

**PRCS
Design & Construction
Standards**

January 2009

Revised June 2014

Loudoun County Department of Parks, Recreation
and Community Services

Design and Construction Standards Manual

Board of Supervisors

Scott K. York, Chairman (At Large)

Susan Klimek Buckley, Sugarland Run District, Vice-Chairman

Jim Burton, Blue Ridge District

Lori Waters, Broad Run District

Sally R. Kurtz, Catoctin District

Stevens Miller, Dulles District

Kelly Burk, Leesburg District

Andrea McGimsey, Potomac District

Eugene Delgaudio, Sterling District

Parks, Recreation and Open Space Board

Su Webb, Catoctin District, Chairman

Stephenie Doyle, Blue Ridge District, Vice Chairman

Laura TeKrony, At Large Member

Michael G. Capretti, Broad Run District

Jean Ault, Dulles District

Stephen De Angioletti, Leesburg District

James G. Potter, Potomac District

Joseph W. Budzinski, Sterling District

Rick Kowalick, Sugarland Run District

Robert C. Wright, Open Space Member

Lori L. Waters, Board of Supervisors Liaison

January 2009

Revised June 2014

Prepared by:

Loudoun County Department of Parks, Recreation & Community Services

Revised By:

Gita Amiri

Mike Burke

Billy Coates

Chris Kenney

Mark Novak

Steve Torpy

Table of Contents
Loudoun County, Virginia
Department of Parks, Recreation & Community Services
Design and Construction Standards Manual (DCSM)

Table of Contents

Chapter	Page #
Table of Contents	1 -4
Introduction	
 1.00 Administration	
1.01 General Reference for All Sections	1 - 1
1.02 Project Review Checklist	1 - 3
 2.00 Project Management	
2.01 Project Documentation	2 - 1
2.02 Coordination & Meetings (for County-built projects)	2- 5
2.03 Quality Control (for County-built projects)	2 – 10
2.04 Submittals (for County-built projects)	2 – 12
2.05 Supplemental Condition (for County-built projects)	2 – 17
2.06 General Material & Equipment (for County-built projects)	2 – 20
2.07 As-Built Drawings	2 – 23
 3.00 Site Preparation & Earthwork	
3.01 Earthwork	3 - 1
3.02 Rough and Fine Grading	3 - 13
3.03 Clearing and Related Work	3 - 16
3.04 Exterior Demolition	3 - 18
3.05 Temporary Utilities and Controls	3 - 19
3.06 Erosion and Sediment Control	3 - 21
3.07 Closed Storm Drainage Systems	3 - 22
3.08 Open Drainage Ditches & Swales	3 - 27
3.09 Paved Ditch	3 - 28
3.10 Fair Weather Stream Crossing	3 - 29
3.11 Subsurface Drainage	3 - 30
 4.00 Athletic Facilities (chapter 4 is under review and being revised. An updated chapter will be added to the manual at later date.)	
4.01 Skinned Infields	4 - 1
4.02 Basketball Court	4 - 3
4.03 Multi-Use Court	4 - 10
4.04 Multi-Use Court – Full Depth Asphalt	4 - 17
4.05 Tennis Courts	4 - 23
4.06 Tennis Courts – Full Depth Asphalt	4 - 30

- 4.07 Tennis Practice Court **4 - 37**
- 4.08 Tennis Court Electrical System **4 - 44**
- 4.09 Warning Track & Mow Strip **4 - 50**
- 4.10 Ballfield Equipment Box **4 - 51**
- 4.11 Lighting Standards **4 - 52**
- 4.12 Athletic Field Turf **4 - 61**
- 4.13 Irrigation Systems **4 - 64**

5.00 Roadway, Parking & Miscellaneous Paving

- 5.01 Asphalt Paving **5 - 1**
- 5.02 Concrete Wheel Stops **5 - 2**
- 5.03 Road and Parking Accessories **5 - 3**
- 5.04 Gravel Parking **5 - 7**
- 5.05 Brick Pavers **5 - 10**
- 5.06 Wood Guardrail **5 - 12**
- 5.07 Wood Parking Bollard **5 - 14**
- 5.08 Removable Locking Bollard **5 - 15**

6.00 Landscaping

7.01 General Fencing, guards and Gates 6 - 1

- 7.02 Split Rail Fence **6 - 4**
- 7.03 Three Board Fence **6 - 5**
- 7.04 Dry Stack Rubble Stone Wall **6 - 7**

- 8.0 Cast-In-Place Concrete **6 - 8**
- 8.1 Concrete **6 - 14**
- 6.7 Landscaping and Site Standards **6 - 15**
- 6.8 Landscape Installation **6 - 17**
- 9 Timber Wall **6 - 25**
- 9 Timber Wall and Steps **6 - 27**
- 9 Timber Wall and Edge **6 - 29**

10.00 Carpentry

- 10.01 Rough Carpentry Work **7 - 1**
- 10.02 Heavy Timber Framing **7 - 3**
- 10.03 Wood-Polymer Composite Decking **7 - 6**
- 10.04 Exterior Painting **7 - 7**

11.00 Passive Recreation

- 11.01 Picnic Shelter **8 - 1**
- 11.02 Play Apparatus Area **8 - 3**
- 11.03 Trail Layout **8 - 4**

12.00 Signage

- 12.01 Signage **9 - 1**

13.0 Historical and Cultural Sites

13.01 Historical and Cultural Sites **10 - 1**

14.0 Proffered Park Sites and Facilities

14.01 Proffered Park Sites and Facilities **11 - 1**

Landscaping and Site Furnishings

Shrub Planting **LS-1.0**

Tree Planting and Staking **LS-2.0**

Tree Planting Slope Area **LS-3.0**

Sodded Swale **LS-4.0**

Underdrain Detail **LS-5.0**

Underdrain **LS-6.0**

Bench Adjacent to Trail **LS-7.0**

Bench Footing / Paved Area **LS-8.0**

Wood Guardrail – Section **LS-9.0**

Wood Guardrail – Elevation **LS-9.1**

Entrance Gate **LS-10.0**

Trails

Trail Paving – Impervious **TR-1.0**

Trail Paving – Pervious **TR-2.0**

Removable Locking Bollard **TR-3.0**

Bollard Post – Sleeve Details **TR-3.1**

Appendix C – Historic Properties Policy

Appendix D – Proposed Park Facility Menu

Introduction

This Design and Construction Standards Manual, (DCSM), has been designed to improve descriptions and specifications regarding construction of Loudoun County Parks, Recreation and Community Services facilities. The (proceeding) is a result of almost two years of monthly meetings held by representatives of the Department of Parks, Recreation and Community Services with several development companies who have been involved in building proffered recreation facilities, school representatives, and individuals who have been contracted to build these facilities. Our great appreciation goes to those who volunteered their time and talents to the project.

This document would not be of the current quality if it were not for the contribution of talent, expertise, and many hours of work by:

Jim Bonfils, Park Board member, Treasurer of Loudoun Soccer

Michael Capretti, Park Board member, Gulick Group

Will Cullen, Heritage Landscape Services

Steve Hahn, Lansdowne Development

Rick Herwig, Van Metre Homes

Kevin Lewis, Loudoun County Public Schools

George McGregor, Greenvest

Guy McNeil, Van Metre Homes

Mike Sawyers, ECS Limited

Steve Schulte, Brambleton Group, LC

Mack Smith, KT Enterprises

Randy Vlad, Loudoun County Public Schools

Chris Bresley, PRCS

Mike Burke, PRCS

Brian Fuller, PRCS

Chris Kenney, PRCS

Mark Millsap, PRCS

Mark Novak, PRCS

Diane Ryburn, PRCS

Steve Torpy, PRCS

In addition, we want to express our special thanks to the Board of County Supervisors for their support and to the Parks, Recreation and Open Space Board for their input and support.

Each section of the previous design and construction guidelines was discussed, debated and

rewritten in order to offer a unified standard for construction of facilities that will present a cohesive system. It will provide Loudoun's citizens with safe, well-built facilities that will allow for more effective maintenance by providing high quality facilities that the Loudoun Community deserves & expects.

We will consistently strive for continuous improvements. Now that this document is approved, Loudoun County Parks, Recreation and Community Services plans to review and update it on an annual basis as needed.

MEANINGS OF “SHALL” OR “WILL”, “SHOULD” AND “MAY”.

To clarify the meanings intended in this manual by the use of these words, the following definitions apply:

- SHALL or WILL; A mandatory condition. When certain design criteria is described in a procedure or design of a street or highway, it is mandatory that this condition be met.
- MAY; A permissive condition. Design or application is optional.

Chapter 1.0 Administration

SECTION 1.01 GENERAL REFERENCES and Codes

1.01 REFERENCES INCORPORATED

All work referenced by the following sections of the Loudoun County Department of Parks, Recreation and Community Services (PRCS) Design and Construction Standards (DCS) Manual is subject to the applicable provisions of:

- 1.0 Current Revised 1993 Loudoun County Zoning Ordinance (RZO)
- 2.0 Loudoun County Facilities Standards Manual (FSM)
- 3.0 Loudoun County Codified Ordinances
- 4.0 Loudoun County Health Department (LCHD)
- 5.0 Loudoun County Sanitation Authority (LCSA)
- 6.0 Virginia Erosion and Sediment Control Handbook
- 7.0 Virginia Department of Historic Resources Guidelines for Archeological Investigations (DHR)
- 8.0 Virginia Department of Transportation Road and Bridge Specifications (VDOT)
- 9.0 American Association of State Highway and Transportation Officials (AASHTO)
- 10.0 American Sod Producers Association (ASPA)
- 11.0 American with Disability Act (ADA)
- 12.0 Sports Turf Management in Virginia Manual (Virginia Tech)
- 13.0 American Society of Testing Materials (ASTM)
- 15.0 Virginia Uniform Statewide Building Code (VUSBC) & all referenced codes.
- 16.0 American Concrete Institute (ACI)
- 13.0 National Forest Products Association (NFPA)
- 17.0 American institute of Steel Construction (AISC)
- 18.0 Uniform Statewide Building Codes (USBC)) and all referenced codes and sections
- 19.0 Western Wood Products Association (WWPA)
- 20.0 Southern Pine Inspection Bureau (SPIB)
- 21.0 American Wood Preservers Association (AWPA)
- 22.0 American Institute of Timber Construction (AITC)
- 23.0 American Wood Preservers Bureau (AWPB)
- 24.0 Southern Forest Products Association (SFPA)
- 25.0 American National Standards Institute (ANSI)

1.2 GENERAL REQUIREMENTS

1.2.1

The contractor is responsible to comply with all applicable codes, and regulations, as well as references noted above as applies to projects, products and equipment.

1.2.2 The conflict between references shall be based on the code hierarchies and stringency and shall be adjudicated by PRCS.

1.2.3 The Specific Product may be replaced by an equal material with prior approval from PRCS and the Engineer/Architect of the record (if any). The contractor shall submit a copy of the material specifications along with engineer /architect of the records approval. All new and existing products shall be listed by ICC (International Code Council) and shall have an Evaluation report (ER) as it relates to buildings.

1.3 WAIVER LETTER

Any deviation or exception from the DCSM requires a formal written letter of approval from the PRCS' Director. The request must cite the specifics, the manual's section and the reason for not being able to comply with the section requirement/s. The waiver request shall be based on practical difficulties in achieving the stated requirements and should include an alternative methods or materials that will provide an equivalent result with same or greater levels of safety and protection. All written requests may be submitted with technical data, plans, details, etc. to illustrate the extent and nature of deficiencies; photographs of existing condition may be included as an exhibit.

Chapter 2

Project Management

2.1 GENERAL

All work under this section is subject to the provisions of Chapter 1, Section 1.0 General References for All Sections.

2.2 SCOPE

2.2.1 This section includes: final cleaning of the project, project record documents, operation and maintenance data, warranties, spare parts and maintenance materials, and final acceptance procedures.

2.2.2 Prior to project's commencement, the Contractor shall obtain all necessary County, State, and/or Federal permits.

2.3 PROJECT RECORD DOCUMENTS

Maintain one (1) set (labeled 'PROJECT RECORD INFORMATION – JOB SET') of the following Record Documents and record actual revisions of the work:

- 2.3.1 Contract Drawings
- 2.3.2 Specifications
- 2.3.3 Addenda
- 2.1.4 Change Orders and other Modifications to the Contract
- 2.1.5 Approved shop drawings, product data, and samples
- 2.1.6 Original and updated project schedules.
- 2.1.7. Permits and Inspection Records
- 2.1.8 Warranty papers.
- 2.1.9 MATERIAL SPECIFICATIONS
- 2.1.10 ANY PRCS' WAIVER APPROVAL LETTERS
- 2.1.11. ANY B&D WAIVER FORMS

2.4 Document Storage

- 2.4.1 Store hard copy Record Documents separate from documents used for construction.
- 2.4.2 All e- mails, scanned materials or computer generated documents, permits, inspection records, waivers (PRCS & B&D), letters of warranties, related to the project shall be stored in a folder, named after the project, in an external hard drive or flash drive stored in designated areas.
- 2.4.3 Record information concurrent with construction progress.
- 2.4.4 Make legible entries on each pertinent sheet of drawings, specifications, or other documents as necessary, in order to properly document the entry.

- 2.4.5 Accuracy shall be such that PRCS may reasonably rely upon the information for preparation of Record Documents, and that PRCS may reasonably rely upon the information for future reference and research.
- 2.4.6 Entries shall be recorded in a timely fashion upon performance or notification of a change or deviation within 24 hours.
- 2.4.7 Provide a copy of all meetings (field or otherwise) records, date, attendees, subject, and conclusions. A copy of the meeting record shall be provided to all attendees for their input.
- 2.4.8 Specifications – Legibly mark and record at each Product section description of actual Products installed, including the following, if different than specified:
 - 2.4.8.1 Manufacturer's name and product model and number.
 - 2.4.8.2 Product substitutions or alternates utilized.
(The substitution or alterations need to have prior approval from the engineer of the record, if any, the PRCS approval and the county's approval when needed. The alternate products shall have a listed ICC-ER report. There shall be no substitution prior to the above mentioned process.)
 - 2.4.8.3 Changes made by Addenda and Modifications approved by PRCS and all other applicable agencies.
- 2.4.9 Record Documents and Shop Drawings – Legibly mark each item to record actual field construction as compared with the approved plans or specifications:
 - 2.4.9.1 Measured depths of foundations in relation to finish datum.
 - 2.4.9.2 Measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
 - 2.4.9.3 Measured locations of appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 2.4.9.4 Field changes of dimension and detail. (Any changes should have been brought to the attention of the Project Manager and the Design Professional early in the project).
 - 2.4.9.5 Details not on Approved Drawings. (all such details are required to have the original design professional's approval seal and signature. In the absence of the required engineered drawings the details shall be submitted to PRCS prior to field erection and construction, or brought to the attention of the PM.)
 - 2.4.9.6 Delete Architect/Engineer title block from all documents. See Section referencing the "As-Built Drawing specifications".
- 2.4.10. A copy of all applicable documents shall be submitted to PRCS.

2.5 OPERATION AND MAINTENANCE DATA

2.5.1. O&M Manuals

Submit two sets prior to final inspection, bound in 8-1/2 x 11-inch text pages, three D-side ring capacity expansion binders with durable covers.

2.5.2. Prepare binder covers with printed title "OPERATION AND

MAINTENANCE INSTRUCTIONS”, title of project, and subject matter of the binder when multiple binders are required.

2.5.3. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

2.5.4 Prepare a Table of Contents for each volume, with each Product or System description identified, typed on 24-pound white paper.

2.5.5 Part 1 – Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.

2.5.6 Part 2 – Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Applicable equipment and systems shall be clearly referenced within the documentation and Identify the following:

1. Significant design criteria.
2. List of Equipment.
3. Parts list for each component.
4. Operating instructions.
5. Maintenance instructions for equipment and systems.
6. Maintenance instructions for finish, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
7. Sequence of operation for all HVAC systems.

2.5.7 Project Documents and Certificates, including the following:

- 2.5.7.1 Shop drawings and product data.
- 2.5.7.2 Certificates.
- 2.5.7.3 Warranties.

2.5.8 Submit draft copy of completed volumes in accordance with the PROJECT REVIEW CHECKLIST, Section 1.02). This copy shall be reviewed and returned with PRCS comments. Revise content of all document sets as required prior to final submission.

2.5.9 Submit revised, approved volumes, after final inspection. For those portions of the manual that may be submitted electronically, please provide a copy on CD or DVD for archive storage purposes.

2.6 Spare Parts and Maintenance Materials

2.6.1 Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification sections. Provide two copies of detailed lists of spare parts and extra materials. Submit copies in separate binders.

2.6.2 Deliver to Project site and place in location as directed; obtain receipt.

2.7 CLOSEOUT PROCEDURES

2.7.1 Substantial Completion.

2.7.2 Certificate of Substantial Completion (AIA DOC G704) unless project manager approves alternate documentation prior to initiation of work.

2.7.3 Provide submittals to PRCS that are required.

2.7.4 Attend pre-inspection walk-through with PRCS.

2.7.5 Submit completed checklist to PRCS.

2.7.6 PRCS may occupy portions of the site as agreed. A letter of Temporary occupancy, approved by Loudoun County Building and Land Development Department shall be submitted to PRCS to allow for partial occupancy.

2.8 Final Cleaning

2.8.1 Complete punch list prior to final clean up of site and or building.

2.8.2 Execute final cleaning prior to final inspection. Work area shall be dust-free; all glass areas polished and free of prints and streaks.

2.8.3 Clean all surfaces exposed to view; remove temporary labels, stains, and foreign substances.

2.8.4 Clean all equipment and fixtures.

2.8.5 Clean debris from drainage systems and swales.

2.8.6 Clean site; sweep paved areas, rake clean landscaped surfaces.

2.8.7 Remove waste and surplus materials, rubbish, and construction facilities from the site and any adjoining areas that have received waste during construction.

2.9 Final Acceptance

2.9.1 Complete all punchlist items.

2.9.2 Copy of all final inspection records approved and signed by the appropriate inspectors; a copy of the final occupancy when applicable.

2.9.3 Complete final site and building clean up.

2.10 COORDINATION AND MEETINGS

2.10.1 GENERAL

All work under this section is subject to the provisions of Chapter 1, General References for All Sections for County-built projects.

2.10.2 SCOPE

2.10.2.1. Coordination and project conditions.

2.10.2.2. Preconstruction meeting.

2.10.2.3. Jurisdictional meetings.

2.10.2.4. Site mobilization meeting.

2.10.2.5. Layout and Field Engineering.

2.10.2.6. Progress meetings.

2.10.2.7. Progress reports.

2.10.2.8. Pre-installation meetings.

2.10.2.9. Examination.

- 2.10.2.10. Preparation.
- 2.10.2.11. Cutting and Patching.

2.10.2.1 COORDINATION AND PROJECT CONDITIONS

Coordinate scheduling, submittals, and Work of the various sections of the Project Manual to insure efficient and orderly sequence of installation of interdependent construction elements.

- 2.10.2.1.1 Verify utility requirements and characteristics of operating equipment and whether they are compatible with utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- 2.10.2.1.2 Coordinate completion and clean up of Work of separate sections in preparation for Substantial Completion.
- 2.10.2.1.3 After Beneficial Occupancy by PRCS, coordinate all access to site for correction of defective Work and Work not in accordance with Contract Documents, with PRCS to minimize disruption of PRCS's activities.

2.10.2.2 PRECONSTRUCTION MEETING

- 2.10.2.2.1 PRCS and Contractor shall schedule Pre-Construction meeting.
- 2.10.2.2.2 Attendance Required: PRCS, Designer, Contractor(s) and sub-contractors, as determined by Project Manager.
- 2.10.2.2.3 Agenda:
- 2.10.2.2.4 Distribution of Contract Documents.
- 2.10.2.2.5 Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
- 2.10.2.2.6 Designation of personnel representing the parties in Contract, and the Designer.
- 2.10.2.2.7 Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Construction Closeout procedures.
- 2.10.2.2.8. Scheduling.
- 2.10.2.2.9 Checklist Items

2.10.2.3 JURISDICTIONAL MEETINGS

- 2.10.2.3.1 Contractor shall coordinate, schedule, and attend meetings with Jurisdictional Agency personnel to insure compliance with all applicable codes, standards, laws, rules, regulations, and required permits and documents in order to obtain the permits. This may include Utility Companies, Local, State, and Federal Government Agencies.

2.10.2.4 SITE MOBILIZATION MEETING

- 2.10.2.4.1 Contractor is to schedule a meeting with PRCS at the Project site prior to each mobilization. This meeting may be combined with other jurisdictional agencies if required.

- 2.10.2.4.2. Required attendees at site visits shall include representatives involved with the project, such as PRCS, project designers, contractor, superintendent, and the subcontractors.
- 2.10.2.4.3. Provide a meeting agenda; the agenda shall include the followings:
 - 2.10.2.4.3.1 Use of premises by PRCS and contractors during construction.
 - 2.10.2.4.3.2 PRCS's requirements as stated in the scope of work, the drawings, and as applicable by DCSM.
 - 2.10.2.4.3.3 Construction facilities and controls provided by PRCS.
 - 2.10.2.4.3.4 Survey and layout.
 - 2.10.2.4.3.5 Security and housekeeping procedures.
 - 2.10.2.4.3.6 Schedules.
 - 2.10.2.4.3.7 Procedures for testing.
 - 2.10.2.4.3.8 Procedures for maintaining record documents.

2.10.2.5 Layout and field engineering

2.10.2.6 PROGRESS MEETINGS

- 2.10.2.6.1. PRCS Project Manager shall schedule, facilitate and administer meetings throughout progress of the work at intervals deemed necessary by all.
- 2.10.2.6.2. PRCS' Project Manager shall make arrangements for meetings; prepare agenda for progress meeting/s, with copies to all participants. , and preside at the meetings.
- 2.10.2.6.3. Attendance Required: The meeting notices shall be sent to the following required participants, as appropriate to agenda topics for each meeting, general contractor, superintendent/s, the involved subcontractors and suppliers, PRCS' representatives, designers, and PRCS's Consultant(s) as appropriate to agenda topics for each meeting.
 - 2.10.2.6.3.1 The agenda for each progress meeting shall include the following:
 - 2.10.2.6.3.1.1 Review minutes of previous meetings, as applicable.

2.10.2.7. PROGRESS REPORTS

- 2.10.2.7.1 General Contractor and each Subcontractor shall prepare a comprehensive daily log and maintain it during the entire project period.
- 2.10.2.7.2. Each Subcontractor will present a copy of the daily log to the General Contractor for compilation into weekly Progress Reports to be presented to PRCS.
- 2.10.2.7.3. The General Contractor to present copies of Progress Reports to PRCS's Project Manager based on the agreed upon schedule.
- 2.10.2.7.4. Each Progress Report shall include the following data for each day the project is in progress.
 - 2.10.2.7.4.1 Manpower, by trade and number of personnel.
 - 2.10.2.7.4.2 Work being performed.
 - 2.10.2.7.4.3 Weather conditions and temperature.

- 2.10.2.7.4.4 Any situation or circumstance that could delay work or give cause for claims for extension of time or added cost.
- 2.10.2.7.4.5 List of visitor's names, to include officials, PRCS's representatives and other authorities.
- 2.10.2.7.4.6 Record of daily observations.
- 2.10.2.7.4.7 Deliveries.
- 2.10.2.7.4.8 Equipment on site.
- 2.10.2.7.4.9 Submit a copy of the test reports and or the inspection records to PRCS along with the progress reports.

2.10.2.8. PRE-INSTALLATION MEETING

- 2.10.2.8.1 When required in individual specification sections, a pre-installation meeting shall be held at the site prior to commencing work
- 2.10.2.8.2 Require attendance of parties directly affecting, or affected by, work of the specific section.
- 2.10.2.8.3 PRCS' Project Manager shall be notified three (3) days in advance of the meeting date.

2.11 QUALITY CONTROL

2.11.1 GENERAL

All work under this section is subject to the provisions of Chapter 1. Section 1.0 General References for All Sections.

2.11.2. SCOPE

The Quality Control scope of work shall include,

- 2.11.2.1. Quality assurance and control of installation.
- 2.11.2.2. Code References.
- 2.11.2.3. Inspection and testing laboratory services.
- 2.11.2.4. Manufacturers' field services and reports.

2.11.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION

- 2.11.3.1 Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- 2.11.3.2 Comply fully with manufacturers' instructions.3. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer and the owner (PRCS) before proceeding.
- 2.11.3.3. Comply with specified standards as a minimum quality for the Work except when code requirements are more stringent in requiring higher standards and or more precise workmanship.
- 2.11.3.4. Perform work by persons qualified to produce workmanship of specified quality.
- 2.11.3.5. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, and vibration to prevent physical distortion or alignment.

