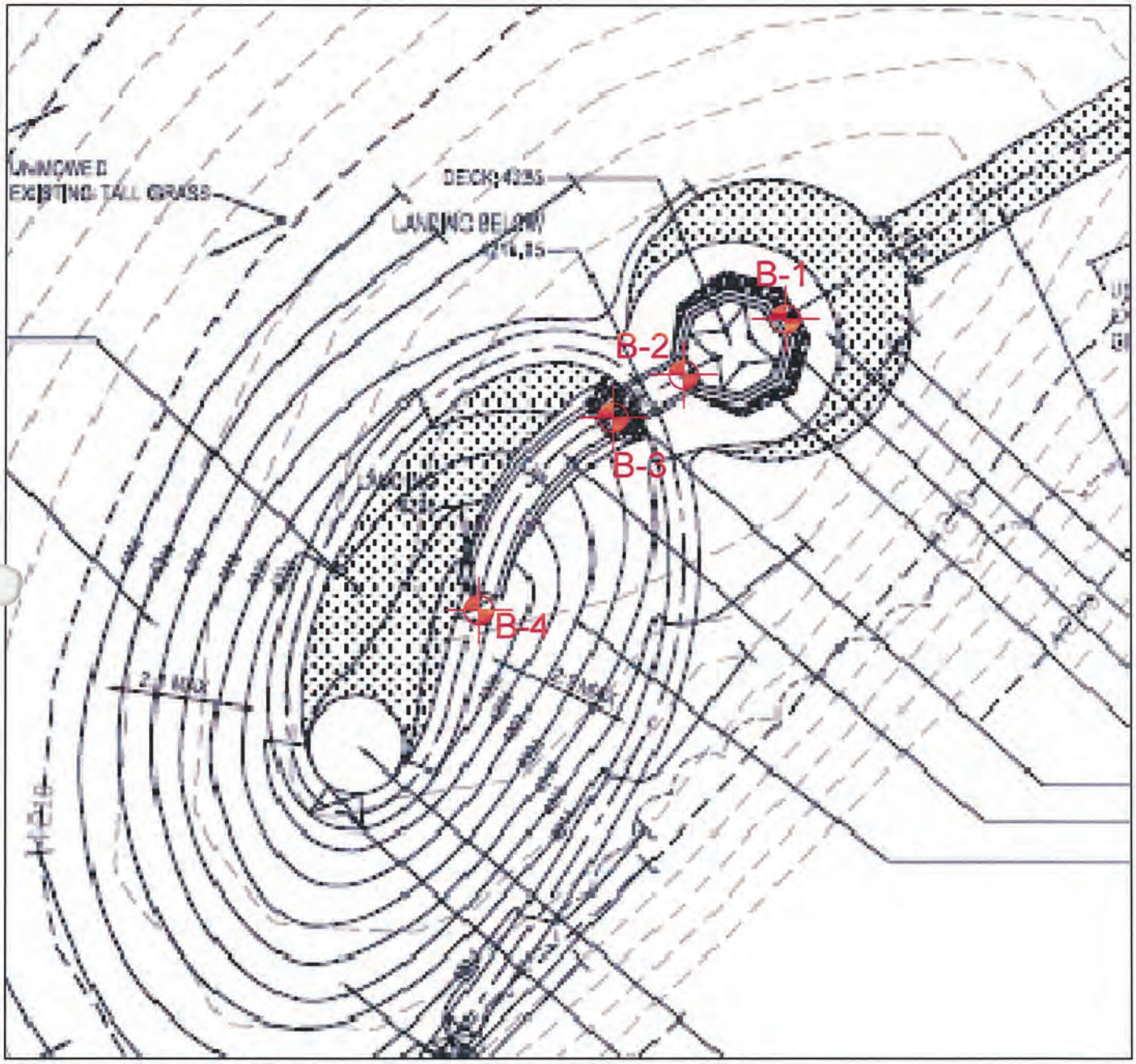
B-4

High Knob Tower		High Knob	Wise, VA
Project Number	2010-036	Drill Rig	CME 55
Geologist	Eric C. Hess, PE	Ground Elevation	Feet
Date Drilled	10/13/10	Total Depth of Borehole	Feet
Borehole Diameter	2.25 Inches	Depth to Water	None Feet

Graphic Log	Description	Depth	Sample	Undefined	Blow Counts	Completion
	Topsoil					
	Residual, Dense, Moist, Yellow and Tan, Silty sand with broken rock fragments				60	
	Residual, Very Soft to Soft, very weathered Sandstone	5			50 = 4"	
					50 = 4"	
	Auger refusal @ 8.5'					
	No groundwater encountered at time of drilling	10				
		15				
		20				
		25				
		30				
		35				

C:\Program File...oise Media\Well Logger\High Knob Tower.wl2



B-1 BORING NUMBER AND LOCATION

Lighthouse Engineering Consultants, LLC

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BORING LOCATION PLAN
PROPOSED OBSERVATION TOWER
HIGH KNOB - WISE COUNTY, VIRGINIA

FOR: THOMPSON & LITTON, INC.