2.11.4 REFERENCES

- 2.11.4.1. Conform to reference standard by date of issue current on date of Contract Documents.
- 2.11.4.2. Obtain copies of standards when required by Contract Documents.
- 2.11.4.3. Should specified referenced standards conflict with Contract Documents, request clarification from PRCS before proceeding.
- 2.11.4.4. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

2.11.5 PERMITS, INSPECTION AND TESTING SERVICES

- 2.11.5.1. The Contractor shall be responsible for obtaining County and/or State permits and inspections as required for each trade and element of construction.
- 2.11.5.2. The Contractor shall be responsible for submitting all laboratory testing reports, and ICC Evaluations Reports for all materials used on this project that are not specified in applicable codes as specified in applicable codes and specification and as required by PRCS.
- 2.11.5.3. Reports shall be submitted to PRCS indicating results of tests and indicating compliance or non-compliance with Contract Documents.
- 2.11.5.4. Retesting required because of non-conformance to specified requirements shall be performed by the same firm on instructions by PRCS. Payment for retesting shall be the responsibility of the Contractor.

2.11.6 MANUFACTURERS' FIELD SERVICES AND REPORTS

- 2.11.6.1. Submit qualifications of observer to PRCS 30 days in advance of required observations. Observer is subject to approval by PRCS.
- 2.11.6.2. When specified in specification Sections, require material or Product suppliers or manufacturers shall provide qualified staff personnel to observe site conditions, surfaces conditions, installations, quality of workmanship, start-up of equipment/s, test/s, adjust and balance of equipment/s as applicable, and to initiate instructions when necessary.
- 2.11.6.3. Individuals to report observations and site decisions or instructions, given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.
- 2.11.6.4. Submit report in duplicate within a week of field observation of Errors and Omissions, installations to PRCS for review.

2.12 SUBMITTALS

- 2.12.1 GENERAL, all work under this section is subject to the provisions of Chapter 1, Administration.
 - 2.12.1.1 Submittal procedures.
 - 2.12.1.2 .General information.
 - 2.12.1.3 Required meetings.

- 2.12.1.4 Construction progress schedule.
- 2.12.1.5 Proposed products list.
- 2.12.1.6 Shop drawings.
- 2.12.1.7 Product data.
- 2.12.1.8 Samples.
- 2.12.1.9 Manufacturers' instructions and manuals.
- 2.12.1.10 Manufacturers' certificates.
- 2.12.1.11 Copy of all permits.
- 2.12.1.12 Copy of all inspection results
- 2.12.1.13 Copy of the initial Miss Utility mark up cleared

2.12.1.1 SUBMITTAL PROCEDURES (WHO IS THIS FOR?)

1. Include a transmittal form with each submittal and maintain a submittal log, upon each submittal and approval.
2. Number the transmittal forms sequentially. For re-submittals use the original number followed by an alphabetic suffix.
3. Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.
4. Apply Contractors shall stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
5. Contractor shall submit a submittal schedule within five (5) days of signing any agreement with PRCS, and shall obtain approval on all submittals schedule/s from owner prior to ordering and fabricating.
6. In order to expedite the project the contractor is required to schedule all submittals.
7. All submittals shall be reviewed and approved by PRCS prior to ordering of materials and fabrication.
8. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
9. All submittals shall provide a space for Contractor and PRCS review stamps and comments
10. The General Contractor to submit all revisions, and identify all changes with revision clouds.
The PM to distribute copies of reviewed submittals to all involved parties.

2.11.1.2 GENERAL REQUIRED INFORMATION

2.11.1.2.1 Submit the following:

1. Site Superintendent(s) resume(s) .
2. Emergency phone number, where a person may be reached 24 hours, when needed.

3. Schedule of Values.
4. Submitted project Schedule.
5. List of Subcontractors. trade, experience number of years practiced in that trade.
6. Name of surveyor and proof of License by Commonwealth of Virginia.
7. As-built drawings per specifications; all as-built drawings shall be approved by the design professional and the owner.

2.11.1.3 REQUIRED MEETINGS

1. Pre-construction meeting prior to Notice to Proceed. At a minimum one (1) week prior to pre-construction meeting the prepared plans shall be submitted to PRCS for their review.
2. Field stakeout approval for layout and grading.
3. Layout, review and approval, including approval of fine grading & seed bed preparation prior to seeding.
4. PRCS' substantial completion inspection.
5. Monthly progress meetings to be scheduled for the same time and same day throughout the project, except for County Holidays. The progress meetings shall be scheduled by PRCS and the Contractor at the pre-construction meeting.

2.11.1.4 CONSTRUCTION PROGRESS SCHEDULE

1. Submit four (4) copies of initial progress schedule immediately after being awarded the Contract.
2. Revise and resubmit as required. Maintain original and updated schedules on site in accordance with PROJECT DOCUMENTATION.
3. Submit revised schedule with each Application for Payment, identifying changes since previous version.
4. Submit a horizontal bar chart with separate line for each section of Work broken down into two (2) week segments.
5. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities.
6. Indicate estimated percentage of completion for each item of Work at each submission.
7. Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by PRCS.

2.11.1.5 PROPOSED PRODUCTS LIST

1. Within ten (10) days after date of PRCS-Contractor Agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

2. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

2.11.1.6 SHOP DRAWINGS

1. Submit the number of hard copies which Contractor requires, plus three (3) extra copies to be retained by PRCS.
2. Submit shop drawings for all equipment, materials and building products.

2.11.1.7 PRODUCT TEST DATA

1. Concrete mix design for slab and footings. number of cylinders per IBC or as specified by the contract whichever is more.
2. Asphalt mix design for trails and parking lots. (to be submitted by the asphalt plant to the contractor and approved by PRCS manager.)
3. Product information for lime and fertilizer.
4. Seed mix certification.
5. Aggregate certifications for concrete and asphalt mix, from the plant.
7. Checkmark each product data to the products 'models, options, and other data. Supplement manufacturers' standard data to provide information unique to this project.
8. Submit product information including color schedule and installation instructions for all equipment, products and building materials. Prior PRCS' approval is required on colors, types and equipment not specifically specified in the scope of work or drawings. Any material that is not listed by the applicable building codes require ICC, Evaluation Services number, and shall be approved for such use.
9. SAMPLES (REQUIRED IF PRODUCT is NOT A STANDARD) prior approval by PRCS is required. Products not listed by ICC-ER shall be presented to Building and Land Development Department for approval prior to submittal to PRCS.
 - 9.1 Submit samples to illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices.
 - 9.2 Submit samples of paint/stain to be used on site amenities for PRCS's approval.
 - 9.3 Include identification on each sample, with full Project information.
 - 9.4 Submit samples of safety fence, posts, and signs used to inform the park patrons of ongoing construction and the length of the project activities.

2.11.1.8 MANUFACTURER'S INSTRUCTIONS AND MANUALS

1. Submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, finishing, and maintenance in quantities specified for Product Data.

2. Contractor to submit all manufacturers' instructions to PRCS. The contractor shall bring any conflicts between the manufacturer's specification and the contract documents to the attention of the owner and the engineer of the record prior to installation.

2.11.1.9 MANUFACTURER'S CERTIFICATES

1. Submit supporting reference data, affidavits, and certifications. Insure that all materials or products conform to or exceed specified requirements.
2. Certificates may be recent or previous test results on material or Product, but must be acceptable to PRCS.

2.11.2 REQUIRED TESTING

- 2.11.2.1 Contractor to coordinate onsite testing with THE PROJECT MANAGER and his/her representative.
- 2.11.2.2 Compaction testing; PRCS AT THEIR EXPENSE TO HIRE A THIRD PARTY ENGINEERING AND TESTING FIRM TO CONDUCT COMPACTION testing WHERE REQUIRED.
- 2.11.2.3. PRCS will employ An ENGINEERING AND testing laboratory to perform ALL TSETS, and quality control testing. All reports prepared by the testing agency shall be submitted to PRCS within 24 hours and reports shall be certified.
- 2.11.2.4 The County will employ a geotechnical engineer to verify the soil bearing requirement, if over 1500 PSF.

2.12 SUPPLEMENTAL CONDITIONS

- 2.12.1 GENERAL- All work under this section is subject to the provisions of Chapter 1, General References for All Sections for County-built projects.

2.12.2 SUPPLEMENTAL CONDITIONS

- 2.12.2.1 The Contractor is responsible to verify all dimensions, locations, elevations, and details for all specified items before beginning construction. The contractor shall notify PRCS' Project Manager, and the engineer of the record immediately if there is any discrepancy between the plans and specifications and the field findings. Written dimensions shall prevail. Do not scale any dimensions off the plans without prior approval by PRCS.
- 2.12.2.2 The Contractor is required to read **ARTICLE 11 INSURANCE REQUIREMENTS (Where is this article??)** of the General Conditions regarding monetary coverage limits. 2.3 In accordance with the **GENERAL CONDITIONS**, PRCS will review proposed "or equals" at any point in the bidding or contract phases, but may not be able to provide a formal response prior to the bid opening unless the following procedure is complied with. Nothing stated herein is intended to preclude or supersede **GENERAL CONDITIONS** Article 7.89 "Or Equal" Clause.

2.12.2.3. Bidders who are considering the submission of "Or Equal" equipment for PRCS review will submit a written request no later than ten (10) calendar days prior to the Bid Opening date.

2.12.2.4. The submission(s) will include, but are not limited to the following:

2.12.2.4.1 A specific listing of each substitution "as equal"

2.12.2.4.2 Appropriate manufacturer's shop drawings, literature, and installation instructions for the substitution.

2.12.2.4.3 A layout drawing showing that the configuration of the proposed "or equal(s)" is the same as that shown on the plans.

2.12.2.4.4 A detailed technical comparisons responding to the criteria contained in the specifications.

2.12.2.5. The Contractor SHALL notifying MISS UTILITY at (800) 257-7777 to ensure all lines in the work area are located and marked for reference. The Contractor will review the plans to ensure that all utility lines that have been field located are shown on the plans. The Contractor will notify PRCS and the engineer of the record immediately if utilities are found to be other than shown on the plans. Also all and any private utilities shall be located prior to digging e.g. irrigation systems, private electrical, and plumbing. PRCS will provide such plans to contractor, if available.

2.12.2.6. Shop drawings, Product Data, Samples, and Certifications SHALL be submitted by the Contractor to PRCS for review and approval OF PRODUCT DATA, SAMPLES AND CERTIFICATIONS, prior to ordering and fabrication. The Contractor SHALL certify that submittals meet the requirements of the plans and specifications. Shop drawings, Product Data, and samples SHALL be submitted for all equipmentS and materials AS AN EXAMPLE BUT NOT LIMITED TO;

1. Off-site Road Improvement
2. Entrance Road and Parking
3. Tennis Courts
4. Basketball Courts
5. Soccer/Football Fields
6. Baseball/Softball Fields
7. Site Furnishings - Benches
8. Bollards
9. Trash Cans Signage Trails
10. Sidewalks Exercise Equipment
11. Lighting Systems, Picnic Areas
12. Play Apparatus
13. Storm Drainage System
14. Sanitary Sewer System
15. Electrical Systems

16. Phone & Data System
17. Finish Materials

- 2.12.2.7. The Contractor shall maintain A CLEAN SITE.
THE CONTRACTOR TO PROVIDE WHATEVER MEANS NECESSARY AT THE ENTRANCES TO KEEP THE PUBLIC ROADS CLEAN.
Roads leading to the site shall be clean at the end of each day.
The Contractor will wash vehicle tires before leaving the site if the construction entrance does not remove sufficient mud.
- 2.12.2.8. The construction sign SHALL be installed within ten (10) calendar days of the Contractor's receipt of the written notice-to-proceed, and prior to START OF Construction. The Contractor shall receive approval from PRCS for the format and location of the sign prior to installation.
- 2.12.2.9. UNLESS TOLD OTHERWISE assume THERE IS no water is available on site. The Contractor will SHALL be responsible for the provision of TO PROVIDE water required to complete the work in this FOR THE project.
- 2.12.2.10. The Contractor SHALL have all AVAILABLE staging and storage areas approved by PRCS.
- 2.12.2.11 Excavation is unclassified and includes excavation to subgrade elevations indicated, regardless of character of materials and obstructions .
- 2.12.2.12 The Contractor is responsible TO coordination with the Virginia Department of Transportation (VDOT) to ensure that the ALL applicable safety precautions REQUIRED BY VDOT and measures are observed when completing WHEN work IS within the VDOT right-of-way. (NEEDS TO MOVE TO JOB PREP.)
- 2.12.2.12 The Contractor SHALL submit manufacturer's installation instructions, shop drawings, parts' lists, maintenance and operating manuals, and product data ON all equipment and manufactured items. The package SHALL be submitted (AS THE PRODUCTS AND EQUIPMENTS ARE BEING INSTALLED.)
- 2.12.2.13 The Contractor is responsible for maintaining a safe and secure WORK PLACE, until the FINAL INSPECTION IS GRANTED AND THE PROJECT IS ACCEPTED BY PRCS.

2.13 GENERAL MATERIAL & EQUIPMENT

- 2.13.1. GENERAL All work under this section is subject to the provisions of Chapter 1, General References.
- 2.13.2 Scope
1. Products.
 2. Transportation and handling.
 3. Storage and protection.
 4. Product options.
 5. Substitutions.
 6. QUALITY CONTROL

2.13.3 PRODUCTS

2.13.3.1 Products ARE NEW material, components, equipment, fixtures and systems , forming the Work and, it does not include any machinery, and equipment used for preparation, fabrication, conveying and erection of the Work.

2.13.3.2 TRANSPORTATION & HANDLING

2.13.3.2.1 All products shall be transported and handled in accordance with manufacturer's instructions.

2.13.3.2.2 Contractor is responsible to promptly inspect shipments to assure that products comply with specifications and plans and are undamaged.

2.13.3.2.3 Provide proper equipment and personnel to handle the products to prevent soiling, disfigurement or damage.

2.13.4 STORAGE & PROTECTION

2.13.4.1 Products shall be stored and protected in accordance with manufacturer's instructions, with all seals and labels intact and legible. All sensitive products shall be stored in weather-tight, climate controlled enclosures.

2.13.4.2 For exterior storage of products, place on sloped supports, above ground.

2.13.4.3 Provide off-site storage and protection when site does not permit on-site storage or protection.

2.13.4.4 Cover products subject to deterioration, if exposed to elements, with impervious sheet covering. Provide ventilation to avoid condensation. Secure the fabric with anchorage.

2.13.4.5 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

2.13.4.6 Provide equipment and personnel to store products properly to prevent soiling, or damage.

2.13.4.7 Arrange products in the storage area to allow access for periodic inspections.

2.13.5 PRODUCT OPTIONS

2.13.5.1 Products are Specified by Reference Standards or by Description Only:

2.13.6. SUBSTITUTIONS

2.13.6.1 Project Manager will consider requests for substitutions within 14 calendar days after date established in Notice to Proceed. Any substitution must be requested in writing and clearly indicated.

2.13.6.2 Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

2.13.6.3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

2.13.6.4 A substitution request constitutes a representation that the Contractor:

- 2.13.6.4.1 Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
- 2.13.6.4.2 Will provide the same warranty for the Substitution as for the specified product.
- 2.13.6.4.3 Will coordinate installation and make the appropriate changes to other Work which may be affected by this change without any additional cost to the owner, PRCS.
- 2.13.6.4.4 Waives all claims for additional costs or time caused
- 2.13.6.4.5 Will reimburse PRCS for review or redesign services associated with the requested substitution by authorities.
- 2.13.6.5 Substitutions will not be considered when they are indicated or implied on the shop drawings or product data submittals, without separate written request for substitution by the contractor, or when the acceptance of such substitution will require revision to the Contract Documents.
- 2.13.6.6 Substitution Submittal Procedure:
 - 2.13.6.6.1 Submit three (3) copies for consideration. Provide one written request for each substitution.
 - 2.13.6.6.2 Submit shop drawings, product data and certified test results attesting to the proposed product equivalence.
 - 2.13.6.6.3 The Project Manager will notify the Contractor, in writing, of decision to accept or reject request.

2.14 AS-BUILT DRAWINGS

2.14.1. GENERAL All work under this section is subject to the provisions of Chapter 1, General References for All Sections.

2.14.2 SCOPE

The Contractor shall submit one set of HARDCOPY AND AN ELECTRONIC COPY OF THE as-built drawings PREPARED BY PROFESSIONAL ENGINEER OR THE LICENCED SURVEYER, to PRCS PRIOR TO FINAL ACCEPTANCE OF THE PROJECT BY PRCS. As built drawings shall ALSO INCLUDE ALL SITE IMPROVEMENTS, SUCH AS BALLFIELDS OR OTHER IMPROVEMENTS AS REQUESTED BY PRCS.

2.14.3 REQUIREMENTS, THE AS-BUILD DRAWINGS SHALL COMPLY WITH THE FOLLOWING REQUIREMENTS:

- 2.14.3.1 All as-built SHALL be prepared by a surveyor or engineer, DEPENDING ON THE TYPE OF project REGISTERED IN THE COMMONWEALTH OF VIRGINIA.
 - 1. The working As-built drawings must be reviewed at least once a month by the Resident Engineer in conjunction with the approval of progress payments.
 - 2. The Scope of Work shall require the Contractor to prepare, maintain and deliver to PRCS a set of redlined, record drawings, which show the actual as-built conditions of the construction phases. After PRCS' review and approval, these

marked-up drawings will be sent to the contractor who shall produce three copies of a final set of as-built drawings.

2.14.3.2. DESCRIPTION OF WORK

Prepare as-built: of the entire area within the limits of the Project, depicting the following:

1. All changes, no matter how minor as well as all clarifications, shall be entered into a change database and recorded by the Contractor on two sets of redlined or record drawings. The red lined drawings shall include the changes and clarifications to shop drawings, change orders, modifications, and RFI's which have been reviewed and approved by PRCS.
2. Redlined drawings must be transferred to the Architect-Engineer for verification, baseline comparison, and creation of a reproducible set of drawings labeled As-Built Drawings.
3. Buildings, Attached or Detached Structures: Location of and all portions of the building including utilities, room dimensions, control locations, panels, doors, etc.
4. Site: On-site paving, storm drainage, utilities—including gas, electric, water, cable, etc. both overhead and underground; topography shall also be reflected. Locations of all storm pipes and culverts and outfalls and rip rap, pipe and culvert sizes, lengths, top and invert elevations, percent of grade of pipes and culvert, swale inverts, and slope of swale.
5. Trails: Spot elevations on entire length of trail at MAXIMUM 25' intervals centered on trail. Include elevations on top and bottom of embankments, location of benches, handrail, and rip-rap.
6. Courts/Fields: elevations of all finished courts and/or ballfields shall be depicted in 2' contours with spot elevations at the middle and perimeter lines.
7. Utilities: Location of all utilities including main irrigation lines, feeder irrigation lines, drains and drain lines, water, sewer and electrical feeder and branch lines, conduits, ballfield light conduits, phone and data lines. Include depth of burial of all underground facility.

Chapter 3 Site Preparation & Earthwork

3.1 EARTHWORK

3.1.1 GENERAL

All work under this section is subject to the provisions of Chapter 1 General References for All Sections.

3.1.2 Scope:

- 3.1.2.1. Review all Drawings and all Sections of these Standards for provisions affecting the work under this scope.
- 3.1.2.2 Review all applicable drawings for environmentally sensitive areas and WETLAND delineation. The Contractor shall use extreme care to prohibit any disturbance or damage in these areas. The contractor is responsible for any damage resulted during the construction to these areas.

3.1.3 DEFINITIONS

Base Course The layer placed between the subbase and surface pavement in a paving system. Base Course (Un-treated Base Course): Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand, COMPLYING WITH ASTM D 2940.

Bedding: Fill material placed under, beside and directly over pipe, prior to subsequent backfill operations.

Borrow Soil Material obtained off-site when sufficient approved soil material is not available from excavations. Material such as river or lake deposit, cinders, or a soil mixture with a high organic content are **not allowed**. Borrow material SHALL be free of substances that:

1. Form putrefying (rotting) deposits
2. Form deleterious (harmful) deposits
3. Produce toxic concentrations or combinations that may be harmful to human, animal, plant, or aquatic life.

The following borrow materials that are not suitable for the growth of vegetation may be used:

1. Recycled materials such as coal combustion products, recycled foundry sand, granulated slag, etc.
2. Dune sand
3. Other granular material

ALL BORROW MATERIAL IS REQUIRED TO BE CERTIFIED BY A PROFESSIONAL ENGINEER REGISTERED IN THE COMMONWEALTH OF VIRGINIA.

Construction Facilities: Access roads, parking, progress cleaning, project signage, and temporary buildings.

Engineered Compacted Fill: Granular soil having a maximum size of 6" with less than 30% passing a No. 200 sieve. Material passing a No. 200 sieve shall have a plasticity index of less than 6.

Excavation: An **Excavation** is any man-made cut, cavity, trench, or depression in an earth surface that is formed by earth removal. A **Trench** is a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth of a trench is greater than its width, and the width (measured at the bottom) is not greater than 15 ft . If a form or other structure installed or constructed in an excavation reduces the distance between the form and the side of the excavation to 15 ft or less (measured at the bottom of the excavation), the excavation is also considered to be a trench. All excavation REFERENCED IN THIS MANUAL shall be defined as "Unclassified Excavation"

Filtering Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 50 sieve.

Gravel Washed, loose or unconsolidated deposit of rounded pebbles or boulders GRADED PER ASTM D 2487. Soil Classification Groups GW, GP, GM free of rock or gravel larger than 2 inches in any dimension

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

Pervious Material: Evenly graded mixture of natural or crushed gravel or crushed stone and natural sand.

OVER EXCAVATION REMOVAL OF materials beyond indicated subgrade elevations or dimensions without direction by PRCS. THE OVER excavations, as well as THE remedial work directed by THE ENGINEER OR PRCS , shall be PERFORMED at the Contractor's expense.

OWNER, WHEN REFERENCED IN THIS MANUAL IS THE PRCS OR PRCS REPRESENTATIVE.

ROCK EXCAVATION, Rock excavation consists of the excavation of igneous, metamorphic, and sedimentary rock and boulders or detached stones having a volume of 1/2 CU yd or greater. The material for this type of excavation is

removed by blasting, by power shovel with a bucket that has a minimum capacity of 1 CU. yd, or by other equivalent powered equipment.

Satisfactory Soil Materials,: Soils MATERIALS CLASSIFIED UNDER ASTM D 2487 Soil Classification Groups AS GW, GP, GM, SW, SP, and SW, SP AND SM; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, or other deleterious matter. THE MATERIAL SHALL BE APPROVED FOR use by A Geotechnical Engineer or Testing Agency, TO establish grades within limits of buildings, paved areas, athletic fields, grass areas, etc.

Structural Backfill Materials, ACCEPTABLE soil materials free of debris, waste, frozen materials, vegetation and other deleterious matters.

Subgrade The layer that lies below the foundation OR pavement and can either occur naturally or be constructed.

Subbase The layer placed between the subgrade and THE base course Sub base is a naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand complying with ASTM D 2940.

Structures , Buildings AND ALL ITS ASSOCIATED COMPONENTS, BACKSTOPS, FENCES, WEIR STRUCTURES, retaining walls, slabs, ABOVE AND BELOW GRADE tank supports, curbs, FLAG POLES, LIGHT POLES, mechanical and electrical appurtenances, and other man-made stationary features constructed above or below ground surface.

Structural Fill Materials: Structural fill is typically a screened earthen material used to create a strong, stable base. For example, IF THE native soil at a site IS too weak to support a structure, the native soil is replaced by compacted APPROVED structural fill to provide the needed bearing capacity. THE STRUCTURAL FILL IS ALSO USED TO fill trenches and other excavations that will support roadways or other structures when completed.

Temporary Controls are Barriers, enclosures and fencing, protection of the Work, and water control.

Temporary Utilities INCLUDEs providing temporary utility services such as Electricity, telephone service, water, and sanitary facilities.

UNCLASSIFIED EXCAVATION Unclassified excavation consists of the excavation of and proper disposal of any type of material that is encountered during the progress of the work.

Unsatisfactory Soil: SOILS CLASSIFIED UNDER ASTM D 2487 Soil Classification Groups GC, SC, ML, MH, CL, CH, OL, OH, and PT (A special

classification, reserved for the highly organic soils, such as peat, which have many undesirable engineering characteristics).

Utilities ALL on-site underground pipes, conduits, ducts, and cables, as well as ALL ground services within building lines.

3.1.4. EXISTING CONDITIONS

3.1.4.1 Existing Utilities: THE Existing utilities serving facilities OR PORTION OF THE FACILITIES THAT ARE NOT UNDER THE CONSTRUCTION, occupied by PRCS or others SHALL not BE INTERRUPTED.

EXCEPTION: THE UTILITY MAY BE INTERRUPTED ONLY WHEN permitted in writing by PRCS. HOWEVER, AN ACCEPTABLE TEMPORARY UTILITY SERVICE SHALL BE PROVIDED. REMOVE THE EXISTING UNDERGROUND UTILITIES FROM THE SITE, AS INDICATED ALL UTILITY SHUT OFFS SHALL BE Coordinated with THE utility Companies.

3.1.4.2 The surveyor or the Engineer of the record shall survey the locations of all private and public underground utilities for record. The location of all underground utilities shall be shown on as-built drawings. A detectable warning tape shall be placed over all utilities.

3.1.4.2.1 Warning Tape placements:

Install warning tape directly above utilities, sleeves and conduits placed 12 inches below finished grade.

Place warning tapes six (6) inches below subgrade under pavements and slabs.

3.4.2.2 Detectable warning tapes shall comply with the following, Acid-and alkali-resistant polyethylene film warning tape, manufactured for marking and identifying underground utilities, six (6) inches wide and four (4) mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 2'-6" deep.

Tape Colors: Provide tape colors to utilities as follows:

- 1 Red: Electric
- 2 Yellow: Gas, oil, steam, and dangerous materials.
- 3 Orange: Telephone and other communications.
- 4 Blue: Water systems.
- 5 Green: Sewer systems.

3.1.5 Temporary Utilities/Barriers:

The contractor is responsible to provide temporary utilities and safety and erosion control barriers at the site prior to any site work.

3.1.5.1 TEMPORARY ELECTRICITY

The contractor shall not assume that it is allowed to use the existing utilities, to remain, at the site. The use of the existing

utilities during construction is only allowed with prior approval and as discussed during the pre-design meeting.

3.1.5.1.1 The contractor is responsible for electrical service, at Contractor's option.

3.1.5.2 To prevent power interruption provide Temporary electric feeder from electrical utility

3.1.6 PROTECTION OF TREES TO REMAIN

3.1.6.1 The Contractor shall be responsible for the protection of tops, trunks and roots of existing trees that are to remain. If damaged the contractor shall box and protect the damaged areas (i.e., no standing water or stock piles of topsoil permitted within branch spread of trees).

3.1.6.2 Dead branches and limbs interfering with the construction shall be removed without injury to the trunks as directed by PRCS.

3.1.6.3 The contractor shall repair any tree, to remain, during construction by a competent arborists, at his/her expense.

3.1.6.4 Trees damaged beyond repair shall be grubbed and removed at the Contractor's expense and replaced per PRCS requirements.

3.1.7 STRIPPING OF TOPSOIL

The contractor shall strip, store and re-spread topsoil in designated areas of grading and construction and shall perform all rough and fine grading required to complete work as shown on the approved drawings.

3.1.7.1 Where required the contractor shall remove topsoil. The Grass and similar light organic matters shall be left to decompose with the topsoil. All topsoil (including sod) shall be reused on the project when specified.

3.1.7.2 Top soil shall be stored separately from the rest of the excavated materials to be used for backfill, and sub-base material and shall be stored in-stock piles at the site. The stockpiling of such materials shall be at location identified at pre-construction meeting and as noted on project checklist.

3.1.7.3 Unless requested by PRCS any excess top soil or sod not required for the job shall be removed from the site and disposed of by the Contractor as required by the Virginia Erosion and Sediment Control Regulations regarding offsite areas.

3.1.7.4 Topsoil shall not be placed when either the topsoil or subgrade is frozen, excessively wet or in a condition otherwise detrimental to the proposed planting or to proper grading.

3.1.8.BARRIERS and Fencing

3.1.8.1 Provide Construction barriers to prevent unauthorized entry to construction areas, and to protect new facilities from damage from construction operations.

3.1.8.2 Provide temporary Safety barriers around all excavations during construction to prevent accidents.

- 3.1.8.3 Provide barricades as required by governing authorities for public rights-of way and for public access.
- 3.1.8.4 Provide erosion control devices, for vegetation to remain, in accordance with the Virginia State Erosion and Sediment Handbook and Loudoun County Codified Ordinance 1220.
- 3.1.8.5 Provide barriers to Protect non-owned vehicular traffic, stored materials and equipments, the site and structures from damage, theft or vandalism.
- 3.1.8.6 Contractor shall use construction fencing as required t
- 3.1.8.7 Safety fence shall be required when working within a residential or highly-trafficked busy commercial area.

3.1.9 EROSION AND SEDIMENT CONTROL

The work consists of the construction and maintenance of erosion and sediment control devices, and temporary seeding and mulching.

- 3.1.9.1 Erosion and sediment control devices SHALL be constructed prior to any land disturbance. The Construction of the devices shall conform to the Virginia Erosion and Sediment Control Handbook and the Loudoun County Codified Ordinance 1220.
- 3.1.9.2 If permanent stabilization cannot be provided, temporary seeding and mulching shall be provided, at the direction of PRCS Project manager. However, the permanent stabilization of graded areas shall be done as soon as possible after construction.
- 3.1.9.3 For permanent seeding and mulching, see ATHLETIC FIELD TURF **Section xxx** EROSION AND SEDIMENT CONTROL DEVICES.
- 3.1.9.4 The contractor shall provide erosion and sediment control devices as shown on the plans and Erosion and Sediment Control Narrative on approved plans.
- 3.1.9.5 The contractor agrees to hold PRCS harmless from any and all liability or damages that may arise out of a violation of the Virginia Erosion and Sediment Control requirements and agrees to indemnify them against any loss.

3.1.10 drainage ditches and swales

Provisions for open site drainage will be in accordance with the current Loudoun County Facilities Standards Manual (FSM) and the Virginia Erosion and Sediment Control Handbook. The work consists of building open drainage ditches and swales in according with the approved plans.

3.1.10.1 Open Drainage ditches

This section provides guidelines for constructing concrete drainage ditches on PRCS sites per approved plans.

3.1.10.1.1 Quality Control

- 3.1.10.1.1.1 Positive drainage must be achieved throughout the site.
- 3.1.10.1.1.2 Stabilization measures for areas of poor drainage shall be coordinated through PRCS project manager

responsible for the site and shall take into consideration maintenance programs required for that area.

3.1.10.1.1.3 Open channels within the active recreational use areas shall conform to the current FSM section on OPEN DRAINAGEWAYS.

3.1.10.1.1.4 Where open channels exist within the recreational use areas, the pedestrian access shall be clearly delineated by means of walkways or footbridges to minimize damage to the drainage ways and reduce potential injuries.

3.1.10.1.1.5 If topography prohibits, the culvert outfalls shall be located a minimum of 100 feet from the perimeter of a field's playing surface or play apparatus area.

Exception: outlet protection shall be provided with alternative materials meeting the required standards for erosion and sediment control. Rip-rap shall be avoided, as it may cause hazards and injuries

3.1.10.1.2 Safety measures such as handrails or fencing may also be required. All safety measures' design shall be based on the anticipated use and shall be coordinated with PRCS project manager.

3.2 PAVED DITCH

This section provides guidelines for constructing concrete drainage ditches on PRCS sites per approved plans

3.2.1 Quality Control

Concrete shall be Class A as specified in CAST IN PLACE CONCRETE, Section XXXX.

3.2.1.1 Sub-grade shall be constructed to the required elevation below the finished surface of the paved ditch in accordance with the dimensions and design shown on the approved plans.

3.2.1.2 All soft and unsuitable materials shall be removed and replaced with an approved material that shall be compacted in accordance with ASTM D- 698, and graded to a smooth surface.

3.2.1.3 The contractor is responsible to remove all excavated materials from the site unless directed by PRCS Project Manager.

3.2.1.3.1 The subgrade shall be moistened prior to placing the concrete.

3.2.1.3.2 Form ditches in accordance with the approved plans. All forms shall be inspected before the placing of concrete.

3.2.1.3.3 The finished surface of the paved ditch shall be smooth. No section shall be less than five feet.

3.2.1.3.4 Provide construction joints as required.

3.2.1.3.5 Provide bituminous expansion material per applicable standards and extend to the full depth of the slab. The expansion joint filler shall conform to (TITLE) of the VDOT Specification.

3.3 FAIR WEATHER STREAM CROSSING

3.3.1 The work consists of the layout and construction of the concrete fair weather stream crossings including related clearing excavation, grading, stream diversion (where necessary), form work, pouring, finishing and stabilization to construct in place a finished structure as shown on the drawings.

3.3.2 GENERAL

All work under this section is subject to the provisions of Chapter 1, General References for All Sections.

3.3.3 REQUIREMENTS

3.3.3.1 The Fair Weather Stream Crossing shall be done in accordance with federal, state and local regulations.

3.4.1 SUBSURFACE DRAINAGE

The work includes, but is not limited to, the provision of all material, services, labor, and equipment necessary to construct the subsurface drainage system. The Contractor shall make adjustments as directed, and as required by field conditions to provide a properly functioning installation at all times.

3.4.1.1 Material

3.4.1.1.1 Geosynthetic Filter Fabric shall be non-woven fabric as recommended in the specifications.

3.4.1.1.2 Aggregate shall be per VDOT No. 57 aggregate.

3.4.1.1.3 Drain Pipe shall be perforated, corrugated, polyethylene plastic pipe.

3.4.1.2 Quality Control

3.4.1.2.1 Trench excavation shall be of necessary depth for proper installation of the drain.

3.4.1.2.2 The bottom of the trenches shall be graded and sloped on a continuous grade with no reverse grades or low spots.

3.4.1.2.3 The trench shall not be left open. The contractor shall not trench more than what can be completed at the end of the day.

3.4.1.2.4 The Contractor shall remove all encountered material of every description prior to drain installation clean the length of the trench of all materials.

3.4.2 Drain

3.4.2.1 Drain Installation place the filter fabric at the bottom of the trench. The fabric shall be of sufficient width to completely (wrap) envelope the aggregate per approved plans and specifications

3.4.2.2 The coarse aggregate will be placed on the filter fabric to the depth and width shown on the plans.

- 3.4.2.2.1 The filter fabric will be wrapped around the aggregate and will overlap 12 inches over the top of the aggregate.
- 3.4.2.2.2 Backfill material will be placed in the trench and brought to grade as shown on the plan.
- 3.4.2.2.3 The drain shall be daylighted to an adequate drainage area as shown in the drawings.

3.4.3 Testing and Inspection Service:

THE OWNER may employ a qualified independent engineering testing agency to protect the owner's interest AT DIFFERENT PHASES OF CONSTRUCTION. The engineering testing agency is responsible to inspect the project as required, to perform testing of materials and/or compaction as required, and to prepare testing and inspection reports on a daily basis. The third party is also responsible to notify the owner of any deficiencies observed during the project and if requested, by the owner, provide solutions to resolve the field issues. The testing agency also certifies the compliance of the materials and THEIR COMPLIANCE WITH the ENGINEER'S RECOMMENDATIONS, DRAWINGS AND SPECIFICATIONS.

- 3.4.4 A soil survey may be made to obtain the necessary information concerning the types and extent of soils that may be encountered in a project by a licensed Geotechnical Engineer. The extent of the survey and the amount of sampling shall depend largely on the size of the project and the character of the soils in the area. The drilling results or the Geotechnical Report shall determine the suitability of soils and the construction methods and equipment required for the Project.

3.5 PROGRESS CLEANING

- 3.5.1 The Contractor is responsible to maintain the construction site in a clean and orderly condition, free of waste materials, and debris.
- 3.5.2 The contractor is responsible to remove accumulated waste materials, and debris from work site, from adjoining property, and staging area, as required but not less than once a week to disposed of off-site.

3.6 SCOPE

The work covered by this Article consists of ALL SITE RELATED items and are as followed:

- 1. Clearing and grubbing.
- 2. Preparing and grading subgrades for slabs-on-grade, walks, pavement, and landscaping.
- 3. Excavating and backfilling for buildings and structures.
- 4. Gravel and moisture-control fill course for slabs-on-grade.
- 5. Sub-base course for walks and pavement.
- 6. Excavating and backfilling trenches within building lines.
- 7. Excavating and backfilling for underground mechanical and electrical, utilities and appurtenances.

3.6.1 Clearing and Grubbing

This work consists of clearing, grubbing, removing, and disposing of all vegetation and debris within the limits of construction unless otherwise indicated as to remain.

- 3.6.1.1 The project manager shall conduct a site visit with the Contractor to review and discuss all areas on the Project that requires clearing and grubbing.
- 3.6.1.2 The project manager shall review all the required equipment that the Contractor plans to use. The Contractor shall not be allowed to continue to use any equipment that may delay the project's progress.
- 3.6.1.3 The contractor shall review all right-of-way provisions within the Contract for any special treatment of items and areas that are to be left undisturbed. The Contractor shall plainly mark all areas, single items, or groups of items that are to be left undisturbed. These areas shall be designated either on the Plans, in the right-of-way provisions, or by direct order from PRCS.
- 3.6.1.3 The Contractor shall clearly mark trees that are to remain standing with flagging or taping.
- 3.6.1.4 The Contractor shall not begin clearing and grubbing, or any other work, until it has installed all required erosion and sediment control measures. The project manager should ensure that all erosion and sediment control installations are complete and in accordance with the Plans and Specifications before allowing the Contractor to proceed with clearing and grubbing.
- 3.6.1.5 The Contractor shall not be allowed to use equipment that may damage the structures.
- 3.6.1.6 The Contractor shall completely dispose of all tree and plant growth removed during clearing and grubbing in accordance with the Specifications.
- 3.6.1.7 The Contractor shall follow the Specifications regarding the filling of all depressions made after removal of tree stumps or other causes.
- 3.6.1.8 Trees that are designated to remain but have been damaged must be satisfactorily repaired in accordance with the Specifications.
- 3.6.1.9 The Contractor shall be responsible for disposing of all material removed during earthwork operations. The disposal site shall be approved by the Engineer before the Contractor dispose of any material on that site.

3.6.2 STRIPPING OF TOPSOIL

The Contractor shall strip, store and re-spread topsoil in designated areas of grading and construction and shall perform all rough and fine grading required to complete work as shown on the approved drawings.

- 3.6.2.1 Where required the contractor shall remove topsoil. The Grass and similar light organic matters shall be left to decompose with the topsoil.

- 3.16.2.2 All topsoil (including sod) shall be reused on the project when specified.
- 3.6.2.2 Top soil shall be stored separately from the rest of the excavated materials to be used for backfill, and subbase material and shall be stored in stockpiles at the site. The stockpiling of such materials shall be at location identified at pre-construction meeting and as noted on project checklist.
- 3.6.2.3 Unless requested by PRCS any excess topsoil or sod not required for the job shall be removed from the site and disposed of by the Contractor as required by the Virginia Erosion and Sediment Control Regulations regarding offsite areas.
- 3.6.2.4 Topsoil shall not be placed when either the topsoil or subgrade is frozen, excessively wet or in a condition otherwise detrimental to the proposed planting or to proper grading.

3.6.3 Disposal of Materials.

The Contractor is responsible for disposing of all material removed during earthwork operations. The disposal site must be approved by the Engineer before the Contractor may dispose of any material on that site. The materials may be disposed of in the following manners:

3.6.3.1 Chipping.

If the chips are to temporarily remain on the project site, the location shall be coordinated with the Contractor, subcontractors, and utilities. Chip piles should never remain for an extended period of time on the site.

3.6.3.2 Burning of Timber. The Fire Marshall's Office has regulations regarding open burning. The Contractor shall obtain approval from the owner as well as the Fire Marshall's offices before burning any timber.

Burning will never be permitted near or under utility lines.

Exceptions: The following instructions may be used only when they are not in conflict with the stated regulations and permits:

1. In areas where burning is not prohibited or where smoke will not present a problem to combustible materials such as trees, limbs, stumps, and brush are normally burned within the limits of construction.

3.6.3 2.1 Burning within the right-of way shall be under the constant care of competent certified watchmen. The burning shall not damage the surrounding timber, grassland, and adjacent properties, will not be injured.

3.6.3 2.2 The Contractor shall notify the State Fire Marshall when burning is about to commence. The Fire Marshall may place restrictions on the manner and timing of the burning.

- 3.6.3 2.3** The owner and the owner's representative shall ensure that the Contractor understands the Fire Marshall's requirements. Notification must be given to the 911 office prior to any open burning.
- 3.6.3 2.4** The contractor and owner should become familiar with all State and local fire ordinances and regulations in the area where the Project is located.
- 3.6.3.2.5** Adequate basic firefighting equipment should always be available.

3.6.4 Blasting

Before the blasting operation, a certified /licensed blasting contractor shall obtain a blasting permit from the Fire Marshall's office. The Blasting operations shall always be conducted in a careful, supervision of the certified contractor to prevent damage to adjacent property and injury to people.

3.6.5 Tall Timber

Clearing and grubbing operations, in dense, tall timbered regions, shall be performed such that the Contractor's operation do not endanger anyone working in the area, result in potential hazards to public, or damage to existing facilities in or adjacent to the areas being cleared.

3.6.6 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

This work consists of,

- 3.6.6 1** Prior to demolition and mobilization the Contractor is responsible to contact the Miss Utility to Mark the fields.
- 3.6.6.2** Prior to demolition the contractor shall notify, in writing, PRCS and each of the utility companies owning or controlling services or appurtenances which may be affected by the work. Sufficient notice shall be given to allow utilities disconnect and removal. The contractor is responsible to coordinate the notices and utility's work.
- 3.6.6.3** Copies of all notices signed by the utility company shall be furnished to PRCS as proof of receipt.
- 3.6.6.4** Removal, wholly or in part, and satisfactory disposal of all structures, and other obstructions which are not designated to remain.
- 3.6.6.5** All demolished buildings shall become the property of the Contractor and shall be disposed of off-site, unless otherwise proffered or noted at preconstruction meeting.
- 3.6.6.6** Burning shall not be permitted unless previously approved by Fire Marshall's Office and PRCS.
- 3.6.6.7** Salvaging of designated materials and backfilling of resulting cavities.
- 3.6.6.8** All designated salvageable materials shall be removed, without unnecessary damage, in sections or pieces that may be readily transported.

- 3.6.6.9 The salvaged materials shall be stored by the Contractor at specified locations within the construction limits unless directed otherwise by the owner or the owner's representative.
- 3.6.6.10 Steel structures that are removed and are required to be salvaged should have matching components clearly marked immediately prior to disassembly.
- 3.6.6.11 The Project Manager should study all specifications before the Contractor proceeds with this type of work.
- 3.6.6.12 Engineer/surveyor to provide a preliminary cross sections for excavation of structures after the old structure has been removed. This is to prevent double payment of the excavation.
- 3.6.6.13 All paved concrete slabs resting on the earth, forming walks and driveways, or first floor slabs of buildings without basements shall be demolished and removed from the site.
- 3.6.6.14 Any building scheduled for demolition shall be offered to the Loudoun County Department of Fire, Rescue, and Emergency Management for potential training opportunities prior to final disposal of cleared material.

3.7 Excavation

3.7.1 Excavation involves loosening, digging, loading, hauling, and disposing of material obtained from roadway cuts, channel changes, ditches, structure foundations, and borrow pits. Disposal of the material is accomplished by incorporating it or wasting the amount that is surplus or of an unsuitable nature. This item of work includes constructing, shaping, and finishing all earthworks as shown on the Plans, and with the Specifications. Excavation and embankment work follows clearing and grubbing. FOR ALL PRACTICAL PURPOSES all excavations are assumed to be unclassified.

- 3.7.1.1 Do not proceed before the area to be cut has been cross sectioned.
- 3.7.1.2 Prior to start of work, review the Plans with all involved parties shall to determine the limits of excavation, the depth of cut, the length of cut, the top and bottom of the slope, and any other details relative to the cut and to ensure that all excavation is being accomplished in accordance with the lines, slopes, and grades shown on the Plans.
- 3.7.1.3 Re-use all suitable excavated material to shape and form grades and backfill. Do not dispose of suitable materials.
- 3.7.1.4 Dispose of all unsuitable material as specified.
- 3.7.1.5 Third party inspector and the project manager to check the final condition of all cut slopes and suggest remedies to stabilize the slopes as required.
- 3.7.1.6 Project manager to note all trees close to the top of the slope or trees with damaged roots should be inspected for possible removal.
- 3.7.1.7 The Third Party Inspector should be alert to the following and notify PRCS and the engineer of the record immediately:

- 3.7.1.8 Contractor and the third party inspector to note and observe presence of underground springs or excess surface water which can affect the construction.
- 3.7.1.9 Any seepage in the slopes should be noted. This seepage should be kept under observation. If seepage continues or increases.
- 3.7.1.10 Erosion from excess surface water should be noted and observed, and a solution should be sought.
- 3.7.1.11 As a safety precaution, both during and after construction, remove all loose boulders and debris from cut slopes.
- 3.7.1.12 Inspect the face of the rock, after blasting, for loose materials or for unstable rock formation or strata. Removal of these materials shall be considered from three standpoints: safety, appearance, and economy.
- 3.7.1.13 Before acceptance, all cut slopes should be cleaned of loose rock, cleared of obstructions, and left in a neat, trimmed condition.

3.7.2 Rock excavation

- 3.7.2.1 Rock excavation consists of the excavation of igneous, metamorphic, and sedimentary rock and boulders or detached stones having a volume of $\frac{1}{2}$ yd³ or greater. The material for this type of excavation is removed by blasting, by power shovel with a bucket that has a minimum capacity of 1 yd³, or by other equivalent powered equipment. Unless otherwise specified or directed, the following criteria is used in excavating the material.
- 3.7.2.2 Exploratory drilling shall be required to determine the existence of cavities and possible sink holes in cut sections. These drilling holes are 1 1/2 in. in diameter, and drilled on centerline at 100 ft intervals to a point which is 7 ft below the proposed grade. If a cavity or sink hole is found then additional holes may be drilled at 25 ft intervals to the same depth below grade or as required by the engineer.
- 3.7.2.3 The rock may be pre-split by the use of drilling and explosives. The explosives and the method of loading depend on the type of material to be blasted.
- 3.7.2.4 The Contractor is required to restrict the amount of explosives used near structures, rock formations, or other property that may be damaged.

3.7.3 Rock Excavation Requirements.

Unless otherwise specified, excavation in solid rock should extend at least 6" below the subgrade. These cuts below grade should be backfilled with material that is in conformance with the Specifications. Isolated rock or portions of large boulders that are exposed should be removed to a depth of not less than 6" below the subgrade elevation. Following the removal and replacement of unsatisfactory subgrade materials, the subgrade should be scarified and all deleterious material removed. Large stones should be broken down or removed from the top portion of the subgrade. The loose material should be brought to the proper moisture content and

compacted. The stability of the roadbed and subgrade should be maintained as existing conditions may require until the pavement section is placed.

3.8 PEAT EXCAVATION

Peat is an unstable and unsuitable material that is subject to settlement when additional load is placed to the deposit. Therefore, peat shall be removed from under foundations, roadways, walkway bases, and etc. Peat excavation involves the removal and satisfactory disposal of peat, marl, or any other unsuitable overlaying materials. The methods of removal may be as directed by the third party engineer and or as specified in the soils report, if one is available.

3.9 Protection of Property.

3.9.1 The property shall be protected during excavation from the start and during all construction phases including the clearing and grubbing. All private properties adjacent to the excavation must be protected from damage by the Contractor's equipment.

3.10 Excavation for Structures;

3.10.1 Excavation for structures, pavements, and walks shall indicate elevations and dimensions. The excavations shall be extended or expanded for placing and removing concrete formwork, for installing services/utility lines and other constructions, and for inspections.

3.10.2 GENERAL

All work under this section is subject to the provisions of Chapter 1 General References for All Sections.

3.10.3 SCOPE

3.10.3.1 This work consists of the excavation, removal, and replacement or disposal of all materials necessary for the construction of the structures.

3.10.3.2 The work also consists of placing and compacting backfill material, furnishing and placing shoring, sheeting, bracing, and dewatering and total or partial demolition of the structures.

3.10.3.3 A preliminary cross sections of the structures shall be taken. After the excavation, to prevent double charging.

3.10.3.4 The excavation pit for a structure should be adequate to accommodate the structure to be installed.

3.10.3.5 The excavation shall provide sufficient space for working, forms and bracing.

3.10.3.6 The size of the excavation shall be kept as small as possible to prevent further disturbance to the undisturbed natural ground under and at the sides of the structure.

3.10.4 Material

3.10.4.1 The excavated material may be classified as followed:

3.10.4.1.1 SUITABLE MATERIAL

If the material removed is suitable, then the material may be used for construction of special fills, or other places as specified or directed depending on the nature of the fill.

3.10.4.1.2 UNSUITABLE MATERIAL

If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace those materials with satisfactory soil materials, AS APPROVED BY PROFESSIONAL ENGINEER OR THE THIRD PARTY ENGINEER. If the planned grade is undercut for any reason, the amount undercut must be measured. If the undercut area has been approved by the third party and the owner then, the record should be properly documented by the third party engineer and the project manager.

3.10.4.1 Borrowed material

The requirements for borrow material shall be as followed:

3.10.4.1.1 Borrow should be free from organic material, leaves, grass, roots, and sewage.

3.10.4.1.2 Borrow should be free from over sized rocks and foreign matters.

3.10.4.1.3 In general, granular soil is desirable.

3.10.4.1.4 No spongy, wet, or frozen material should be used. The materials specification for borrow to be used as embankment is extremely flexible; therefore, the burden of constructing a successful embankment is on material placement and compaction rather than on the material alone. Borrow may be any soil that does not contain organic material, leaves, grass, roots, sewage, boulders, or foreign matter.