DRAWN BY: ECH	NOTES: ADAPTED FROM FIELD MEASUREMENTS LOCATIONS ARE APPROXIMATE
SCALE: NONE	DATE: 10-25-2010
DWG #: 2010-036B	

Appendix C
General Notes

GENERAL NOTES

SAMPLE IDENTIFICATION

All samples are visually classified in general accordance with the Unified Soil Classification System (ASTM D-2487-75 or D-2488-[illegible])

DESCRIPTIVE TERM (% BY DRY WEIGHT)

Trace:	1-10%
Little:	11-20%
Some:	21-35%
And/Adjective	36-50%

PARTICLE SIZE (DIAMETER)

Boulders:	8 in and larger
Cobbles:	3 in to 8 in
Gravel:	coarse – ¾ to 3 in
	fine – No. 4 (4.76 mm) to ¾ in
Sand:	coarse – No. 4 (4.76 mm) to No. 10 (2.0 mm)
	medium – No. 10 (2.0 mm) to No. 40 (0.42 mm)
	fine – No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt:	No. 200 (0.074 mm) and smaller (Non-plastic)
Clay:	No. 200 (0.074 mm) and smaller (Plastic)

SOIL PROPERTY SYMBOLS

Dd:	Dry Density (pcf)
LL:	Liquid Limit, percent
PL:	Plastic Limit, percent
PI:	Plasticity Index (LL-PL)
LOI:	Loss on Ignition, percent
Gs:	Specific Gravity
K:	Coefficient of Permeability
w:	Moisture content, percent
qp:	Calibrated Penetrometer Resistance, tsf
qs:	Vane-Shear Strength, tsf
qu:	Unconfined Compressive Strength, tsf
qc:	Static Cone Penetrometer Resistance Correlated to Unconfined Compressive Strength, tsf
PID:	Results ov vapor analysis conducted on representative samples utilizing a Photoionization Detector calibrated to a benezene standard. Results expressed in HNU-units (BDL=Below Detection Limits)

DRILLING AND SAMPLING SYMBOLS

SS:	Split-Spoon
ST:	Shelby Tube – 3" O.D. (except where noted)
CS:	3" O.D. California Ring Sampler
DC:	Dynamic Cone Penetrometer per ASTM Special Technical Publication No. 399
AU:	Auger Sample
DB:	Diamond Bit
CB:	Carbide Bit
WS:	Wash Sample
RB:	Rock-Roller Bit
BS:	Bulk Sample
Note:	Depth intervals for sampling shown on Record of Subsurface Exploration are not indicative of sample recovery, but position where sampling initiated

N: Penetration Resistance per 6 inch interval, or fraction thereof, for a standard 2 inch O.D. (1 3/8 inch I.D.) split spoon sampler driven with a 140 pound weight free-falling 30 inches. Performed in general accordance with Standard Penetration Test Specifications (ASTM D-1586). N in blows per foot equals sum of N values where plus sign is shown.

Nc: Penetration Resistance per 1 ¾ inches of Dynamic Cone Penetrometer. Approximately equivalent to Standard Penetration Test N-Value in blows per foot.

Nr: Penetration Resistance per 6 inch interval, or fraction thereof, for California Ring Sampler driven with a 140 pound weight free-falling 30 inches per ASTM D-3550. Not equivalent to Standard Penetration Test N-Value.

SOIL STRENGTH CHARACTERISTICS

COHESIVE (CLAYEY) SOILS

COMPARATIVE CONSISTENCY	*BLOWS PER FOOT (N)*
Very Soft	0-2
Soft	3-4
Medium Stiff	5-8
Stiff	9-15
Very Stiff	16-30
Hard	31+

DEGREE OF PLASTICITY	*PI*
None to Slight	0-4
[illegible]ght	5-10
[illegible]edium	11-30
High to Very High	31+

NON-COHESIVE (GRANULAR) SOILS

UNCONFINED COMPRESSIVE STRENGTH (TSF)	*RELATIVE DENSITY*	*BLOWS PER FOOT (N)*
0-0.25	Very Loose	0-4
0.25-0.50	Loose	5-10
0.50-1.00	Firm	11-30
1.00-2.00	Dense	31-50
2.00-4.00	Very Dense	51+
4.00+		

DEGREE OF EXPANSIVE POTENTIAL	*PI*
Low	0-15
Medium	15-25
High	25+