3.11. Stability of Excavations

3.11.1 Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations. Cut the sides of all excavations to prevent caving. Do not disturb the material below the bottom of footings.

3.11.2 Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to workers is not permitted except when the excavation is entirely in stable rock or a support system such as underpinning is provided to ensure employee safety and stability of the structure or a registered professional engineer (PE) has approved and determined that the structure is far enough away from excavation activity or that such excavation work will not pose a hazard to workers.

3.11.3 Daily inspections of excavations, the adjacent areas, and protective systems must be made by a competent person for evidence of a situation that could

result in possible cave-ins, failure of protective systems, hazardous atmospheres, or other hazardous conditions.

- 3.11.4 Excavations subject to heavy rain runoff are to be inspected by a competent person and, as necessary, precautions instituted to protect against the hazard. Inspections shall be made after every rainstorm or other hazard-increasing occurrence.

3.12 Excavations for Footings and Foundations (SOILS)

- 3.12.1 The bottom of the excavation shall not be disturbed. If necessary, excavate by hand to final grade just before placing concrete reinforcement. In case of disturbance contact the engineer of the record or the third party engineer for solution.

- 3.12.1.1 The elevations of the bottoms of footings as shown on the plans are approximate and they may change by the design Engineer depending on the field condition.

- 3.12.1.2 Concrete shall not be placed until the depth of excavation has been checked and the suitability of the foundation material is approved.

- 3.12.1.3 When approved by the design engineer the foundation excavation may be trimmed to the exact size of the footing to omit footing forms.

- 3.12.1.4 Where foundation piles are used, the excavation of each foundation bed shall be completed before the piles are driven. After the pile driving is completed, loose and displaced material shall be removed or compacted to a smooth solid bed at or below plan elevation.

- 3.12.1.5 If the excavated material is suitable, per the third party engineer, then it may be used for backfilling, otherwise dispose of as directed and specified.

- 3.12.1.6 The Engineer and the County Inspector shall be notified as soon as each excavation is completed. Concrete or piling shall not be placed until the Engineer and the County Inspector determines that the depth and size of the excavation and the foundation bearing material is acceptable.

3.13 Direct Bearing Foundations and Spread Footings.

- 3.13.1 When structures are designed to bear directly on soil or rock, it is important that the material on which the structure is finally placed be better than the design value specified by the design engineer.

- 3.13.1.1 The boring logs shall be provided to the engineer of the record and or the third party inspector to review prior to excavation.

- 3.13.1.2 During excavation the third party inspector shall inspect the sample materials collected, during the boring/drilling and or the boring log, with the

excavated material and if different from the plans contact the design engineer for solution.

3.13.1.3 The contractor shall stop the construction and notify the Inspector and the design engineer once the desired depth of excavation has reached. The construction may continue only when the excavation inspection has passed.

3.13.1.4 If the bottom of excavation is below the planned grade, the area shall be backfilled only with approved material. Backfill material may be sub-foundation concrete or coarse aggregate, and must be in conformance with the Specifications.

3.13.2 FOUNDATION ON ROCK

When the foundations for structures are set on rock instead of soil, any rock excavation associated with foundation work should be done as directed by the DESIGN ENGINEER OR THE THIRD PARTY inspector WITH prior APPROVAL FROM THE DESIGN ENGINEER.

3.13.2.1 Rock foundations SHALL be cut to the intended shape of the proposed footing.

3.13.2.2 Rock foundations shall not be smooth, but shall be well keyed, stepped, or serrated to ensure footing does not move on the rock foundation when the structure is loaded.

3.13.2.3 THE Rock foundations for structures SHALL be examined by THE THIRD PARTY Inspection AGENCY prior to concrete placement.

3.13.2.4 IF blasting is REQUIRED to excavate rock, the work shall be done in accordance with the Specifications. The Inspector shall ensure that all material that becomes shattered or loosened has been removed PER the Engineer's directions.

3.13.2.5 Rock or other hard foundation material shall be free of loose material, cleaned, and cut to a firm surface. The surface may be level, stepped, or serrated as approved by the Engineer.

3.13.3 Excavation for Underground Tanks, Basins, and Mechanical or Electrical Appurtenances:

3.13.3.1 Excavate to elevations and dimensions as indicated on the design specifications and within the acceptable tolerances. Do not disturb bottom of excavations intended for bearing surface.

3.13.3.2 Trenches; excavate utility trenches to the indicated depths, and invert elevations of uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless stated otherwise.

3.14 Dewatering

- 3.14.1 Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, freezing temperatures or frost, and other hazards created by earthwork operations. Provide protective insulating materials as necessary.
- 3.14.2. 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.
- 3.14.3. Prevent surface water and ground water from entering excavations, ponding on prepared sub-grades, and from flooding Project site and surrounding area.
- 3.14.4. Protect sub-grades AND FOUNDATION from softening, undermining, washout, and damage by rain or water accumulation.
- 3.14.5 Provide, operate and maintain pumping equipment from excavations. This operation shall be coordinated with PRCS and in accordance with all applicable standards.

3.15 Storage of Soil Materials

- 3.15.1 Stockpile excavated materials that are acceptable for backfill, subbase and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing.
- 3.15.2 Place, grade, and shape stockpiles to drain surface water. Stabilize to prevent wind-blown dust in accordance with the requirements of Virginia Erosion and Sediment Control Handbook.
- 3.15.3 Stockpile soil materials away from edge of excavations. Do not store anything within the drip line of trees to be saved.
- 3.15.4 Excess subsoil shall be disposed of off the property by the Contractor.
- 3.15.5 Any subsoil removed from the site must be disposed of in a manner consistent with the Virginia Erosion and Sediment Control Regulations regarding offsite areas.

3.16 Below Grade Construction

- 3.16.1 Prior to Acceptance of construction below finish grade, where applicable, damp proofing, waterproofing, under the slab insulation (where required) and perimeter insulation shall be inspected and approved.
- 3.16.2 Waterproofing. Specifications for waterproofing concrete surfaces shall be per IBC (International Building Code) or an equal approved product listed by ICC-ES (international Code Council-Evaluation Services).
 - 3.16.2.1 The Project manager shall refer to the specifications for information as to the type of waterproofing material to be used.
 - 3.16.2.2 Prior to the application of the waterproofing or dampproofing materials, the surface of the concrete shall be prepared by filling Epoxy base fillers in cracks and voids and by removing all undesirable irregularities from the surface.

- 3.16.2.3 Waterproofing is to be accomplished when the weather is dry and the surface is dry and cured to the extent that no moisture exists in the concrete.
- 3.16.2.4 Contractor shall submit detail on the specific material used or applied for waterproofing to underground walls.
- 3.16.2.5 Care shall be taken to follow the manufacturer's literature as how to apply waterproofing or dampproofing to below grade walls.

3.17. QUALITY ASSURANCE

- 3.17.1 Meet with representatives of the governing authorities, AND ALL OTHER INVOLVED PARTIES such as all involved Consultants, and Testing Agency before THE START OF ANY EARTHWORK PROJECT DURING THE MEETING Review earthwork procedures and ASSIGNED responsibilities, including testing and inspection procedures and ALL OTHER requirements. Record discussions and agreements and furnish a copy to each ALL participant.

3.17.2 MATERIALS

- 3.17.2.1 BORROWED Soil Material USED TO FILL THE CUT AREAS. THE MATERIAL SHALL BE OF APPROVED EARTH MATERIALS SUCH AS SAND, GRAVEL OR MAY BE FROM OFF SITE SOURCES IF THE ON-SITE EXCAVATED SOIL IS NOT ACCEPTABLE. THE BORROW SOIL SHALL BE APPROVED BY AN ENGINEER PRIOR TO PLACEMENT AT THE SITE.

3.18 BACKFILLING FOR STRUCTURES

3.18.1 General

- 3.18.1.1. Properly backfilling structures such as box culverts, abutments, and retaining walls is essential to eliminate future settlement. Strict adherence to the Specifications with regard to lift thickness, moisture content, and density required should be maintained throughout the backfilling operation.
- 3.18.1.2 Fill material within the building perimeter and extending a minimum of 10-feet beyond the building's exterior walls shall be suitable excavated or approved borrowed material.

3.18.2 PLACEMENT

- 3.18.2.1 Backfill material shall be placed in horizontal layers in specified Thicknesses BEFORE COMPACTION.
- 3.18.2.2. The backfill operation shall be rejected because of the following:
 - 3.18.2.2.1 Oversized rocks shall be present in the fill material.
 - 3.18.2.2.2 Unsuitable or materials that are not approved are present in backfill materials.

- 3.18.2.2.3 If the fill material contains roots or other organic material, or is in some other way different from the approved material.
- 3.18.2.2.4 Fill activity is concentrated in one area (not evenly spread out).
- 3.18.2.2.5 Insufficient number of passes with the compactor is counted.
- 3.18.2.2.6 Lift thickness is in excess of the specification.
- 3.18.2.2.7 fill Material is placed on spongy, wet, or frozen ground.
- 3.18.2.2.8 If the backfill behind the foundation wall is placed before the ROOF OR FIRST FLOOR FRAMING or SLAB ARE IN-PLACE.

3.19 COMPACTION:

- 3.19.1 FILL areas ADJACENT TO ANY STRUCTURE SHALL BE COMPACTED, MANUALLY, OR WITH VIBRATING PLATE COMPACTORS, POWER TAMPERS, SELF PROPELLED VIBRATING ROLLERS OR ETC. DEPENDING ON THE TYPE OF BACKFILL MATERIAL AND DESIRED COMPACTION.
- 3.19.2 Project manager or the third party engineer shall reject any equipment that is not an approved equipment.

Exception:

Do not use SELF PROPELLED VIBRATING ROLLERS WITHIN 5 FEET OF ANY STRUCTURE.

- 1 Under athletic field areas, compact in accordance with the Athletic Field Fill Detail (See Drawing PF-10.0 in Appendix B).
- 2 Under structures, building slabs, steps, and pavements, compact the top 12 inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
- 3 Under walkways, compact the top six (6) inches below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.
- 4 Under turf or unpaved areas, compact the top six (6) inches
- 5 Below subgrade and each layer of backfill or fill material at 95 percent maximum dry density.

3.19.3 MOISTURE CONTENT:

FILL MATERIAL AT THE TIME OF COMPACTION SHALL BE SUCH THAT THE SOIL WILL FORM A BALL WHEN SQUEEZED IN HAND AND NO WATER IS OBSERVED. IF THE FILL MATERIAL BECOMES TOO WET ALLOW FOR IT TO DRY PRIOR TO COMPACTION.

- 1 Soil clogs the sheepsfoot roller or soil covers the steel-wheel roller.
- 2 Moisture content insufficient or excessive when.
- 3 Insufficient moisture is indicated by surface cracking or powdering.
- 4 Excessive moisture is indicated by pumping or weaving action.
- 5 Fill placement is adjacent to manholes, inlets, or similar structures where smaller.

3.19.3.1 Backfill and fill MATERIAL IN grass areas shall be satisfactory excavated or borrow soil materialS, approved by A Geotechnical Engineer or Testing Agency prior to placement.

3.20 Subgrade

3.20.1 Subgrade soils consist of the in-situ, prepared, and compacted soils below the structure that can affect the structural design. Before placement of the subgrade any unstable or soft areas should be corrected by removal and replacement of the unsatisfactory materials. Areas that appear to be excessively wet should be investigated for seepage and other sources of water. The inspector shall notify the owner and the Engineer of the record on any existing problem. Excavate to sub-grade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions. Notify PRCS when excavations have reached the required subgrade depth. Proof roll sub grades, before filling or placing aggregate courses.

3.20.2 General

The subgrade is prepared to supports the pavement, foundation and slab. To ensure the stability of the structures the subgrade is required to be constructed using certain proven procedures that provide satisfactory results.

1. Excavate to sub-grade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.
2. Notify PRCS when excavations have reached the required subgrade depth.
3. Proof roll sub grades, before filling or placing aggregate courses.
4. Test rolling or proof rolling is a loading test performed to evaluate the stability of subgrade to determine the location of

soft, unstable areas that may exist. Do not proof roll wet or saturated sub grades.

5. Provide a smooth transition between existing adjacent grades and new grades.
6. Use heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. The equipment should provide a load that will equal or slightly exceed the load on the subgrade of the finished structure.
7. The subgrade of any area which is to receive bituminous or Portland Cement paving shall be prepared in accordance with current VDOT Specifications (i.e., multi-use courts, tennis courts, roads, parking lots, curbing, concrete slabs, sidewalks, etc.).

3.20.3 Placing

Prior to placing the base course and after test rolling, the surface upon which the base or subbase material is to be placed shall be carefully examined.

1. Check the surface with a sight level or stringline to verify that it meets grade.
2. If soft spots, ruts, and grade deficiencies are observed, have the Contractor correct the deficiency by removing material, replacing material, or regrading where necessary.
3. The Contractor's personnel should develop a spread rate for the base course material prior to starting the spreading operation. The third party inspector shall check the spread rate.
4. The base and subbase material should not be dumped in piles but should be spread by the use of a spreader.
5. Precautions should be taken to avoid segregation of the material; If segregation does occur, the Contractor shall remix the aggregate by roto tilling, or other approved methods.
6. The third party Inspector shall be alert during placement to detect changes in the appearance of the material.
7. If silt, clay, and organic matters are present in the mix then , the mix shall be removed from the material.
8. Oversized rocks shall be removed, since uniform compaction is difficult to obtain if they are present also, the freezing and thawing may move the oversized rocks vertically, and ultimately producing bumps in the finished surfaces.

3.20.3.1 Sampling and Testing.

- 3.20.3.1.1 It is the third party testing engineer's responsibility to see that required samples are taken and tested prior to start of the next phase of construction. The Contractor shall allow

testing agency to test and inspect subgrade, before proceeding to next layer.

3.20.3.1.2 Perform Test rolling or proof rolling to evaluate the stability of subgrade and to determine the location of soft, unstable areas that may exist.

3.20.3.1.3 Do not proof roll wet or saturated sub grades.

3.20.3.1.4 Project may proceed only after test results for completed work comply with requirements and compaction test results are within the tolerances specified.

3.20.4 Quality Control:

The following are possible observations that may be made during test rolling, along with the possible corrective action to be taken (assuming proper loading is used on the roller).

1. Remove the identified soft spots, during the test rolling, and replace with suitable, compactable approved material.
2. The Third Party Inspector should fill out the Test Rolling Record form to document each test.
3. If the testing agency determines the subgrade have not achieved the required degree of compaction, he shall scarify and moisten, or remove and replace soil to depth required. The subgrade then shall be re-compacted and retested until specified compaction is obtained.

3.1 If the moisture is within the proper range and movement is observed, the subgrade should be investigated and the cause determined. If no movement is observed, the subgrade is acceptable.

3.2 If the moisture content is excessive and movement is observed, the moisture content must be lowered and the test rolling repeated.

3.3 If the moisture content is low, it must be increased before proceeding with test rolling. Otherwise, a false impression of stability could result and future movement or settlement may occur.

4. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by THE THIRD PARTY ENGINEER.

5. Protect the newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

6. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

7. Where settling occurs during the Project remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing. Per third party inspector's instruction.

8. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the extent possible.
9. Existing and newly installed utilities shall be protected and safeguarded from damage during grading operation; if damaged, the contractor is responsible repaired the damage immediately in like manner and materials.
10. The utilities shall not be placed in drainage divides and swales unless otherwise approved.
11. All utility stub-outs shall be coordinated with the utility company and the PRCS prior to placement.
12. All finished surfaces of base course shall be within tolerances as specified in the specifications and plans.
13. Refer also to Athletic Field Fill Detail PF-10.0 for additional specifications.

3.20.5 Checking Grade.

The third party inspector shall inspect the aggregate base course to ensure proper grade and shape of the finished surface. The grade may be checked in one of several ways:

1. Hand levels, for sights not exceeding a distance of 50'.
2. String lines, may be used when the distances are about 25' or less.
3. Engineer's level, to produce cross sections in order to check the grades. This method may be used on embankments, bases, subbases or any other course being placed that is to be parallel to the proposed profile grade.

3.20.6 RECORDS BY THIRD PARTY INSPECTION AGENCY.

3.20.6.1 The third party inspector shall keep a detailed **daily** record, with emphasis on recording all construction progress daily as it is performed, of all his/her observations, measurements, and directions. Written reports and records of the third party Inspector's observations and measurements shall remain as part of the permanent record.

3.20.6.1.1 The procedure to be used to document the base and subbase course construction follows:

1. The third party inspector shall make a written statement each time a series of grade checks is made. These statements should reflect the Inspector's work and findings. All Statements shall be recorded, dated, and signed on the appropriate form.
2. All notes and computations are to be retained and made a part of the Project records regardless of their form or condition.

3.20.6.2 Other records MAY INCLUDE

- 1 Soil Analysis Reports to show the quality of the material used.
- 2 Field density tests that shows the required compaction was achieved. This should also include tests for moisture content.
- 3 Measurements for final payment, such as cross sections, delivery slips, or in-place measurements as required. Record the results on the Inspector's Daily Report.

3.21 AGGREGATE BASE COURSE

3.21.1 General. This work consists of furnishing, placing, and compacting graded aggregate base course materials on a prepared subgrade or base. A base and subbase course is one or more layers of material placed on a prepared surface. Base courses are placed in various depth and width combinations, depending on the particular location and the existing soils conditions. If, due to field conditions, the depth and width of the base coarse needs to be modified, then the third party inspector shall inform the owner and the design engineer of the issues that require design changes.

A base course is constructed:

- 1 To distribute the loads.
- 2 To provide a free-draining material.
- 3 To provide a material that is not susceptible to frost and can support other base and surface courses.

3.21.2 Materials.

Typical materials used to construct subbase and base courses are borrow, sand, gravel, crushed stone, slag, a combination of these, or other readily available granular type materials. Generally, the base aggregate is of a higher quality material and usually requires some form of preparation such as a screening or crushing.

1. The Contractor shall provide material that meets or exceeds the gradation requirement stated in specification and plans. Changes to the gradation requirements may be allowed only if they are justified and are approved by the designer and the owner.
2. The third party inspector/engineer shall ensure that all preliminary tests have been made and properly documented and that the proposed material will be acceptable when placed.
3. Regardless of any difficulties obtaining materials, the Contractor shall not substitute any material for base course that is not in conformance with the Specifications.

4. The Contractor shall remove or upgrade the base material if substandard material or material not in conformance with the plan and specification is used.
5. The Contractor shall not knowingly haul substandard material onto the construction site with the intention of later upgrading to aggregate in place.

3.21.3 Placement

1. The third party Inspector shall not permit placement of any graded aggregate until the spreading and compacting equipment has been approved and the equipment is brought on site and the contractor demonstrated that it is operational.
2. When spreading graded aggregate base the material shall not become segregated, that is, the fine material should not become separated from the larger material.
3. The third party inspector and the contractor shall check the Plans and Specifications for depths of lift and compaction requirements.
4. When water is added to the graded aggregate material, it shall be done prior to compacting the lift. This moisture content is essential to good base course construction.
5. The base material moisture content shall be checked periodically to ensure that it is within the specified range of optimum.
6. Compaction of the base material can be accomplished with either a vibratory or static steel-wheel roller. Vibratory rollers are more efficient for compaction of densely graded base materials. Static rollers are less effective for full depth compaction, especially at depths greater than 4".
7. Rubber-tire rollers are useful in "sealing" the base course for asphalt treatment, if specified. Make sure that the Contractor doesn't over-roll the base course, as excessive rolling could "flush" fines to the surface, resulting in a poor bonding surface for asphalt or portland cement concrete courses.
8. Once the base course surface is compacted and on grade, the Contractor shall be discouraged from hauling or allowing traffic on the completed base course prior to paving to prevent contamination.
9. Place aggregate Under slabs-on-grade, on prepared subgrade.
10. Compact aggregate fill to required cross sections and thickness.
 - 10.1 When compacted thickness of gravel fill is six (6) inches or less, place materials in a single layer.
 - 10.2 When compacted thickness of gravel fill exceeds six (6) inches thick, place materials in equal layers, with no layer more than six (6) inches thick or less than three (3) inches thick when compacted.

3.21.4 Bedding Course:

- 3.21.4.1 Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand placed over the

excavated subgrade in a trench before laying pipe AND GRADED BASED ON ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve. IT IS USED TO PROVIDE FIRM AND EVEN BEARING AREA FOR PIPES, AND ETC.

3.21.5 Installation

1. Excavate pipe trench in accordance with the approved plans and specifications. The excavation may be hand trimmed for accurate placement of pipe to the required elevations as indicated.
2. Place bedding material at trench bottom, level materials in continuous layer not exceeding eight (8) inches compacted depth.
3. Maintain optimum moisture content of bedding material to obtain the required compaction density to within established tolerances.
4. In areas to receive landscaping, remove to depth appropriate to accommodate root ball / planting.

3.22 EXTERIOR DEMOLITION

3.22.1 GENERAL

All work under this section is subject to the provisions of Chapter 1, General References for All Sections.

3.22.2 Demolition:

- 3.22.2.1 Building foundation walls shall be demolished to four feet below the proposed line of finished grade.
- 3.22.2.3 All paved concrete slabs resting on the earth, forming walks and driveways, or first floor slabs of buildings without basements shall be demolished and removed from the site.
- 3.22.2.4 Any building scheduled for demolition shall comply with the following:
 1. Shut off all utilities.
 - 1.1 The Contractor shall notify in writing each of the utility companies owning or controlling any services or appurtenances which may be affected by the work and PRCS. Sufficient notice shall be given to permit utilities removal of meters, wires, poles, etc. Contractor is to coordinate notice and utility's work.
 - 1.2 Copies of notices signed by the utility company shall be furnished to PRCS as proof of receipt.
 - 1.3 Obtain all required permits.
 2. Full demolition permit to be obtained by Loudoun County Department of Land and Building Development.

Exception:

The structure may be offered to the Loudoun County Department of Fire, Rescue, and Emergency Management for potential training opportunities prior to final disposal of cleared material.

3.22.3 DISPOSAL OF CLEARED MATERIAL

1. All demolished buildings shall become the property of the Contractor and shall be disposed of off-site, unless otherwise proffered or noted at preconstruction meeting.
2. Burning shall not be permitted unless previously approved by Fire Marshall Office.
3. The Contractor shall be required to clear and dispose off-site all debris and unsuitable materials stored at the site, as a result of demolition, backfilling, and rough grading.

3.22.4 WATER CONTROL

- 3.22.4.1 Grade site to drain. Maintain excavations free of water. Provide, operate and maintain pumping equipment. Pumping of water from excavations to be coordinated with PRCS in accordance with State standards.
- 3.22.4.2 Protect construction area from puddling or running water.

3.23 CLOSED STORM DRAINAGE SYSTEMS

3.23.1 GENERAL

All work under this section is subject to the provisions of Chapter 1 and General References for All Sections. Provisions for closed storm drainage will be in accordance with the Loudoun County Facilities Standards Manual (FSM) in effect at the time of plan approval.

3.23.2 Scope

The Work covered by these Specifications consists of providing all plant, labor, equipment, supplies, transportation, handling, storage and performance of all operations necessary to complete the construction for the pipe bedding, jointing, and testing of storm drain systems and culverts.

1. Requirements for earthwork including trench excavation and backfill are specified in Earthwork section.
2. Pipe bedding shall be in accordance with the details shown on the approved drawings. In wet trench conditions, stabilization stone is to be installed.
3. Miscellaneous storm drainage includes subsurface drains and roof and drain collection systems.

3.23.3 Applicable Standards

All work shall comply with the latest revision of the following standards of the American Society for Testing and Materials (ASTM), the American Association for State Highway and Transportation Officials (AASHTO).

ASTM A-48 Standard Specifications for Gray Iron Castings

ASTM C-76 Specification for Reinforced Concrete

ASTM C-150 Specification for Portland Cement

ASTM C-478 (AASHTO-199) Specification for Precast Reinforced Concrete Manhole Sections

ASTM C-990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

ASTM D 1248 Polyethylene Plastics Molding and Extrusion Materials, Type III, High Density

ASTM D 3035 Polyethylene Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter, ASTM D 3350 Polyethylene Plastics and Fittings Materials

AASHTO M-36 Corrugated Steel Pipe & Fittings

AASHTO M-45 Sand for Cement Mortar

AASHTO M-105 Gray Iron Castings

AASHTO M-190 Bituminous Coating of CMP

AASHTO M-196 Corrugated Aluminum Pipe & Fittings

AASHTO M-198 Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

AASHTO M-245 Precoated Galvanized Steel Culverts and Underdrains

AASHTO M-246 Precoated Galvanized Steel Sheets for Culverts and Underdrains

AASHTO M-274 Corrugated Aluminized Pipe and Fittings

AASHTO M-252 Corrugated Polyethylene Pipe 3"-10" diameter

AASHTO M-294 Corrugated Polyethylene Pipe, 12" diameter and larger

AASHTO M-306 Drainage, Sewer, Utility, and Related Castings

3.23.4 Product Data:

Provide data indicating pipe, pipe accessories, and joint material.

3.23.5 Manufacturer's Installation Instructions:

Indicate special procedures required to install Products specified.

3.23.6 Manufacturer's Certificate:

Certify that products meet or exceed specified requirements.

3.23.7 PROJECT RECORD DOCUMENTS

3.23.7.1 Submit under provisions of PROJECT MANAGEMENT.

3.23.7.2 Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

3.23.7.3 Contractor shall promptly notify PRCS Project Manager to identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

3.23.8. REGULATORY REQUIREMENTS

3.23.8.1 Conform to applicable FSM requirements for materials and installation of the Work of this section.

3.23.9. FIELD MEASUREMENTS

3.23.9.1 Verify that field measurements and elevations are as indicated on approved plans. The Contractor shall layout in the field the alignment and grade of Work to be done

- 3.23.9.2 The Contractor shall be responsible for the preservation of all line stakes, grade stakes, and hubs. In the event of their loss or destruction, the Contractor shall be responsible for their proper replacement.
- 3.23.9.3 The line and grade for pipe lines shall be given from reference hubs offset from each manhole or cleanout.
- 3.23.9.4 The Contractor shall be responsible for the transfer of the control points.

3.23.10. COORDINATION

- 3.23.10.1 Coordinate work under provisions of PROJECT MANAGEMENT
- 3.23.10.2 Coordinate the Work with termination of storm sewer connection outside building, connection to municipal sewer utility service and trenching.

3.23.11. PRODUCTS

3.23.11.1 STORM PIPE MATERIALS

All piping shall be in accordance with the Contract Documents conforming to the size and class shown and specified. Changes in class shall be made within one-half of a pipe length of the station indicated on the Drawings.

3.23.11.1.1 Corrugated Metal Pipe (CMP)

Corrugated metal pipe shall only be used in culvert crossings and similar applications. CMP use in a piped storm drain system is prohibited without approval from Street Maintenance and the Municipal Engineer. Corrugated metal pipe is intended to refer to both steel and aluminum. The pipe shall conform to the following specifications:

1. **Steel:** Corrugated steel pipe shall meet the requirements of AASHTO M-36.
2. **Aluminum:** Corrugated aluminum pipe shall conform to the requirements of the AASHTO M-196.
3. **Aluminum Coated (Aluminized):**
Corrugated aluminized pipe shall conform to the requirements of AASHTO M-36 and AASHTO M-274.

3.23.11.1.2 Fittings:

All CMP fittings shall be fabricated in a workmanlike manner, develop the full strength of the material being joined, and finished to conform to the appropriate requirements of AASHTO M-36, AASHTO M-196 and AASHTO M-274.

1. Corrugated steel and aluminum pipe shall be jointed by using coupling bands applied as recommended by the manufacturer and approved by the Engineer.
2. All CMP fittings shall be fabricated in a workmanlike manner, develop the full strength of the material being joined, and finished to conform to the appropriate requirements of AASHTO M-36, AASHTO M-196 and AASHTO M-274.

3. Corrugated steel and aluminum pipe shall be jointed by using coupling bands applied as recommended by the manufacturer and approved by the Engineer.
4. Dissimilar metals may only be used in extending in place metal CMP and reattachment of dissimilar metal end sections provided an electrical insulating material, at least one-sixteenth inch (1/16") in thickness, is used to separate the dissimilar materials.
5. All angles, bolts, and nuts shall be as recommended by the manufacturer for the type of pipe used and as approved by the Engineer.
6. The metal gauge for pipe to be used shall be in accordance with the Contract Documents.
7. If bituminous coating of CMP is required, the bituminous coating shall conform to the requirements of AASHTO M-190.
8. All welding performed by the Contractor on aluminum pipe shall incorporate the use of 4043 or 5356 alloy for welding wire. The welding shall be accomplished by either the "TIG" (tungsten, inert gas shielded) or "MIG" (metal arc welding, inert gas shielded) process.
9. End Section for Corrugated Metal Pipe - Galvanized steel and aluminum end sections shall be flared, beveled, shop-assembled units to serve as structural, hydraulic and esthetic treatment to corrugated metal pipe culverts. They may be attached to culverts by threaded bolts, by riveting or bolting in accordance with the manufacturer's standard procedure. End sections shall have a turned-down lip or toe plate at the wide end to act as a cutoff. Materials for steel end sections shall be galvanized steel conforming to the requirements of ASHTO M-36. 9.2

3.23.12 PIPE ACCESSORIES

3.23.12.1 Filter Fabric:

Water pervious type, Black polyolefin.

3.23.12.2 Trace Wire:

Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Storm Sewer Service" in large letters.

3.23.13 CATCH BASINS

3.23.13.1 Lid and Frame:

Cast iron construction, with hinged lid:

3.23.13.1.1 Lid Design: Linear grill.

3.23.13.1.2 Nominal Lid and Frame Size:

To be determined and shall be approved by PRCS Project Manager.

3.23.13.2 Shaft Construction and Cone Top Section: Reinforced pre-cast concrete pipe sections, lipped male/female joints.

3.23.13.3 Base Pad: Cast-in-place concrete of type specified in CAST-IN-PLACE CONCRETE Section.

3.23.13.1 BEDDING MATERIALS

3.23.13.1.1 Bedding: Fill Type shall be as outlined in EARTHWORK section.

3.35.13.2 EXAMINATION

3.23.13.2.1 Verify that trench cut or excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.23.13.3 PREPARATION

3.23.13.3.1 Excavate pipe trench in accordance with plans, Hand trim excavations to required elevations for accurate placement of pipe. Correct over excavation with fine aggregate.

3.23.13.3.2 Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.23.13.3.3 Place bedding material at trench bottom, level materials in continuous layer not exceeding eight (8) inches compacted depth.

3.23.13.3.4 Maintain optimum moisture content of bedding material to attain required compaction density.

3.23.13.4 INSTALLATION - PIPE

3.23.13.4.1 Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal joints watertight.

3.23.13.4.2 Place pipe on minimum eight (8) inch deep bed of filter aggregate.

3.23.13.4.3 Lay pipe to slope gradients noted on drawings.

3.23.13.4.4 Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches, compact to 95% proctor.

3.23.13.4.5 Do not displace or damage pipe when compacting.

3.23.13.4.6 Connect to building, collection, or sump pits, building sewer outlet, municipal storm sewer system, or manholes through installed sleeves.

3.23.13.4.7 Install trace wire continuous over top of pipe buried six (6) inches below finish grade, above pipe line.

3.23.13.5 INSTALLATION - CATCH BASINS AND CLEANOUTS

3.23.13.5.1 Form bottom of excavation clean and smooth to correct elevation.

3.23.13.5.2 Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.

3.23.13.5.3 Level top surface of base pad to receive concrete shaft sections, sleeved to receive storm sewer pipe sections.

- 3.23.13.5.4 Establish elevations and pipe inverts for inlets and outlets as indicated.
- 3.23.13.5.5 Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.23.13.6 FIELD QUALITY CONTROL

- 3.23.13.6.1 Field inspection and testing as required by FSM.
- 3.23.13.6.2 Request inspection prior to and immediately after placing aggregate cover over pipe.
- 3.23.13.6.3 Compaction testing will be performed in accordance with PRCS requirements.
- 3.23.13.6.4 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- 3.23.13.6.5 Pressure Test: Test in accordance with FSM requirements.
- 3.35.19.6 Infiltration Test: Test in accordance with FSM requirements.
- 3.35.19.7 Deflection Test: Test in accordance with FSM requirements.

3.23.13.7 PROTECTION

- 3.23.13.7.1 Protect finished Work.
- 3.23.13.7.2 Protect pipe and aggregate cover from damage or displacement until backfilling operation is completed.

3.23.13.8 SCHEDULE

- 3.23.13.8.1 Storm Sewer Main: Size as noted on drawings.
- 3.23.13.8.2 Storm Pipe Branch Lines: Connect catch basins at various site locations with intersection of main storm line. Sizes as noted on drawings.

3.24 OPEN DRAINAGE DITCHES AND SWALES

3.24.1. GENERAL

All work under this section is subject to the provisions of Chapter 1, General References for All Sections.

- 3.24.1.1 Provisions for open site drainage will be in accordance with the Loudoun County Facilities Standards Manual (FSM) and the Virginia Erosion and Sediment Control Handbook in effect at the time of plan approval

3.24.2 SCOPE

The work consists of building open drainage ditches and swales according to the plans.

3.24.3. SITE DRAINAGE

- 3.24.3.1 Positive drainage must be achieved throughout the site. Stabilization measures for areas of poor drainage shall be coordinated through PRCS project manager responsible for the site and shall take into consideration maintenance programs required for that area.

- 3.24.3.2 Open channels within the active recreation use areas of a site shall conform to Loudoun County Facilities Standard Manual the (FSM) OPEN DRAINAGEWAYS for open drainage ways. Where open channels exist between use areas, pedestrian access shall be clearly delineated by armored walkways or footbridges to minimize damage to the drainage ways and reduce the potential for accidents and/or injuries.
- 3.24.3.3 Unless special circumstances or topography prohibits same, culvert outfalls shall be located a minimum of 100 feet from the perimeter of a field playing surface or play apparatus area. When this is not possible, outlet protection shall be provided with alternative materials meeting the required standards for erosion and sediment control. Rip-rap should be avoided, as it poses hazards such as tripping or falling, ponding water, snake refuge, etc. Safety measures such as handrails or fencing may also be required. Specific safety measures shall be coordinated with PRCS project manager for the site and shall be designed based on the anticipated use.

3.25 Concrete Drainage Ditches

3.25.1 SCOPE

This section provides guidelines for constructing concrete drainage ditches

3.25.2 MATERIALS

Concrete shall be Class A as specified in CAST IN PLACE CONCRETE Section of this manual .

3.25.3 CONSTRUCTION

- 3.25.3.1 Sub-grade shall be constructed to the required elevation below the finished surface of the paved ditch in accordance with the dimensions and design as shown on the approved plans.
- 3.25.3.2 All soft and unsuitable materials shall be removed and replaced with an approved material that shall be compacted to 95% density in accordance with ASTM D- 698, and graded to a smooth surface.
- 3.25.3.3 All material removed by excavation shall be removed from the site by the Contractor, unless agreed to, and directed by PRCS Project Manager to suitable on-site location.
- 3.25.3.4 The subgrade shall be moistened prior to placing the concrete.
- 3.25.3.5 Form ditches in accordance with the approved plans. All forms shall be inspected before the placing of concrete begins. The finish surface of the paved ditch shall be smooth. No section shall be less than five feet.
- 3.25.3.6 Provide construction joints every ten (10) feet. Provide bituminous expansion material per applicable standards and

extend to the full depth of the slab. The expansion joint filler shall conform to VDOT Specification.

Chapter 4

The sections and all details, covered in this chapter are to be followed until the new revisions are reviewed and inserted into the manual.

Chapter 4

Athletic Fields SKINNED INFIELD

1. GENERAL

All work under this section is subject to the Special and General Conditions and Instructions to Bidders which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual and Virginia Department of Transportation (VDOT) Road and Bridge Specifications. The Contractor shall be responsible for and governed by all the requirements thereunder.

1

2. SCOPE

- 2.1 The work includes the provision of all material, services, labor, and equipment necessary for and incidental to executing and completing the construction of skinned infields.
- 2.2 The term skinned infield refers to those areas in which turf have not been specified and includes base paths, pitcher's mounds, and batter's boxes on totally skinned infields as well as fields with turf infields.

3. MATERIALS

- 3.1 Infield mix shall be as provided by Luck Stone Corporation of Charlottesville, VA 22903. Infield mix supplied shall be "Fielders Choice Ballfield Mix" as specified in Fairfax County Contract Number: BL0149864311A. Contact: Mark Roberts, 804-295-3611
- 3.2 A representative sample shall be submitted for physical analysis and approval by PRCS before transportation to the site.
- 3.3 Mix delivered to the site that does not conform to the approved sample as specified will be rejected. The Contractor shall be required to remove it and

replace the material with the specified mix at his expense.

4. CONSTRUCTION

4.1 Stripping and Grading

4.1.1 Strip the area to be skinned, as indicated on the plans. All soil, sod, roots, etc. shall be removed to a depth of four inches below finished grade.

4.1.2 Excavated material shall be removed from the site by the Contractor.

4.1.3 The subgrade shall conform to all grades and contours of the finished grade with a depth of four inches.

4.1.4 The subgrade shall be approved by PRCS before placement of the infield mix.

5. INFIELD SOIL MIX

5.1 Place a four inch layer of the infield mix over the approved subgrade.

5.2 Uniformly fine grade the infield mix to the grade and contours specified on the plan.

5.3 Properly shape the pitcher's mound using the approved material.

5.4 Blend the infield mix grade with the grade at the juncture of the turf areas so there is no difference in elevation between the two surfaces.

5.5 Edge all turf at the juncture of the skinned infields in straight lines, or contours as required for the pitcher's mound, batter's boxes, base paths, and perimeter of the infield

BASKETBALL COURT

1. GENERAL

All work under this section is subject to the Special and General Conditions and Instructions to Bidders which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual and Virginia Department of Transportation (VDOT) Road and Bridge Specifications. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SECTION INCLUDES

2.1 Subgrade.

2.2 Aggregate sub-base and base.

2.3 Asphaltic concrete leveling and surface course.

2.4 Asphalt resurfacer, fillercoat and colored surfacing.

2.5 Basketball backstops and goals

2.6 Volleyball net post sleeves.

3. RELATED SECTIONS

3.1 ROUGH AND FINE GRADING

4. PRODUCTS

4.1 MATERIALS

- 4.1.1 Sub-base course: VDOT Sec. 203, No. 57 aggregate.
- 4.1.2 Base course: VDOT Sec. 209 Type I grade 21A material.
- 4.1.3 Asphalt Resurfacer: Plush-Tex manufactured by KOCH Materials Company, 1050 State St., Perth Amboy, NJ 08861, or approved equal.
- 4.1.4 Filler coat: Acrylic Filler Coat Binder Color manufactured by KOCH Materials Company, 1050 State St., Perth Amboy, NJ 08861, or approved equal.
- 4.1.5 Color coat: Deco Color Multi-Purpose Coating manufactured by KOCH Materials Company, 1050 State St., Perth Amboy, NJ 08861, or approved equal. Light green in the central play area and red outside. Colors shall be approved by the Owner.
- 4.1.6 Fine aggregate for filler coat and color coat: Silica sand, 100% passing a No. 80 sieve.

4.2 ACCESSORIES

- 4.2.1 Filter fabric: Typar 3401, Mirafi 140s, or approved equal.
- 4.2.2 Primer: VDOT Sec. 211 low viscosity asphalt MC-30 or MC-70.
- 4.2.3 Fine Aggregate: VDOT Section 202, Grade C material. This material is used only for blotting excess primer.
- 4.2.4 Line paint: Novatex manufactured by Nova Sports USA.

4.3 EQUIPMENT

- 4.3.1 Basketball Backstop, Post and Goal: Model No. #541-637 as manufactured by PCA Industries Inc., 5642 Natural Bridge, St. Louis MO 63120, telephone number (800) 727-8180, or approved equal.

4.4 ASPHALT PAVING MIX

4.4.1 Leveling Course: VDOT Sec. 212 Type SM-2A.

4.4.2 Surface Course: VDOT Sec. 212 Type SM-1.

5. CONSTRUCTION

5.1 The Contractor shall stake the corners of the court for approval by the Owner prior to construction of the court.

5.2 Clearing

Areas to be paved shall be cleared of all roots, sod, mulch and other debris not part of the soil, to a depth of at least one foot below finished subgrade.

5.3 Subgrade Preparation

5.3.1 Subgrade shall be constructed in accordance with VDOT Section 305 and the ROUGH AND FINE GRADING section specified herein.

5.3.2 The Contractor shall notify the Owner if the subgrade is found to be unsuitable for adequate leveling and compaction due to moisture content or other conditions.

5.3.3 Existing subgrade material which will not readily compact as required shall be removed and replaced with satisfactory material. Additional material needed to bring subgrade to required line and grade and to replace unsuitable material removed shall conform to this section.

5.3.4 Excavation required in the subgrade shall be completed before fine grading and compaction are performed. When excavation must be performed in completed subgrade, subsequent backfill and compaction shall be performed as directed by the Owner. Completed subgrade, after filling and compaction, shall be uniformly and properly graded and have a uniform, stable density.

5.3.5 Materials shall not be stored or stockpiled on prepared subgrade.

5.3.6 Disposal of debris and other material excavated or stripped under this section, and material unsuitable for or in excess of requirements for completing work of this section shall be disposed of off-site by the Contractor.

5.3.7 The subgrade, subbase, and base course shall be kept clean and uncontaminated. Less select material shall not be permitted to become mixed with aggregate. Material spilled outside pavement lines shall be removed and the area repaired.

5.3.8 Graded and compacted subgrade shall be approved by the Owner before placement and preparation of the aggregate subbase course.

5.4 Aggregate Subbase Course

5.4.1 Construction of the subbase course shall conform to VDOT Section 309.

5.4.2 The aggregate subbase course shall not be placed on muddy, or frozen subgrade.

5.4.3 The compacted aggregate subbase course shall be a minimum of six inches.

5.4.4 Aggregate shall be applied in lifts less than or equal to six inches thick, compacted measure. Each lift shall be separately compacted to the specified density.

5.4.5 Rolling shall begin on the low side and progress toward the high side of the court cross section. Rolling shall continue until material does not creep or wave ahead of roller wheels.

5.5 Aggregate Base Course

5.5.1 Construction of the aggregate base course shall conform to VDOT Section 309.

5.5.2 The compacted aggregate base course shall be a minimum of four inches.

5.5.3 Rolling shall begin on the low side and progress toward the high side of the court cross section. Rolling shall continue until material does not creep or wave ahead of roller wheels.

- 5.5.4 Surface irregularities which exceed $\frac{1}{2}$ inch as measured by means of a 10-foot long straightedge, shall be replaced and properly compacted.
- 5.5.5 Graded and compacted aggregate base course shall be approved by the Owner before placement of the asphalt surface course.
- 5.5.6 Primer shall be sprayed with a pressure distributor, under average conditions from 0.20 to 0.50 gallon per square yard on the prepared aggregate base course. The asphalt shall be entirely absorbed by the base course. If it is not absorbed within 24 hours after application, sand shall be spread over the surface to blot the excess asphalt. Care shall be taken to prevent over priming. The prime shall be fully set and cured before placing the surface treatment.
- 5.5.7 Basketball post footings shall be installed prior to construction of the asphalt concrete courses.

5.6 Asphalt Course

- 5.6.1 Construction of the asphalt concrete courses shall comply with VDOT Section 320.
- 5.6.2 During construction the Contractor shall submit test results on the aggregate gradation and binder content of the mixes (minimum of two tests). These tests may be made by either the material supplier or an independent laboratory. Costs incurred as a result of any of the above tests will be borne by the Contractor.
- 5.6.3 The leveling course shall be uniformly spread and compacted to a minimum depth of $1\frac{1}{2}$ inches.
- 5.6.4 The surface course shall be laid at right angles to the leveling course.
- 5.6.5 The surface course shall be uniformly spread and compacted to a depth of $1\frac{1}{2}$ inches.
- 5.6.6 Deliveries shall be timed to permit spreading and rolling all material during daylight hours, unless artificial light, satisfactory to the Owner is provided. Loads which have become wet shall not be accepted. Hauling over freshly laid or rolled material will not be permitted.

- 5.6.7 Portions of pavement courses which become mixed with foreign material or are in any way defective shall be removed, replaced, replaced with fresh mixture, and compacted to density of surrounding areas. Asphalt concrete spilled outside the lines of finished pavement shall be immediately and completely removed. Such material shall not be employed in the work.
- 5.6.8 Joints shall present the same texture, density, and smoothness as other sections of the course. A continuous bond shall be obtained between successive placement of new pavement. New material at joints shall be thick enough to allow for compaction when rolling. Compaction of pavement, base, and subgrade at joints shall be such that there is no yielding of new pavement relative to existing pavement when subjected to traffic.
- 5.6.9 Variations in smoothness of the finished surface shall be less than or equal to 1/4 inch when tested with a 10 foot straightedge, measured in any direction. Irregularities exceeding these amounts or which retain water on the surface shall be corrected by removing defective work and replacing it with new material conforming to this section.
- 5.6.10 The finished surface course shall not vary from the specified grade more than 1/8 inch in ten feet when measured in any direction.

5.7 Color Surface System

- 5.7.1 All resurfacer, filler coat, and color coat required for the job shall be on the job site prior to beginning the squeegee phase of construction.
- 5.7.2 Surface Preparation - All surfaces shall be thoroughly cleaned, removing all loose dirt, dust, oil grease, leaves and other debris.
- 5.7.3 Asphalt Resurfacer
 - 5.7.3.1 The court shall be checked with a ten foot straight-edge or shall be flooded with water to locate low areas which are more than 1/8" deep.
 - 5.7.3.2 Minor depressions, 1/8" - 1/4" deep shall be leveled by troweling a layer of undiluted asphalt resurfacer over the low area.
 - 5.7.3.3 Depressions between 1/4" and 1/2" deep require multiple layers of asphalt resurfacer.

5.7.3.4 Depressions exceeding 1/2" shall be filled with VDOT SM-1 bituminous concrete. All rough paving joints and roller marks shall be leveled prior to application of the asphalt resurfacer.

5.7.3.5 Apply one coat of resurfacer over the entire court, after filling all depressions. Mix design, application rates and procedures shall be according to the manufacturer.

5.7.4 Acrylic Filler Coat Binder

5.7.4.1 Apply one coat of filler coat binder over the asphalt resurfacer. Mix design, application rates and procedures shall be according to the manufacturer.

5.7.4.2 Surface Preparation - The surface of the filler coat shall be checked to insure a smooth and uniform texture, free from ridges, and tool marks. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris.

5.7.5 Deco Color Mult-Purpose Coating

5.7.5.1 Apply one texture course of color coat over the filler coat. Mix design, application rates and procedures shall be according to the manufacturer.

5.7.5.2 Apply one finish course of color coat over the texture course. Mix design, application rates and procedures shall be according to the manufacturer.

5.8 Playing Lines

5.8.1 Allow the color coat to cure before painting lines. This may vary from 2 to 4 days under good curing conditions. Two inch wide playing lines shall be accurately located and marked. White line paint shall be used. Painters shall use soft soled shoes and knee pads or kneel on boards to prevent surface indentation. Ragged lines shall not be acceptable.

6. TRAFFIC

Protect from traffic during all operations and until opening for use. Allow the color coat surface to cure at least 24 hours before allowing light foot traffic. Following painting of the lines, the court shall be allowed to cure for a minimum of 4 days before being opened for play.

MULTI-USE COURT

1. GENERAL

All work under this section is subject to the Special and General Conditions and Instructions to Bidders which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual and Virginia Department of Transportation (VDOT) Road and Bridge Specifications. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SECTION INCLUDES

2.1 Sub-grade.

2.2 Aggregate sub-base and base.

2.3 Asphalt concrete leveling and surface course.

2.4 Asphalt resurfacer, fillercoat and colored surfacing.

2.5 Basketball backstops and goals

2.6 Volleyball net post sleeves.

3. RELATED SECTIONS

3.1 ROUGH AND FINE GRADING

4. PRODUCTS

4.1 MATERIALS

- 4.1.1 Sub-base course: VDOT Sec. 203, No. 57 aggregate.
- 4.1.2 Base course: VDOT Sec. 209 Type I grade 21A material.
- 4.1.3 Asphalt Resurfacer: Plush-Tex manufactured by KOCH Materials Company, 1050 State St., Perth Amboy, NJ 08861, or approved equal.
- 4.1.4 Filler coat: Acrylic Filler Coat Binder Color manufactured by KOCH Materials Company, 1050 State St., Perth Amboy, NJ 08861, or approved equal.
- 4.1.5 Color coat: Deco Color Multi-Purpose Coating manufactured by KOCH Materials Company, 1050 State St., Perth Amboy, NJ 08861, or approved equal. Light green in the central play area and red outside. Colors shall be approved by the Owner.
- 4.1.6 Fine aggregate for filler coat and color coat: Silica sand, 100% passing a No. 80 sieve.

4.2 ACCESSORIES

- 4.2.1 Filter fabric: Typar 3401, Mirafi 140s or approved equal.
- 4.2.2 Primer: VDOT Sec. 211 low viscosity asphalt MC-30 or MC-70.
- 4.2.3 Fine Aggregate: VDOT Section 202, Grade C material. This material is used only for blotting excess primer.
- 4.2.4 Line paint: Novatex manufactured by Nova Sports USA.

4.3 EQUIPMENT

- 4.3.1 Basketball Backstop, Post and Goal: Model No. #541-637 as manufactured by PCA Industries Inc., 5642 Natural Bridge, St. Louis MO 63120, telephone number (800) 727-8180, or approved equal.

- 4.3.2 Volleyball Net Post Ground Sockets: Model #138 as manufactured by Gametime, P.O. Box 121, Ft. Payne, AL 35967, telephone number (800) 235-2440.

4.4 ASPHALT PAVING MIX

- 4.4.1 Leveling Course: VDOT Sec. 212 Type SM-2A.

- 4.4.2 Surface Course: VDOT Sec. 212 Type SM-1.

5. CONSTRUCTION

- 5.1 Before construction of the court, the Contractor shall stake the corners of the court for approval by the Owner.

5.2 Clearing

- 5.3 Areas to be paved shall be cleared of all roots, sod, mulch and other debris not part of the soil, to a depth of at least one-foot below finished subgrade.

5.4 Subgrade Preparation

- 5.4.1 Subgrade shall be constructed in accordance with VDOT Section 305 and the ROUGH AND FINE GRADING section specified herein.

- 5.4.2 The Contractor shall notify the Owner if the subgrade is found to be unsuitable for adequate leveling and compaction due to moisture content or other conditions.

- 5.4.3 Existing subgrade material that will not readily compact as required shall be removed and replaced with satisfactory material. Additional material needed to bring subgrade to required line and grade and to replace unsuitable material removed shall conform to this section.

- 5.4.4 Excavation required in the subgrade shall be completed before fine grading and compaction are performed. When excavation must be performed in completed subgrade, subsequent backfill and compaction shall be performed as directed by

the Owner. Completed subgrade, after filling and compaction, shall be uniformly and properly graded and have a uniform, stable density.

5.4.5 Materials shall not be stored or stockpiled on prepared subgrade.

5.4.6 Disposal of debris and other excavated or stripped material and unsuitable or excess material shall be disposed of off-site by the Contractor.

5.4.7 The subgrade, subbase, and base course shall be kept clean and uncontaminated. Less select material shall not be permitted to become mixed with aggregate. Material spilled outside pavement lines shall be removed and the area repaired.

5.4.8 Graded and compacted subgrade shall be approved by the Owner before placement and preparation of the aggregate subbase course.

5.5 Aggregate Subbase Course

5.5.1 Construction of the subbase course shall conform to VDOT Section 309.

5.5.2 The aggregate subbase course shall not be placed on muddy, or frozen subgrade.

5.5.3 The compacted aggregate subbase course shall be a minimum of six inches.

5.5.4 Aggregate shall be applied in lifts less than or equal to six inches thick, compacted measure. Each lift shall be separately compacted to the specified density.

5.5.5 Rolling shall begin on the low side and progress toward the high side of the court cross section. Rolling shall continue until material does not creep or wave ahead of roller wheels.

5.6 Aggregate Base Course

5.6.1 Construction of the aggregate base course shall conform to VDOT Section 309.

5.6.2 The compacted aggregate base course shall be a minimum of four inches.

- 5.6.3 Rolling shall begin on the low side and progress toward the high side of the court cross section. Rolling shall continue until material does not creep or wave ahead of roller wheels.
- 5.6.4 Surface irregularities that exceed 1/2 inch as measured by means of a 10-foot long straightedge, shall be replaced and properly compacted.
- 5.6.5 Graded and compacted aggregate base course shall be approved by the Owner before placement of the asphalt surface course.
- 5.6.6 Primer shall be sprayed with a pressure distributor, under average conditions from 0.20 to 0.50 gallon per square yard on the prepared aggregate base course. The asphalt shall be entirely absorbed by the base course. If it is not absorbed within 24 hours after application, sand shall be spread over the surface to blot the excess asphalt. Care shall be taken to prevent over priming. The prime shall be fully set and cured before placing the surface treatment.
- 5.6.7 Basketball post footings and volleyball net post ground socket footings shall be installed prior to construction of the asphalt concrete courses.

5.7 Asphalt Course

- 5.7.1 Construction of the asphalt concrete courses shall comply with VDOT Section 320.
- 5.7.2 During construction the Contractor shall submit test results on the aggregate gradation and binder content of the mixes (minimum of two tests). Either the material supplier or an independent laboratory may make these tests. Costs incurred as a result of any of the above tests will be borne by the Contractor.
- 5.7.3 The leveling course shall be uniformly spread and compacted to a minimum depth of 1 1/2 inches.
- 5.7.4 The surface course shall be laid at right angles to the leveling course.
- 5.7.5 The surface course shall be uniformly spread and compacted to a depth of 1 1/2 inches.

- 5.7.6 Deliveries shall be timed to permit spreading and rolling all material during daylight hours, unless artificial light, satisfactory to the Owner is provided. Loads that have become wet shall not be accepted. Hauling over freshly laid or rolled material will not be permitted.
- 5.7.7 Portions of pavement courses that become mixed with foreign material or are in any way defective shall be removed, replaced, replaced with fresh mixture, and compacted to density of surrounding areas. Asphalt concrete spilled outside the lines of finished pavement shall be immediately and completely removed. Such material shall not be employed in the work.
- 5.7.8 Joints shall present the same texture, density, and smoothness as other sections of the course. A continuous bond shall be obtained between successive placement of new pavement. New material at joints shall be thick enough to allow for compaction when rolling. Compaction of pavement, base, and sub-grade at joints shall be such that there is no yielding of new pavement relative to existing pavement when subjected to traffic.
- 5.7.9 Variations in smoothness of the finished surface shall be less than or equal to 1/4 inch when tested with a 10-foot straightedge, measured in any direction. Irregularities exceeding these amounts or which retain water on the surface shall be corrected by removing defective work and replacing it with new material conforming to this section.
- 5.7.10 The finished surface course shall not vary from the specified grade more than 1/8 inch in ten feet when measured in any direction.

5.8 Color Surface System

- 5.8.1 All resurfacer, filler coat, and color coat required for the job shall be on the job site prior to beginning the squeegee phase of construction.
- 5.8.2 Surface Preparation - All surfaces shall be thoroughly cleaned, removing all loose dirt, dust, oil grease, leaves and other debris.
- 5.8.3 Asphalt Resurfacer
 - 5.8.3.1 The court shall be checked with a ten-foot straightedge or shall be flooded with water to locate low areas that are more than 1/8" deep.

- 5.8.3.2 Minor depressions, 1/8" - 1/4" deep shall be leveled by troweling a layer of undiluted asphalt resurfacer over the low area.
- 5.8.3.3 Depressions between 1/4" and 1/2" deep require multiple layers of asphalt resurfacer.
- 5.8.3.4 Depressions exceeding 1/2" shall be filled with VDOT SM-1 bituminous concrete. All rough paving joints and roller marks shall be leveled prior to application of the asphalt resurfacer.
- 5.8.3.5 Apply one coat of resurfacer over the entire court, after filling all depressions. Mix design, application rates and procedures shall be according to the manufacturer.

5.8.4 Acrylic Filler Coat Binder

- 5.8.4.1 Apply one coat of filler coat binder over the asphalt resurfacer. Mix design, application rates and procedures shall be according to the manufacturer.
- 5.8.4.2 Surface Preparation - The surface of the filler coat shall be checked to insure a smooth and uniform texture, free from ridges, and tool marks. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris.

5.8.5 Deco Color Multi Purpose Coating

- 5.8.5.1 Apply one texture course of color coat over the filler coat. Mix design, application rates and procedures shall be according to the manufacturer.
- 5.8.5.2 Apply one finish course of color coat over the texture course. Mix design, application rates and procedures shall be according to the manufacturer.

5.9 Playing Lines

- 5.9.1 Allow the color coat to cure before painting lines. This may vary from 2 to 4 days under good curing conditions. Two inch wide playing lines shall be

accurately located and marked. White line paint shall be used. Painters shall use soft-soled shoes and kneepads or kneel on boards to prevent surface indentation. Ragged lines shall not be acceptable.

6. TRAFFIC

- 6.1 Protect from traffic during all operations and until opening for use. Allow the color coat surface to cure at least 24 hours before allowing light foot traffic. Following painting of the lines, the court shall be allowed to cure for a minimum of 4 days before being opened for play.

MULTI-USE COURT
FULL DEPTH ASPHALT

1. GENERAL

All work under this section is subject to the Special and General Conditions and Instructions to Bidders which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual and Virginia Department of Transportation (VDOT) Road and Bridge Specifications. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SCOPE

The work includes, but is not limited to, the provision of all material, services, labor, and equipment necessary to construct the following:

- 2.1 Preparation of the sub-grade and base course.
- 2.2 Leveling course.
- 2.3 Filler and color coats.
- 2.4 Line markings.
- 2.5 Basketball backstops.
- 2.6 Volleyball equipment.

3. MATERIALS

- 3.1 Base Course shall be VDOT Section 203, No. 57 coarse aggregate.
- 3.2 Leveling Course shall be VDOT SM-2A asphalt concrete.
- 3.3 Surface Course shall be VDOT SM-1 asphalt concrete.
- 3.4 Filler coat shall be Latex-ite Acrylic Color System as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.

- 3.5 Color coat shall be Latex-ite Acrylic Color System as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.
- 3.6 Fine aggregate for filler coat and color coat shall be silica sand, 100% passing a No. 80 sieve.
- 3.7 Color coat shall be light green in the central play area and red outside. The Owner shall approve colors.
- 3.8 Line paint shall be Latex-ite Line Paint as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.
- 3.9 Basketball Backstop - Shall be a 10' tandem support backstop with a 7'-0" extension. Main post and extension shall be 4-1/2" O.D. galvanized steel pipe. Stabilizing support post shall be 3-1/2" O.D. galvanized steel pipe. Backboard shall be fan shaped cast aluminum (lifetime guarantee) with double strength "Super Goal" and a steel chain net. See PCA Industries Inc. Model No. #541-637 as distributed by Educational Media, Inc., 3191 Westover Drive, S.E., Washington, DC 20020, Telephone No. (202) 583-9594, or approved equal.
- 3.10 Mounting height of the "Super Goal" on the full court shall be ten feet.
- 3.11 Mounting height of the "Super Goal" on the half court shall be 8 feet.
- 3.12 Volleyball Net Post Sleeves - Shall be 2-7/8" O.D. galvanized steel pipe approximately 2' long, threaded to accept screw-in caps that shall be included. See Gametime #138 as distributed by Cunningham Associates, Inc., Charlotte, NC 28224, 800-438-2780.
- 3.13 Concrete shall be class B. See the CAST IN PLACE CONCRETE section contained herein.

4. CONSTRUCTION

- 4.1 Clearing
 - 4.1.1 Areas to be paved shall be cleared of all roots, sod, mulch and other debris, not part of the soil, to a depth of at least one-foot below finished grade.

4.2 Sub-grade Preparation

- 4.2.1 Sub-grade shall be prepared with proper fill, if required, having a stable, hard, compacted, uniform density throughout its entire length, width and depth. The sub-grade area shall be compacted sufficiently to support the asphalt paver without causing deformation to the sub-grade.
- 4.2.2 Sub-grade shall be constructed in accordance with VDOT Section 305 and the ROUGH AND FINE GRADING section contained herein.
- 4.2.3 The Contractor shall notify the Owner if the sub-grade is found to be unsuitable for adequate leveling and compaction due to moisture content, or other conditions.
- 4.2.4 Existing sub-grade material that will not readily compact as required shall be removed and replaced with satisfactory material. Additional material needed to bring sub-grade to required line and grade and to replace unsuitable material removed shall conform to this section.
- 4.2.5 Excavation required in the sub-grade shall be completed before fine grading and compaction are performed. When excavation must be performed in completed sub-grade, subsequent backfill and compaction shall be performed as directed by the Owner. Completed sub-grade, after filling and compaction, shall be uniformly and properly graded and have a uniform stable density.
- 4.2.6 Material shall not be stored or stockpiled on prepared subgrade.
- 4.2.7 Disposal of debris and other material excavated or stripped under this section, and material unsuitable for or in excess of requirements for completing work, shall be disposed of off-site by the Contractor.
- 4.2.8 The sub-grade and base course shall be kept clean and uncontaminated. Less select material shall not be permitted to become mixed with aggregate. Material spilled outside pavement lines shall be removed and the area repaired.
- 4.2.9 Graded and compacted subgrade shall be approved by the Owner before placement and preparation of the aggregate base course.

4.3 Aggregate Base Course

- 4.3.1 Construction of the aggregate base course shall conform to VDOT Section 309.
- 4.3.2 The compacted aggregate base course shall be a minimum of four inches.
- 4.3.3 Base course material that will not readily compact as required shall be removed and replaced with satisfactory materials. Additional materials needed to bring base course to required line and grade and to replace unsuitable material removed shall conform to this section.
- 4.3.4 Rolling shall begin on the low side and progress toward the high side of the court cross section. Rolling shall continue until material does not creep or wave ahead of roller wheels.
- 4.3.5 Surface irregularities that exceed 1/2 inch as measured by means of a 10-foot long straightedge, shall be replaced and properly compacted.
- 4.3.6 The graded and compacted aggregate base course shall be approved by the Owner before placement of the asphalt surface course.
- 4.3.7 Basketball posts and footings and volleyball net post sleeves shall be installed prior to construction of the leveling and surface courses.

4.4 Asphalt Court

- 4.4.1 Samples of aggregate to be used on the project shall be submitted, together with a report of aggregate gradation and recommended binder content, one week prior to beginning construction.
- 4.4.2 During construction the Contractor shall submit test results of the aggregate gradation and binder content of the mixes (minimum of two tests). Either the material supplier or an independent laboratory may make these tests. The Contractor shall incur any costs as a result of any of the above tests.
- 4.4.3 Deliveries shall be timed to permit spreading and rolling all material during daylight hours, unless artificial light, satisfactory to the Owner is provided. Loads that have become wet shall not be accepted. Hauling over freshly laid or rolled material will not be permitted.

- 4.4.4 Portions of pavement courses which become mixed with foreign material, or are in any way defective, shall be removed, or replaced, with fresh mixture and compacted to the density of surrounding areas. Asphalt concrete spilled outside the lines of finished pavement shall be immediately and completely removed. Such material shall not be employed in the work.
- 4.4.5 Joints shall present the same texture, density, and smoothness as other sections of the course. A continuous bond shall be obtained between successive placement of new pavement. New material at joints shall be thick enough to allow for compaction when rolling. Compaction of pavement, base, and sub-grade at joints shall be such that there is no yielding of new pavement relative to existing pavement when subjected to traffic.
- 4.4.6 Variations in smoothness of the finished surface shall be less than or equal to 1/4 inch when tested with a 10-foot straightedge, measured in any direction. Irregularities exceeding these amounts or which retain water on the surface shall be corrected by removing defective work and replacing it with new material conforming to this section.
- 4.4.7 Leveling Course shall be thoroughly compacted to a depth of 3 inches. The finished surface shall not vary from the specified grade more than 1/4 inch in ten feet when measured in any direction.
- 4.4.8 Surface Course shall be thoroughly compacted to a depth of 1 1/2 inches with a maximum of 3% air voids. The finished surface shall not vary from the specified grade more than 1/8 inch in ten feet when measured in any direction.
- 4.4.9 Field density determination will be performed with the nuclear field density device utilizing the density control strip as specified under VDOT Section 304 and Virginia Test Method - 10 (VTM-10).
- 4.4.10 All filler coat and color coat required for the job shall be on the job site prior to beginning the squeegee phase of construction.
- 4.4.11 Filler coat mix design. All materials shall be mixed to a uniform free-flowing consistency.

4.4.11.1	Latex-ite	55 gal.
4.4.11.2	80 Mesh Sand	400 lbs.
4.4.11.3	Water	24 gal.

4.4.12 Surface Preparation - The surface shall be thoroughly cleaned, removing all loose dirt, dust, oil, grease, leaves, and other debris. The court shall be checked with a ten-foot straightedge or shall be flooded with water to locate low areas that are more than 1/8" deep. Minor depressions, 1/8" - 1/4" deep shall be leveled by troweling or screeding a layer of patch mix over the low area. Suitable patch mix is Latex-ite filler coat that has not been diluted with water. All rough paving joints and roller marks shall be leveled prior to application of the filler coat.

4.4.13 Method of Application - Latex-ite shall not be stored in direct sunlight or allowed to freeze. The color coat shall not be applied when the ambient air temperature is below 50 degrees Fahrenheit, when the court surface temperature is above 140 degrees Fahrenheit, or when rain is imminent. The first filler coat shall be applied perpendicular to the playing net. The entire surface shall be checked for ridges between the first and second filler coat applications, and following the second application. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris. The second filler coat shall be applied parallel to the playing net. Uniformly apply the filler coat with a 24" to 48" wide flexible rubber squeegee. No irregularities of texture or level are to be left for correction by color coat application.

4.4.14 Coverage - Each filler coat shall be applied at a rate of .05 gal. per square yard. Allow two hours of dehydrating time between each application.

4.4.15 Color coat mix design. All materials shall be mixed to a uniform free-flowing consistency.

4.4.15.1 Latex-ite 55 gal.

4.4.15.2 Water 24 gal

4.4.16 Surface Preparation - The surface of the second application of filler coat shall be checked to insure a smooth and uniform texture, free from ridges, and tool marks. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris.

4.4.17 Method of Application - Color coat shall be applied with a 24" - 48" wide flexible squeegee. The color coat shall be applied parallel to the playing net. The color coat shall not be applied when the ambient air temperature is below 50 degrees Fahrenheit, when the court surface temperature is above 140 degrees Fahrenheit, or when rain is imminent. The color coat surface shall not be scraped to remove imperfections.

4.5 Playing Lines

Allow the color coat to cure before painting lines. This may vary from 2 to 4 days under good curing conditions. Two inch wide playing lines shall be accurately located and marked. White line paint shall be used. Painters shall use soft-soled shoes and kneepads or kneel on boards to prevent surface indentation. Ragged lines will not be acceptable.

4.6 Traffic

Protect from traffic during all operations and until opening for use. Allow the color coat surface to cure at least 24 hours before allowing light foot traffic. Following painting of the lines, the court shall be allowed to cure for a minimum of 4 days before being opened for play.

TENNIS COURTS

1. GENERAL

All work under this section is subject to the Special and General Conditions and Instructions to Bidders which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual and Virginia Department of Transportation (VDOT) Road and Bridge Specifications. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SCOPE

This work includes the furnishing of all labor, materials, equipment, and services necessary for and incidental to the preparation of the sub-grade, base course, leveling course, filler coats and finish color coat with suitable line working, and installation of a fence enclosure to construct a new tennis court.

3. MATERIALS

3.1 Net Posts, Nets, and Fixtures

3.1.1 Net Posts shall be the Premier tennis post as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal. The tennis post shall be 11-gauge steel, 3" OD with an internal wind gear. The handle and faceplate shall be chrome plated. The handle shall be removable. The post shall be finished with a forest green acrylic urethane.

3.1.2 Net Post sleeves shall be the Premier model GS-24 as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal. The tennis post sleeve shall fit 3" OD net posts. PVC cap shall be included.

3.1.3 Net shall be model TN-60 tennis net as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal. The tennis net shall be 3.0 mm braided black polyethylene, 1 3/4" square mesh design with 285 lb. break strength. The top six rows shall be double mesh. The headband shall be vinyl coated steel, double thickness 6.0-mm cable with 3300

lb. break strength. The net shall have reinforced black vinyl bottom and side pockets with fiberglass dowels.

- 3.1.4 Adjustable center strap shall be model ACS as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal.
- 3.1.5 Pipe anchor for the center strap tie down shall be the ANCHOR as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal.
- 3.1.6 Concrete shall be class B. See the CAST-IN-PLACE CONCRETE section contained herein.

3.2 Fence Enclosure

- 3.2.1 Materials - The fence shall be 10 feet high and the materials shall be as follows:

- 3.2.1.1 Line posts - 2 1/2" O.D. standard weight, galvanized pipe, 3.65 lbs./ft.
- 3.2.1.2 Corner and gateposts - 3" O.D. standard weight, galvanized pipe, 5.79 lbs./ft.
- 3.2.1.3 Top rail - 1 5/8" O.D. standard weight, galvanized pipe 2.27 lbs./ft.
- 3.2.1.4 Corner and gate horizontal braces - 1 5/8" O.D. standard weight, galvanized pipe 2.27 lbs./ft.
- 3.2.1.5 Chain link fabric - #9 gage, 1 3/4" mesh, knuckled finish, top and bottom. Base shall be commercial quality hot dipped galvanized steel wire.
- 3.2.1.6 Bottom wire - #7 coil spring wire.
- 3.2.1.7 Corner and gate post tops - Malleable iron or aluminum sand castings.
- 3.2.1.8 Fabric ties - Aluminum or galvanized wire of approved gage and design.

3.2.1.9 Gate frames - 1 5/8" O.D. standard weight, galvanized pipe.

3.2.1.10 Internal bracing - 1 3/8" O.D. standard weight, galvanized pipe.

3.2.1.11 Miscellaneous fittings shall be those which are necessary to make a complete installation. All fence materials shall be hot-dipped galvanized inside and out.

3.2.1.12 All components listed under the fence enclosure section above shall be coated with thermally bonded vinyl coating as specified in THE VINYL COATED CHAIN LINK FENCE section of these specifications.

3.2.2 Concrete shall be class B. See the CAST-IN-PLACE CONCRETE section of these specifications.

3.3 Court Pavement

3.3.1 Primer shall be MC-30 or MC-70 low viscosity asphalt conforming to VDOT Section 211.

3.3.2 Base Course shall be VDOT Section 209, Type I, 21A, crushed stone.

3.3.3 Leveling Course shall be VDOT Section 212, SM-2A asphalt concrete.

3.3.4 Surface Course shall be VDOT Section 212, SM-1 asphalt concrete.

3.3.5 Samples of aggregate to be used in connection with the project will be submitted together with a report of aggregate gradation and recommended binder content one week prior to beginning construction.

3.3.6 Filler coat shall be Latex-ite Acrylic Color System as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.

3.3.7 Color coat shall be Latex-ite Acrylic Color System as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.

- 3.3.8 Fine aggregate for filler coat and color coat shall be silica sand, 100% passing a No. 80 sieve.
- 3.3.9 Color coat shall be light green in the central play area and red outside.
- 3.3.10 Line paint shall be Latex-ite Line Paint as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.

4. CONSTRUCTION

4.1 Preparation of Sub-Grade

- 4.1.1 Sub-grade - All roots, sod, mulch, foreign matter, etc. shall be removed to a depth of at least 12 inches below finished grade. It shall then be prepared with proper fill, if needed, having a stable, hard, compacted, uniform density throughout its entire length, width and depth. The sub-grade area shall be compacted sufficiently to support the asphalt paver without causing deformation to the sub-grade. If deformation does occur, the Contractor shall place and roll VDOT No. 57 coarse aggregate into the sub-grade until it supports the asphalt paver without deformation. The Owner prior to construction of the leveling course shall approve the sub-grade.

4.2 Net Posts, Nets, and Fixtures

- 4.2.1 All net posts and footings shall be installed before installation of the court base, leveling and surface courses.
- 4.2.2 A 10" long 1/2" diameter steel rod shall be placed through the net post, 10" above the bottom. It shall protrude evenly on both sides and be welded.
- 4.2.3 Set net post sleeves and net anchor posts for each court in concrete. The hole for net post concrete footings shall be of the dimensions shown on the contract drawing. The hole for net anchor posts shall be 12" deep and 12" in diameter or square.
- 4.2.4 The top of all net post and net anchor post concrete footings shall be level with the surface of the sub-grade and shall not project into the base course or asphalt leveling course.
- 4.2.5 The net shall not be installed until the Contractor has received approval of the installation of the color coat surface from the Owner.

4.3 Fence Enclosure

- 4.3.1 All posts and footings shall be installed before installation of the court base, leveling, and surface courses.
- 4.3.2 The fence fabric shall be installed before the installation of the color coat surface.
- 4.3.3 Line posts shall be set approximately 3'-0" below finished ground level. They shall be spaced in the line of fence at a maximum of 10'-0" apart.
- 4.3.4 Corner and gateposts shall be set approximately 3'-0" below finished ground level. (Note: line, corner, and gate posts shall be set in cylindrical concrete foundations. The hole for the concrete footings shall be 6" deeper than the bottom of the posts and a minimum of 12" in diameter).
- 4.3.5 Top rail shall be furnished in random lengths averaging not less than 20' and joined with extra long pressed steel sleeves providing a rigid connection but allowing for expansion and contraction.
- 4.3.6 All corner and gate posts shall be braced by a horizontal pipe securely attached to corner and first line posts with malleable iron or aluminum sand cast fittings, leveled edge bands and truss braced with 3/8" rod and take up.
- 4.3.7 The fabric shall be placed on the courtside. It shall be fastened to line posts at approximately 24" intervals. The bottom reinforcing wire shall be securely clipped to the fabric at a maximum of 18" intervals.
- 4.3.8 The bottom of the fabric shall be 1" above the finished surface.
- 4.3.9 Location of the fence shall be as shown on the plan. The 3' gate openings shall be as shown on the plan.

4.4 Asphalt Court

- 4.4.1 Samples of aggregate to be used in connection with the project shall be submitted together with a report of aggregate gradation and recommended binder content one week prior to beginning construction.

- 4.4.2 During construction the Contractor shall submit test results of the aggregate gradation and binder content of the mixes (minimum of two tests). Either the material supplier or an independent laboratory may make these tests. Costs incurred as a result of any of the above tests will be borne by the Contractor.
- 4.4.3 The leveling course shall be thoroughly compacted to a depth of 2 inches with a maximum of 3% air voids. The finished surface shall not vary from the specified grade more than 1/4 inch in ten feet when measured in any direction.
- 4.4.4 The surface course shall be thoroughly compacted to a depth of 1 1/2 inches. The finished surface shall not vary from the specified grade more than 1/8 inch in ten feet when measured in any direction.
- 4.4.5 Field density determination will be performed with the nuclear field density device utilizing the density control strip as specified under VDOT Section 304 and Virginia Test Method - 10 (VTM-10).
- 4.4.6 The compacted bituminous concrete shall be saw cut to a depth of four inches as shown on the plan and detail, and filled with the joint filler specified.
- 4.4.7 All filler coat and color coat required for the job shall be on the job site prior to beginning the squeegee phase of construction.
- 4.4.8 Filler coat mix design. All materials shall be mixed to a uniform free-flowing consistency.
- | | | |
|---------|--------------|----------|
| 4.4.8.1 | Latex-ite | 55 gal. |
| 4.4.8.2 | 80 Mesh Sand | 400 lbs. |
| 4.4.8.3 | Water | 24 gal. |
- 4.4.9 Surface Preparation - The surface shall be thoroughly cleaned, removing all loose dirt, dust, oil grease, leaves and other debris. The court shall be checked with a ten-foot straightedge or shall be flooded with water to locate low areas that are more than 1/8" deep. Trowel or screed a layer of patch mix over minor depressions, 1/8" - 1/4" deep. Suitable patch mix is Latex-ite filler coat that has not been diluted with water. Depressions 1/4" to 1/2" deep require multiple layers of patch mix. Depressions exceeding 1/2" shall be filled with VDOT SM-1 asphalt concrete. All rough paving joints and roller marks shall be leveled prior to application of the filler coat.
- 4.4.10 Method of Application - Latex-ite shall not be stored in direct sunlight, or allowed to freeze. The color coat shall not be applied when the ambient air temperature is below 50 degrees Fahrenheit, when the court surface temperature is above 140 degrees Fahrenheit, or when rain is imminent. The first filler coat

shall be applied perpendicular to the playing net. The entire surface shall be checked for ridges between the first and second filler coat applications, and following the second application. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris. The second filler coat shall be applied parallel to the playing net.

Uniformly apply the filler coat with a 24" to 48" wide flexible rubber squeegee. No irregularities of texture or level are to be left for correction by color coat application.

4.4.11 Coverage - Each filler coat shall be applied at a rate of .05 gal. per square yard. Allow two hours of dehydrating time between each application.

4.4.12 Color coat mix design. All materials shall be mixed to a uniform free-flowing consistency.

4.4.12.1	Latex-ite	55 gal.
4.4.12.2	Water	24 gal

4.4.13 Surface Preparation - The surface of the second application of filler coat shall be checked to insure a smooth and uniform texture, free from ridges, and tool marks. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris.

4.4.14 Method of Application - Color coat shall be applied with a 24" - 48" wide flexible squeegee. The color coat shall be applied parallel to the playing net. The color coat shall not be applied when the ambient air temperature is below 50 degrees Fahrenheit, when the court surface temperature is above 140 degrees Fahrenheit, or when rain is imminent. The color coat surface shall not be scraped to remove imperfections.

4.5 Playing Lines

4.5.1 Allow the color coat to cure before painting lines. This may vary from 2 to 4 days under good curing conditions. Two inch wide playing lines shall be accurately located and marked. White line paint shall be used. Painters shall use soft-soled shoes and kneepads or kneel on boards to prevent surface indentation. Ragged lines will not be acceptable.

5. Traffic

Protect from traffic during all operations and until opening for use. Allow the color coat surface to cure at least 24 hours before allowing light foot traffic. Following painting of the lines, the court shall be allowed to cure for a minimum of 4 days before being opened for play.

TENNIS COURTS – FULL DEPTH ASPHALT

1. GENERAL

All work under this section is subject to the Special and General Conditions and Instructions to Bidders which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual and Virginia Department of Transportation (VDOT) Road and Bridge Specifications. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SCOPE

The work includes, but is not limited to, the provision of all material, services, labor, and equipment necessary to construct the following:

2.1 Preparation of the sub-grade and base course.

2.2 Fence enclosure

2.3 Leveling course.

2.4 Filler and color coats.

2.5 Line markings.

3. MATERIALS

3.1 Net Posts, Nets, and Fixtures

- 3.1.1 Net Posts shall be the Premier tennis post as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal. The tennis post shall be 11-gauge steel, 3" OD with an internal wind gear. The handle and faceplate shall be chrome plated. The handle shall be removable. The post shall be finished with a forest green acrylic urethane.
- 3.1.2 Net Post sleeves shall be the Premier model GS-24 as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal. The tennis post sleeve shall fit 3" OD net posts. PVC cap shall be included.
- 3.1.3 Net shall be model TN-60 tennis net as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal. The tennis net shall be 3.0 mm braided black polyethylene, 1 3/4" square mesh design with 285 lb. break strength. The top six rows shall be double mesh. The headband shall be vinyl coated steel, double thickness 6.0-mm cable with 3300 lb. break strength. The net shall have reinforced black vinyl bottom and side pockets with fiberglass dowels.
- 3.1.4 Adjustable center strap shall be model ACS as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal.
- 3.1.5 Pipe anchor for the center strap tie down shall be the ANCHOR as manufactured by Douglas Industries, Inc. P.O. Box 393, Eldridge, Iowa 52748, (800) 553-8907, or approved equal.
- 3.1.6 Concrete shall be class B. See the CAST-IN-PLACE CONCRETE section contained herein.

3.2 Fence Enclosure

- 3.2.1 Materials - The fence shall be a standard manufactured item. It shall be 10 feet high and the materials shall be as follows:
 - 3.2.1.1 Line posts - 2½" OD, std. weight pipe, 3.65 lbs./ft.
 - 3.2.1.2 Corner and gate posts - 3" OD, std. weight pipe, 5.79 lbs./ft.

- 3.2.1.3 Top rail - 1 5/8" OD, std. weight pipe, 2.27 lbs./ft.
- 3.2.1.4 Corner and gate horizontal braces - 1 5/8" OD, std. weight pipe, 2.27 lbs./ft.
- 3.2.1.5 Chain link fabric - #11 gauge, 1 3/4" mesh, knuckled finish, top and bottom. Fabric shall be aluminum coated with a minimum of 0.40 oz. of aluminum per square foot of uncoated wire surface. Base shall be commercial quality steel wire. Fence fabric shall pass the ASTM A491-63T tests for Class II aluminum coated wire.
- 3.2.1.6 Bottom wire - #7 coil spring wire.
- 3.2.1.7 Corner and gate post tops - Malleable iron or aluminum sand castings.
- 3.2.1.8 Fabric ties - Aluminum or galvanized wire of approved gauge and design.
- 3.2.1.9 Gate frames - 1 5/8" OD, std. weight pipe.
- 3.2.1.10 Internal bracing - 1 3/8" OD, std. weight pipe.
- 3.2.1.11 Miscellaneous fittings shall be those which are necessary to make a complete installation. All fence materials, other than chain link fabric shall be hot-dipped galvanized inside and out.
- 3.2.1.12 Concrete shall be class B. See the CAST-IN-PLACE CONCRETE section of these specifications.

3.3 Court

- 3.3.1 Sub-grade shall be stabilized with four inches of No. 57 coarse aggregate as specified in Section 203 of the VDOT specifications.
- 3.3.2 Leveling Course shall be VDOT SM-2A asphalt concrete.
- 3.3.3 Surface Course shall be VDOT SM-1 asphalt concrete with 3% additional asphalt cement added to the Job Mix Formula.

- 3.3.4 Filler coat shall be Latex-ite Acrylic Color System as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.
- 3.3.5 Color coat shall be Latex-ite Acrylic Color System as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.
- 3.3.6 Fine aggregate for filler coat and color coat shall be silica sand, 100% passing a No. 80 sieve.
- 3.3.7 Color coat shall be light green in the central play area and red outside.
- 3.3.8 Line paint shall be Latex-ite Line Paint as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.

4. CONSTRUCTION

4.1 Preparation of Sub-Grade

- 4.1.1 Sub-grade - All roots, sod, mulch, foreign matter, and debris shall be removed to a depth of at least 12 inches below finished grade. It shall then be prepared with proper fill, if needed, having a stable, hard, compacted, uniform density throughout its entire length, width and depth. The sub-grade area shall be compacted sufficiently to support the asphalt paver without causing deformation to the sub-grade. If deformation does occur, the Contractor shall place and roll VDOT No.57 coarse aggregate into the sub-grade until it supports the asphalt paver without deformation. The sub-grade shall be approved by the Owner prior to construction of the leveling course.

4.2 Net Posts, Nets, and Fixtures

- 4.2.1 A 10" long 1/2" diameter steel rod shall be placed through the net post, 10" above the bottom. It shall protrude evenly on both sides and be welded.
- 4.2.2 Set net post sleeves and net anchor posts for each court in concrete. The hole for net post concrete footings shall be of the dimensions shown on the contract drawing. The hole for net anchor posts shall be 12" deep and 12" in diameter or square.

4.2.3 The top of all net post and net anchor post concrete footings shall be level with the surface of the sub-grade and shall not project into the base course or asphalt leveling course.

4.2.4 The net shall not be installed until the Contractor has received approval of the installation of the color coat surface from the Owner.

4.3 Fence Enclosure

4.3.1 The fence fabric shall not be installed until the Contractor has received Owner approval of the installation of the color coat surface.

4.3.2 Line posts shall be set approximately 3'-0" below finished ground level. They shall be spaced in the line of fence at a maximum of 10'-0" apart.

4.3.3 Corner and gate posts shall be set approximately 3'-0" below finished ground level. (Note: line, corner, and gate posts shall be set in cylindrical concrete foundations. The hole for the concrete footings shall be 6" deeper than the bottom of the posts and a minimum of 12" in diameter).

4.3.4 Top rail shall be furnished in random lengths averaging not less than 20' and joined with extra long pressed steel sleeves providing a rigid connection but allowing for expansion and contraction.

4.3.5 All corner and gate posts shall be braced by a horizontal pipe securely attached to corner and first line posts with malleable iron or aluminum sand cast fittings, leveled edge bands and truss braced with 3/8" rod and take up.

4.3.6 The fabric shall be placed on the courtside. It shall be fastened to line posts at approximately 24" intervals. The bottom reinforcing wire shall be securely clipped to the fabric at a maximum of 18" intervals.

4.3.7 The bottom of the fabric shall be 1" above the finished surface.

4.3.8 Location of the fence shall be as shown on the plan. The 3' gate openings shall be as shown on the plan.

4.4 Asphalt Court

- 4.4.1 Samples of aggregate to be used in connection with the project shall be submitted together with a report of aggregate gradation and recommended binder content one week prior to beginning construction.
- 4.4.2 During construction the Contractor shall submit test results of the aggregate gradation and binder content of the mixes (minimum of two tests). Either the material supplier or an independent laboratory may make these tests. Costs incurred as a result of any of the above tests will be borne by the Contractor.
- 4.4.3 The leveling course shall be thoroughly compacted to a depth of 2 inches with a maximum of 3% air voids. The finished surface shall not vary from the specified grade more than 1/4 inch in ten feet when measured in any direction.
- 4.4.4 The surface course shall be thoroughly compacted to a depth of 1 1/2 inches. The finished surface shall not vary from the specified grade more than 1/8 inch in ten feet when measured in any direction.
- 4.4.5 Field density determination will be performed with the nuclear field density device utilizing the density control strip as specified under VDOT Section 304 and Virginia Test Method - 10 (VTM-10).
- 4.4.6 The compacted bituminous concrete shall be saw cut to a depth of four inches as shown on the plan and detail, and filled with the joint filler specified.
- 4.4.7 All filler coat and color coat required for the job shall be on the job site prior to beginning the squeegee phase of construction.
- 4.4.8 Filler coat mix design. All materials shall be mixed to a uniform free-flowing consistency.
 - 4.4.8.1 Latex-ite 55 gal.
 - 4.4.8.2 80 Mesh Sand 400 lbs.
 - 4.4.8.3 Water 24 gal.
- 4.4.9 Surface Preparation - The surface shall be thoroughly cleaned, removing all loose dirt, dust, oil grease, leaves and other debris. The court shall be checked with a ten-foot straightedge or shall be flooded with water to locate low areas that are more than 1/8" deep. Minor depressions, 1/8" - 1/4" deep shall be leveled by troweling or screeding a layer of patch mix over the low area. Suitable patch mix is Latex-ite filler coat that has not been diluted with water. Depressions 1/4" to 1/2" require multiple layers of patch mix. Depressions exceeding 1/2" shall be filled with VDOT SM-1 asphalt concrete. All rough paving joints and roller marks shall be leveled prior to application of the filler coat.

4.4.10 Method of Application - Latex-ite shall not be stored in direct sunlight or allowed to freeze. The color coat shall not be applied when the ambient air temperature is below 50 degrees Fahrenheit, when the court surface temperature is above 140 degrees Fahrenheit, or when rain is imminent. The first filler coat shall be applied perpendicular to the playing net. The entire surface shall be checked for ridges between the first and second filler coat applications, and following the second application. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris. The second filler coat shall be applied parallel to the playing net. Uniformly apply the filler coat with a 24" to 48" wide flexible rubber squeegee. No irregularities of texture or level are to be left for correction by color coat application.

4.4.11 Coverage - Each filler coat shall be applied at a rate of .05 gal. per square yard. Allow two hours of dehydrating time between each application.

4.4.12 Color coat mix design. All materials shall be mixed to a uniform free-flowing consistency.

4.4.12.1	Latex-ite	55 gal.
4.4.12.2	Water	24 gal

4.4.13 Surface Preparation - The surface of the second application of filler coat shall be checked to insure a smooth and uniform texture, free from ridges, and tool marks. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris.

4.4.14 Method of Application - Color coat shall be applied with a 24" - 48" wide flexible squeegee. The color coat shall be applied parallel to the playing net. The color coat shall not be applied when the ambient air temperature is below 50 degrees Fahrenheit, when the court surface temperature is above 140 degrees Fahrenheit, or when rain is imminent. The color coat surface shall not be scraped to remove imperfections.

4.5 Playing Lines

4.5.1 Allow the color coat to cure before painting lines. This may vary from 2 to 4 days under good curing conditions. Two inch wide playing lines shall be accurately located and marked. White line paint shall be used. Painters shall use soft-soled shoes and kneepads or kneel on boards to prevent surface indentation. Ragged lines will not be acceptable.

5. Traffic

- 5.1 Protect from traffic during all operations and until opening for use. Allow the color coat surface to cure at least 24 hours before allowing light foot traffic. Following painting of the lines, the court shall be allowed to cure for a minimum of 4 days before being opened for play.

TENNIS PRACTICE COURT

1. GENERAL

All work under this section is subject to the Special and General Conditions and Instructions to Bidders which form a part of these specifications as well as to the latest edition of the Loudoun County Facilities Standards Manual and to the applicable sections of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SCOPE

This work includes the furnishing of all labor, materials, equipment, and services necessary for and incidental to the preparation of the sub-grade, base course, leveling course, CMU masonry wall, filler coats and finish color coat with suitable line working, and installation of a fence enclosure to construct a new tennis practice court.

3. MATERIALS

3.1 Fence Enclosure

- 3.1.1 Materials - The fence shall be a standard manufactured item. It shall be 10 feet high and the materials shall be as follows:

- 3.1.1.1 Line posts - 2 1/2" OD-std. weight pipe, 3.65 lbs./ft.

- 3.1.1.2 Corner and gate posts - 3" OD-std. weight pipe, 5.79 lbs./ft.

- 3.1.1.3 Top rail - 1 5/8" OD-std. weight pipe 2.27 lbs./ft.

- 3.1.1.4 Corner and gate horizontal braces - 1 5/8" OD-std. weight pipe 2.27 lbs./ft.
- 3.1.1.5 Chain link fabric - #11 gauge, 1 3/4" mesh, knuckled finish, top and bottom. Fabric shall be aluminum coated with a minimum of 0.40 oz. of aluminum per square foot of uncoated wire surface. Base shall be commercial quality steel wire. Fence fabric shall pass the ASTM A491-63T tests for Class II aluminum coated wire.
- 3.1.1.6 Chain link fabric for top of ball wall - 11 gauge, 1" mesh, knuckled finish, top and bottom. Fabric shall be aluminum coated with a minimum of 0.40 oz. of aluminum per square foot of uncoated wire surface. Base shall be commercial quality steel wire. Fence fabric shall pass the ASTM A491-63T tests for Class II aluminum coated wire.
- 3.1.1.7 Bottom wire - #7 coil spring wire.
- 3.1.1.8 Corner and gate post tops - Malleable iron or aluminum sand castings.
- 3.1.1.9 Fabric ties - Aluminum or galvanized wire of approved gauge and design.
- 3.1.1.10 Gate frames - 1 5/8" OD-std. weight pipe.
- 3.1.1.11 Internal bracing - 1 3/8" OD-std. weight pipe.
- 3.1.1.12 Miscellaneous fittings shall be those which are necessary to make a complete installation. All fence materials, other than chain link fabric shall be hot-dipped galvanized inside and out.

3.1.2 Concrete Footings

- 3.1.2.1 Concrete shall be class B. See the CAST IN PLACE CONCRETE specification.

3.2 Court

- 3.2.1 Primer shall be MC-30 or MC-70 low viscosity asphalt conforming to VDOT Section 211.
- 3.2.2 Base Course shall be VDOT Section 209, Type I, 21A, crushed stone.
- 3.2.3 Leveling Course shall be VDOT Section 212, SM-2A asphalt concrete.
- 3.2.4 Surface Course shall be VDOT Section 212, SM-1 asphalt concrete.
- 3.2.5 Samples of aggregate to be used in connection with the project will be submitted together with a report of aggregate gradation and recommended binder content one week prior to beginning construction.
- 3.2.6 Filler coat shall be Latex-ite Acrylic Color System as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.
- 3.2.7 Color coat shall be Latex-ite Acrylic Color System as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.
- 3.2.8 Fine aggregate for filler coat and color coat shall be silica sand, 100% passing a No. 80 sieve.
- 3.2.9 Color coat shall be light green in the central play area and red outside.
- 3.2.10 Line paint shall be Latex-ite Line Paint as manufactured by American Tennis Courts, Inc., 4051 North Point Road, Baltimore, Maryland 21222, or approved equal.

3.3 Ball Wall

- 3.3.1 Concrete Masonry Units (CMU)
 - 3.3.1.1 ASTM C 90 Grade N-1 Moisture cured). Lightweight aggregate, hollow.
 - 3.3.1.2 Provide autoclave treatment of CMU @ 350° F, 125 psi.

- 3.3.1.3 Corner units shall have square external corners. Provide units as necessary for the conditions shown. The texture of units shall match the approved samples for the type of construction and the locations designated. Exposed units shall not contain iron spots or other substances that will stain paint.

3.3.2 Continuous Masonry Wire Reinforcing for Straight Walls

- 3.3.2.1 Truss design, 9 gauge welded steel wire, 0.8 oz. hot dip zinc coating (after fabrication) for exterior walls, mill-galvanized wire for interior walls, width 1 1/2" - 2" less than wall thickness.

4. CONSTRUCTION

4.1 Preparation of Sub-Base

- 4.1.1 Sub-base - The sub-base area shall be compacted to 95% density at optimum moisture content and all roots, sod, mulch, foreign matter, and debris removed to a depth of at least 12 inches below finished grade. It shall then be prepared with proper fill, if needed, having a stable, hard, compacted, uniform density throughout its entire length, width and depth. The sub-base shall be approved by the Owner prior to construction of the base course.

4.2 Fence Enclosure

- 4.2.1 All line and corner posts and footings shall be installed prior to placement of the court base, leveling, and surface courses.
- 4.2.2 Line posts shall be set approximately 3'-0" below finished ground level. They shall be spaced in the line of fence at a maximum of 10'-0" apart.
- 4.2.3 Corner and gate posts shall be set approximately 3'-0" below finished ground level. (Note: line, corner, and gate posts shall be set in cylindrical concrete foundations. The hole for the concrete footings shall be 6" deeper than the bottom of the posts and a minimum of 12" in diameter).
- 4.2.4 Top rail shall be furnished in random lengths averaging not less than 20' and joined with extra long pressed steel sleeves providing a rigid connection but allowing for expansion and contraction.

- 4.2.5 All corner and gate posts shall be braced by a horizontal pipe securely attached to corner and first line posts with malleable iron or aluminum sand cast fittings, leveled edge bands and truss braced with 3/8" rod and take up.
- 4.2.6 The fence fabric shall be installed before the installation of the color coat surface.
- 4.2.7 The fabric shall be placed on the courtside. It shall be fastened to line posts at approximately 24" intervals. The bottom reinforcing wire shall be securely clipped to the fabric at a maximum of 18" intervals.
- 4.2.8 The bottom of the fabric shall be 1" above the finished surface.
- 4.2.9 Location of the fence shall be as shown on the plan. The 3' gate openings shall be as shown on the plan.

4.3 Court

- 4.3.1 During construction the Contractor shall submit test results on the aggregate gradation and binder content of the mixes (minimum of two tests). Either the material supplier or an independent laboratory may make these tests. Costs incurred as a result of any of the above tests will be borne by the Contractor.
- 4.3.2 Base - The base shall be uniformly spread and compacted with 8 to 10 ton roller to a minimum depth of 4 inches.
- 4.3.3 Primer - A pressure distributor shall be used to prime the prepared surface of absorbent base at a rate, under average conditions, from 0.20 to 0.50 gallon per square yard. The asphalt should be entirely absorbed by the base course. If it is not absorbed within 24 hours after application, sand shall be spread over the surface to blot the excess asphalt. Care shall be exercised, however to prevent overpriming. The prime shall be fully set and cured before placing the surface treatment.
- 4.3.4 Leveling Course - The leveling course shall be thoroughly compacted by rolling with an 8 to 10 ton roller to a compacted depth of 1 1/2 inches. The finished surface shall not vary from the specified grade more than 1/4 inch in ten feet when measured in any direction.
- 4.3.5 Surface Course - The surface course shall be thoroughly compacted by rolling with an 8 to 10 ton roller to a compacted depth of 1 inch. The finished surface shall not vary from the specified grade more than 1/8 inch in ten feet when measured in any direction.

4.4 Ball Wall

- 4.4.1 Construct masonry units in the bond pattern indicated.
- 4.4.2 Cut exposed masonry units, where necessary, with power saw. Avoid the use, by proper layout, of less than half size units.
- 4.4.3 Hold uniform joint sizes as indicated, or if not indicated, hold 3/8" joints.
- 4.4.4 Cut all joints flush, unless otherwise indicated.
- 4.4.5 Protect newly laid masonry from exposure to precipitation, excessive drying, freezing, soiling, backfill and other harmful elements.
- 4.4.6 All filler coat and color coat required for the job shall be on the job site prior to beginning the squeegee phase of construction.
- 4.4.7 Filler coat mix design. All materials shall be mixed to a uniform free-flowing consistency.
 - 4.4.7.1 Latex-ite 55 gal.
 - 4.4.7.2 80 Mesh Sand 400 lbs.
 - 4.4.7.3 Water 24 gal.
- 4.4.8 Surface Preparation - The surface shall be thoroughly cleaned, removing all loose dirt, dust, oil grease, leaves and other debris. The court shall be checked with a ten-foot straightedge or shall be flooded with water to locate low areas that are more than 1/8" deep. Minor depressions, 1/8" - 1/4" deep shall be leveled by troweling or screeding a layer of patch mix over the low area. Suitable patch mix is Latex-ite filler coat that has not been diluted with water. Depressions between 1/4" and 1/2" deep require multiple layers of patch mix. Depressions exceeding 1/2" shall be filled with VDOT SM-1 asphalt concrete. All rough paving joints and roller marks shall be leveled prior to application of the filler coat.
- 4.4.9 Method of Application - Latex-ite shall not be stored in direct sunlight, or allowed to freeze. The color coat shall not be applied when the ambient air temperature is below 50 degrees Fahrenheit, when the court surface temperature is above 140 degrees Fahrenheit, or when rain is imminent. The first filler coat shall be applied perpendicular to the ball wall. The entire surface shall be checked for ridges between the first and second filler coat applications, and following the second application. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris. The second filler coat shall be applied parallel to the playing net. Uniformly apply the filler coat with a 24" to

48" wide flexible rubber squeegee. No irregularities of texture or level are to be left for correction by color coat application.

4.4.10 Coverage - Each filler coat shall be applied at a rate of .05 gal. per square yard. Allow two hours of dehydrating time between each application.

4.4.11 Color coat mix design. All materials shall be mixed to a uniform free-flowing consistency.

4.4.11.1 Latex-ite 55 gal.

4.4.11.2 Water 24 gal.

4.4.12 Surface Preparation - The surface of the second application of filler coat shall be checked to insure a smooth and uniform texture, free from ridges, and tool marks. All imperfections shall be scraped smooth and the court surface cleaned of all loose debris.

4.4.13 Method of Application - Color coat shall be applied with a 24" - 48" wide flexible squeegee. The color coat shall be applied parallel to the playing net. The color coat shall not be applied when the ambient air temperature is below 50 degrees Fahrenheit, when the court surface temperature is above 140 degrees Fahrenheit, or when rain is imminent. The color coat surface shall not be scraped to remove imperfections.

4.4.14 The ball wall shall receive colorcoat on all exposed surfaces per manufacturer's recommendations and as shown on the plans.

4.5 Playing Lines - Court Surface and Ball Wall

4.5.1 Allow the color coat to cure before painting lines. This may vary from 2 to 4 days under good curing conditions. Two inch wide playing lines shall be accurately located and marked. White line paint shall be used. Painters shall use soft-soled shoes and kneepads or kneel on boards to prevent surface indentation. Ragged lines shall not be acceptable.

5. TRAFFIC

Protect from traffic during all operations and until opening for use. Allow the color coat surface to cure at least 24 hours before allowing light foot traffic. Following painting of the lines, the court shall be allowed to cure for a minimum of 4 days before being opened for play.

TENNIS COURT ELECTRICAL SYSTEM

1. GENERAL

All work under this section is subject to the Special and General Conditions and Instructions to Bidders which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual and Virginia Department of Transportation (VDOT) Road and Bridge Specifications. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SCOPE

2.1 The work includes, but is not limited to, the provision of all material, services, labor, and equipment necessary to construct the following:

2.2 Underground electric services.

2.3 Provide a complete system of lighting panels, wiring raceways, feeders, and lighting fixtures, poles and branch circuits including all conduits, cables, conductors, boxes, wiring device, etc.

2.4 Lighting fixtures, lamps, brackets and poles.

2.5 Temporary electric service during construction.

2.6 Grounding system as indicated on drawings and specified herein.

2.7 Permits and certificates.

3. CODES AND STANDARDS

3.1 Installation of all electrical work shall be in accordance with the following regulations, codes, etc.

3.2 Local electrical codes and ordinances.

3.3 National Electrical Code.

3.4 National Board of Fire Underwriters.

3.5 Rules and regulations of Virginia Power.

4. REGULATIONS

The Contractor shall effectively protect at his expense, such of his work, materials, and equipment, as is liable to injury during the construction period. The Contractor shall be held responsible for all damage so done until his work is fully and finally accepted.

5. CERTIFICATE OF INSPECTION

The Contractor shall, at his expense, have an inspection made by the Loudoun County Department of Building & Development, Electrical Inspections, of the complete electrical installation and shall deliver the certificate of approval of the complete work to the Owner before receiving his final payment.

6. PERMITS

6.1 The Contractor shall obtain all necessary permits from any authority required for his work. Loudoun County PRCS shall waive any permit fees.

6.2 Copies of all permits and approvals shall be submitted to the Owner.

7. MANUFACTURER'S DRAWINGS

7.1 The Contractor shall submit manufacturer's drawings for the following electrical equipment to be installed on the job, for the Owner's approval, before ordering same for installation.

7.1.1 Panelboards.

7.1.2 Lighting fixtures, poles and brackets.

7.1.3 Relays, time clocks and contractors.

7.1.4 No substitutions shall ordinarily be accepted. To insure the use of any item as and equal, such approval shall be obtained prior to installation.

8. CHARACTER OF MATERIALS AND EQUIPMENT

- 8.1 All material and equipment, except as herein otherwise noted, shall be new and conform to standards specified herein. Equipment is herein defined to include conduits, cable, wiring, materials and devices, panelboards, relays, etc.
- 8.2 All materials and equipment shall be of an approved standard design. Similar materials shall be of one manufacturer wherever possible.
- 8.3 All equipment offered under these specifications shall be limited to products regularly produced and recommended for service ratings in accordance with manufacturers' catalogs, engineering data, or other comprehensive literature made available to the public and in effect at the time of opening bids.
- 8.4 Equipment shall be installed in strict accordance with manufacturers' instructions for type, capacity and suitability of each piece of equipment used.
- 8.5 The Contractor shall obtain these instructions which shall be considered a part of these specifications.

9. RACEWAYS AND FITTINGS

- 9.1 When service does not already exist on the site, the contractor shall extend ducts as indicated on the plans for electric company service, encased on all sides with 3" of concrete, and enveloped with proper space allowed at end for extension by the electric company.
- 9.2 Underground and in pole base - galvanized rigid steel conduit.
- 9.3 Panel feeders - galvanized rigid steel conduit.
- 9.4 Branch circuits above grade in service enclosures shall be in galvanized rigid steel conduit.

10. CONDUCTORS

- 10.1 All conductors shall be copper and shall be accordance with the National Electrical Code.

10.2 #12 AWG shall be the smallest wire size used.

10.3 Materials shall be new and as follows:

10.3.1 Panel feeders - RHW or THW, 600 volt.

10.3.2 Branch feeders #6 AWG and larger - THW or RHW.

10.3.3 Branch feeders #8 AWG and smaller - RHW or TW, 600 volt.

10.3.4 Underground - direct burial type UF 600 volt, 60 degrees C cable.

11. WORKMANSHIP

11.1 All wiring shall be color coded to identify phases, neutral and switch legs.

11.2 Direct burial cable shall be run below grade at depth indicated. If unsuitable rocky soil is encountered, a 6" layer of sand shall be installed at the top and bottom of cable, or install cable in appropriate conduit or other approved means.

12. ELECTRICAL SERVICES

12.1 The service shall be underground 3 phase, 4 wire, 120/240 volts from the appropriate utility company pad mounted transformer. The Contractor shall provide secondary conduits and raceways between the pad and C/T cabinets in accordance with the utility company requirements and install the C/T cabinets and meters supplied by the utility company.

12.2 The Contractor shall arrange with the appropriate utility company for service and shall be responsible for verification of the same and shall pay all service charges.

12.3 The Contractor shall install all electrical components in a Hoffman-padlockable steel NEMA 3 enclosure. The panel shall be sized to have the back mounting wall panel be 200% of the space of the electrical components.

13. PANELBOARDS

13.1 The panelboards shall be constructed in accordance with the standards set up by the Underwriters Laboratories, Inc., and shall contain the number and type of circuit breakers

as indicated on the drawings and as indicated on the drawings and as manufactured by G.E., Westinghouse, Square D, or ITE.

- 13.2 The panelboards shall be equipped with flush locks. Furnish six keys.
- 13.3 All surface mounted panels shall be mounted on 12 gauge formed steel channel having a cross section dimension of at least 1" x 1". The channel and fittings shall have Gal-V-Kren or hot-dipped galvanized finish. Channels shall be installed vertically.
- 13.4 Stencil the panel number or letter to the inside of the panel door to correspond with the panel designation on the drawings.
- 13.5 Panels calling for spaces shall have bus mounting holes and knock-outs in the front cover for future breakers.
- 13.6 All details of the panelboard shall be submitted to the Owner for approval before construction is begun.
- 13.7 All 240/120 volt panels shall be G.E. type NLAB on NAB as shown on the drawings.
- 13.8 All panels shall be equipped with a ground bus.

14. GROUND

- 14.1 The Contractor shall provide a ground for service neutral, service wireway, metallic conduits, poles, cabinet devices and utilization equipment permanently and effectively in accordance with requirements of Article 250 of the National Electrical Code. All grounding and bonding connections shall be solderless.

15. WIREWAY

Wireways shall be the standard manufactured product of a company regularly producing wireway and shall not be a local shop assembled unit. Wireways shall be of the hinged cover type; Underwriters' listed and of sizes indicated or as required by NEC if not indicated. Finish shall be ASA No. 49 medium light gray enamel over rust inhibitor.

16. CONTACTORS AND RELAYS

- 16.1 Contractors and relays shall be of the single coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hoods, latches or semi-permanent magnets. Control stations shall be required to make but not break the operating coil current.
- 16.2 Main contacts of contractors shall be double break silver to silver type protected by arcing contacts. Contacts shall be self-aligning and renewable from the front of the panel.
- 16.3 Control connections shall be clearly marked "L" for line wire, "C" for closing wire and "O" for opening wire. A manual operating lever shall be included.
- 16.4 Contractors shall be Underwriters' Laboratories listed at full load rating for use with gas-filled tungsten filament lamps and shall be Automatic Switch Company "Type RC" Bulletin 920 Remote Control Switch or approved equal.
- 16.5 Relays shall be Automatic Switch Company Bulletin 1255 or approved equal.

17. TIME CLOCK

- 17.1 The time switch shall be Tork Model W-120L or approved equal, seven day calendar dial type, capable of being set for different ON/OFF times each day of the week, to an operating accuracy of plus or minus 15 minutes of desired time.
 - 17.1.1 It shall be possible to have a minimum of one hour between an ON and OFF operation with a minimum of four ON/OFF trippers on the dial.
 - 17.1.2 ON/OFF operations shall be accomplished by removable ON/OFF trippers on the dial.
- 17.2 Time switch contacts shall be capable of carrying a minimum of 40 amperes per pole continuously at 120 volts and shall be SPDT.
- 17.3 Enclosure shall be Nema 1 surface type, finished in baked gray enamel and with knockouts on the bottom, both sides and top.
- 17.4 The time switch shall be powered by a self-starting synchronous motor with spring driven reserve sufficient to operate the time switch contacts at least 16 hours after power failure. On restoration of power, the time switch shall transfer to synchronous motor drive and automatically rewind reserve.

17.5 Terminals shall be of copper pressure type, capable of receiving #6 AWG wire.

18. LIGHTING FIXTURES AND LAMPS

Fixtures shall be furnished and installed as indicated on the plans. Fixtures shall be complete with all required sockets, wiring, reflectors, fittings, necessary for a complete installation. All fixtures shall be completely lamped and operating at the time of final acceptance.

19. PRIME PAINTED STEEL POLES

19.1 Poles shall be heavy-duty round tapered rigid steel with a 2" standard pipe (2 3/8" OD) top tenon.

19.2 Poles shall be 11 gauge single piece construction with guaranteed minimum yield strength of 48,000 psi.

19.3 A 4" x 6 1/2" handhole for wire splicing shall be located 12" above the flat plate base and furnished with a reinforcing frame and cover.

19.4 Poles and bases shall have a shop coat of rust-inhibitive primer inside and out and shall be field painted with two coats of flat black oil base paint.

19.5 Galvanized anchor rods and plate nuts shall be furnished with each pole.

WARNING TRACK & FENCE MOW STRIP

1. GENERAL

All work under this section is subject to the Information for Bidders, General and Supplemental Conditions which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual, the Virginia Erosion and Sediment Control Handbook, Loudoun County Codified Ordinances. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SCOPE

2.1 Installation of stonedust warning track and fence mow strip on baseball/softball fields.

3. GENERAL REQUIREMENTS

3.1 Stonedust shall be crushed bluestone, or similar, of standard grade, free of debris.

3.2 Underlayment material shall be spunbound and/or woven fabric

3.3 Fence mow strips shall extend 12" on either side of fence.

3.4 Warning track shall be 10' for 200' ball fields; 15' for 300'+ fields inside the fence and extend 12" outside the fence.

4. INSTALLATION

4.1 Area shall be excavated to depth of 4" from final grade. Grade must be maintained.

4.2 Base shall be mechanically tamped or rolled.

4.3 Continuous or overlapped underlayment fabric shall be rolled to cover 100% base surface. Joined edges shall be overlapped, minimum of 12".

4.4 Stone dust shall be placed and rolled or tamped to match surface grade.

SECTION 4.10 BALLFIELD EQUIPMENT BOX

1. GENERAL

1.1 All work under this section is subject to the provisions of Section 1.01 General References for All Sections.

2. PRODUCT

2.1 30' x 30" x 72" (?) steel storage box with side or front additional access. Factory painted green. Safety lid with emergency release to prevent lock-in, compression spring lid to prevent slamming closed, double padlock hasp for use with basic combination lock.

3. SOURCES

3.1 Model BFB3072 as manufactured by Thybar Equipment Boxes or equal.
PRCS Athletic Fields Page 4-51

SECTION 4.11 ATHLETIC FIELD LIGHTING STANDARDS

1. GENERAL

- 1.1
- 1.2
- 1.3
- 1.4

All work under this section is subject to the provisions of Chapter 1, Section 1.01 General References for All Sections.

Athletic Field Lighting Standards will parallel the Fairfax County Park Authority Athletic Field Lighting Systems Performance Specifications as outlined in the Revision 2.2 outline, dated September 1, 2006.

Class of Play Category (IESNA RP-6-01) will be Category III.

Lighting Environmental Zone.

2. GENERAL DESIGN CRITERIA

- 2.1
- 2.2
- 2.3
- 2.4

Class of Play Category (IESNA RP-6-01) Category III.

Lighting Environmental Zone Classification (IESNA RP-33-99).... LEZ 2 and LEZ 3 Aimable System.

Light Loss Factor (LLF).....0.801

3. ELECTRICAL REQUIREMENTS

- 3.1
- 3.2
- 3.3
- 3.4

Voltage..... 480 Volt, 3 Phase

Lamp..... 1,500 Watt metal halide

Luminaires (including spill and glare control devices)..... UL 1598-00

Electrical equipment enclosures..... NEMA 3R

4. LIGHTING PERFORMANCE REQUIREMENTS

4.1

ON-FIELD – Rectangular Fields

4.1.1 Maximum permitted illuminance.....50 foot-candles

4.1.2 Maintained average horizontal illuminance.....33 foot-candles2

1 Alternate Light Loss Factors will be considered. A Tilt Factor is required when applicable.

2 Testing tolerance 10% included therefore field measured maintained average horizontal illuminance levels shall not be below 30 foot-candles.

PRCS Athletic Fields Page 4-52

4.1.3 Uniformity Ratio not to exceed..... 3:1

4.1.4 Calculation and on-field measurement grid (see Figures 1 to 5) 15 ft x 15 ft

4.2

4.3

4.4

ON-FIELD – Baseball/Softball Fields

- 4.2.1 Maximum permitted illuminance..... 60 foot-candles
- 4.2.2 Min. maintained average horizontal illuminance (Infield).... 55 foot-candles³
- 4.2.3 Min. maintained average horizontal illuminance (Outfield).. 33 foot-candles⁴
- 4.2.4 Uniformity Ratio not to exceed (Infield)..... 2:1
- 4.2.5 Uniformity Ratio not to exceed (Outfield)..... 2.5:1
- 4.2.6 Calculation and on-field measurement grid (see Figures 1 to 5)... 15 ft x15 ft

OFF-FIELD – Standard A5

- 4.3.1 Maximum permitted initial vertical spill⁶..... 0.3 foot-candles
- 4.3.2 Maximum permitted initial glare..... 7,000 candelas

OFF-FIELD – Standard B7

- 4.4.1 Maximum permitted initial vertical spill⁶..... 0.8 foot-candles
- 4.4.2 Maximum permitted initial glare..... 12,000 candelas

5. REMOTE CONTROL SYSTEM REQUIREMENTS

5.1

A security code based, 24-hour, remote control system that enables PRCS to remotely turn the system on or off, control the field lighting schedule, and monitor the system, using telephone, world-wide-web or software driven computer.

3 Testing tolerance 10% included therefore field measured maintained average horizontal illuminance levels shall not be below 50 foot-candles.

4 Testing tolerance 10% included therefore field measured maintained average horizontal illuminance levels shall not be below 30 foot-candles.

5 When a residential property line is 200 ft or less from a field perimeter line, foul line, or outfield fence line as applicable and indicated on Figures 1 to 5 Standard A will apply.

6 Spill light measurement grid points at 30 ft on center as shown of Figures 1 to 5.

Measurements shall be in the vertical plane at 5 ft above grade, with the meter oriented towards a point at the center of the field 50 ft above grade.

7 When a residential property line is more than 200 ft from a field perimeter line, foul line, or outfield fence line as applicable and indicated on Figures 1 to 5 Standard B will apply.

The remote control system shall be protected against power outages and memory loss, shall reboot to real-time once power is restored, and execute any commands issued prior to the outage.

The remote control system shall monitor and provide reports of actual lighting system usage.

On-site equipment shall include manual on/off switches to allow for maintenance and manual operation.

The system shall be capable of operating any given field from multiple computers via the internet.

The system shall be capable of being integrated with and controlled by schedules within Vermont Systems Inc. RecTrac.

6. POLE AND FOUNDATION STANDARDS

Pole locations..... As shown on Figures 1 to 5

Pole height (above finished grade)..... maximum 90 ft.
Pole material..... ASTM A595, hot-dip galvanized steel
Design criteria..... Dead load and basic wind velocity of 90 mph. plus gust factor
Foundation..... Reinforced concrete 8

7. WARRANTY AND MAINTENANCE REQUIREMENTS

7.1

7.2

The lighting system manufacturer shall provide all materials and labor to ensure all lighting system components, excluding lamps, remain in good operating condition for a ten (10) year Warranty Period.

The lighting system manufacturer shall provide all materials and labor to ensure the lighting systems performs as designed, throughout the Maintenance Period of 7,500 service hours or 15 years, whichever occurs first. During the Maintenance Period the manufacturer shall:

7.2.1 Maintain lighting levels within +/- 10% of the maintained horizontal average luminance level for the entire field.

7.2.2 Group-replace all lamps when they reach the end of their service life as specified by the lamp manufacturer.

8 Foundations are to be designed by a Professional Engineer registered in Virginia.
PRCS Athletic Fields Page 4-54

7.2.3 Spot-replace individual lamps when 10% of the lamps are extinguished on the entire field or more than one lamp is extinguished on any one pole.

7.3 All repairs shall be made within two (2) weeks of notification.

ATHLETIC FIELD TURF

1. GENERAL

All work under this section is subject to the Information for Bidders, General and Supplemental Conditions which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual, the Virginia Erosion and Sediment Control Handbook, Loudoun County Codified Ordinances and Sports Turf Management in Virginia from VA Tech. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SCOPE

The work consists of the installation, establishment and acceptance of playing surface.

2.1 Seeding

2.2 Sprigging

2.3 Sodding

3. GENERAL REQUIREMENTS

3.1 Application of turf material after final grade and soil bed is approved by PRCS Maintenance Division.

3.2 Playing area should be clearly staked to include required overrun areas.

3.3 Contractor shall supply certification information to PRCS Maintenance Division.

3.4 Soil tests showing nutrition, pH and organic content shall be provided to PRCS Maintenance Division.

4. TURF TYPES

4.1 Selection of appropriate varieties to be coordinated with PRCS Maintenance Division.

4.2 Certified seed of cool season or Bermuda varieties as listed for the Washington DC metropolitan area.

4.3 Certified sprigs of Hybrid Bermuda as listed for the Washington DC metropolitan area.

4.4 Certified, non-netted cool season or Hybrid Bermuda sod as listed for the Washington DC metropolitan area.

5. INSTALLATION

5.1 Seeding

5.1.1 Seed bed shall consist of 2-3 inches of loose, friable, debris and weed free topsoil.

5.1.2 Cool season varieties shall be slit and broadcast seeded in two directions, totaling 20 lbs./1000sq.ft., to achieve even distribution. Starter fertilizer (1-2-1 ratio) at ½ lb. Nitrogen/1000 sq. ft., shall be applied at seeding. Hydro mulch or clean

straw with tack shall be distributed uniformly over entire area. If seeded in late fall, turf blankets will be required.

- 5.1.3 Seeded Bermuda shall be broadcast in two directions, totaling 2lbs./1000sq.ft., using Green Sand as a carrier. Starter fertilizer (1-2-1 ratio) at ½ lb. Nitrogen/1000 sq.ft. shall be applied after germination. Light rolling shall be performed to assure adequate seed soil contact.

5.2 Sprigging

- 5.2.1 Seed bed shall consist of 2-3 inches of loose, friable debris free topsoil.
- 5.2.2 Hybrid Bermuda sprigs shall be distributed by sprigging machine or similar at 400-800 bushels/acre. Starter fertilizer (1-2-1 ratio) at ½ lb. Nitrogen/1000 sq.ft., shall be applied at sprigging. Light rolling shall be performed to assure adequate soil contact.
- 5.2.3 Light topdressing may be required to prevent sprig dessication.

5.3 Sodding

- 5.3.1 Seed bed shall consist of 2-3 inches of loose, friable debris free topsoil.
 - 5.3.1.1 Starter fertilizer (1-2-1 ratio) at ½ lb. Nitrogen/1000 sq.ft., shall be applied prior to sod installation.
- 5.3.2 Sod shall be cut no more than 24 hours in advance of installation. All sod delivered must be installed within this period.
- 5.3.3 Sod shall be of uniform ½ - 1" thickness, free of debris, holes or weeds. Large rolls shall be used and should be solid and tightly woven.
- 5.3.4 Unless sodding in dormant period, sod shall be have a healthy green color with adequate moisture in root zone.
- 5.3.5 Edges shall be butted tightly on all sides. Light rolling shall be performed to assure adequate soil contact and uniformity.

6. WATERING

- 6.1 Seed bed must maintain a consistent moisture content, achieved by short repetitive intervals to assure germination (cool season 7-10 days; Bermuda 21 days). Excess water will deter germination or kill new seedlings.
- 6.2 At installation, sprigs and sod will require more water per interval. Water may be allowed to pool slightly.
- 6.3 Once germinated and/or roots develop, intervals should be spaced further apart with longer duration. Continued weaning is necessary to encourage deep roots. No pooling should be seen.

7. ESTABLISHMENT

- 7.1 Apply starter fertilizer (1-2-1 ratio) at 1 lb. Nitrogen/1000 sq.ft. 30 days after germination or installation. Weather conditions may dictate lesser Nitrogen rate. Contact PRCS Maintenance Division.
- 7.2 Sod may require additional rolling to achieve uniform surface.
- 7.3 Spaces between sod rolls shall be dressed with top dress mixture and/or similar seed mixture.
- 7.4 Turf shall be mowed at a minimum 3" height for cool season turf and 2" for bermuda. No more than 1" of the leaf surface should be removed per cutting. Clippings should be left not bagged.
- 7.5 Fertilization, ½ lb./1000 sq.ft. monthly, and watering should be continued until acceptance.

8. ACCEPTANCE

- 8.1 Field should be ready for play
- 8.2 Seeded and sprigged fields shall have uniform 95% coverage of total area. No erosion should be seen. Turf is healthy, disease and weed free.
- 8.3 Sodded fields shall have uniform 100% coverage of total area. Turf is healthy, disease and weed free. Consistent deep root development is present.

IRRIGATION

1. GENERAL

All work under this section is subject to the Information for Bidders, General and Supplemental Conditions which form a part of these specifications and to the current editions of the Loudoun County Facilities Standards Manual, the Virginia Erosion and Sediment Control Handbook, Loudoun County Codified Ordinances, Loudoun County Sanitation Authority. The Contractor shall be responsible for and governed by all the requirements thereunder.

2. SCOPE

2.1 Design

2.2 Installation

2.3 Acceptance

3. GENERAL REQUIREMENTS

3.1 Design for system should be presented to PRCS Maintenance Division after water source (well preferred) and power source determined, but prior to installation.

3.2 Installation should not commence until design and final grade approved by PRCS Maintenance Division.

4. DESIGN

4.1 Plan shall be designed to provide adequate water based on water volume available, distance from well, field sizes and quantity.

4.2 Shall be designed to provide easy turf maintenance to the fields, efficient valve and head placement, and coverage including the overrun areas.

4.3 Each field shall be zoned for individual use.

4.4 Backflow preventor, blowby valve, pressure regulator, etc... as required to maintain system operation.

5. MATERIALS

- 5.1 Controller – shall be Toro Sentinel or similar. Must offer remote access/programming capability via phone line, radio control onsite and additional zone capacity.
- 5.2 Heads – shall be Hunter I25 or similar, as well as, conform to industry standard design principals.
- 5.3 Valves – Hunter PGV or similar
- 5.4 Pipe and fittings – shall be minimum of schedule 40 PVC. Cleaned and glued to industry standards.
- 5.5 Wire - X gauge individually coated copper

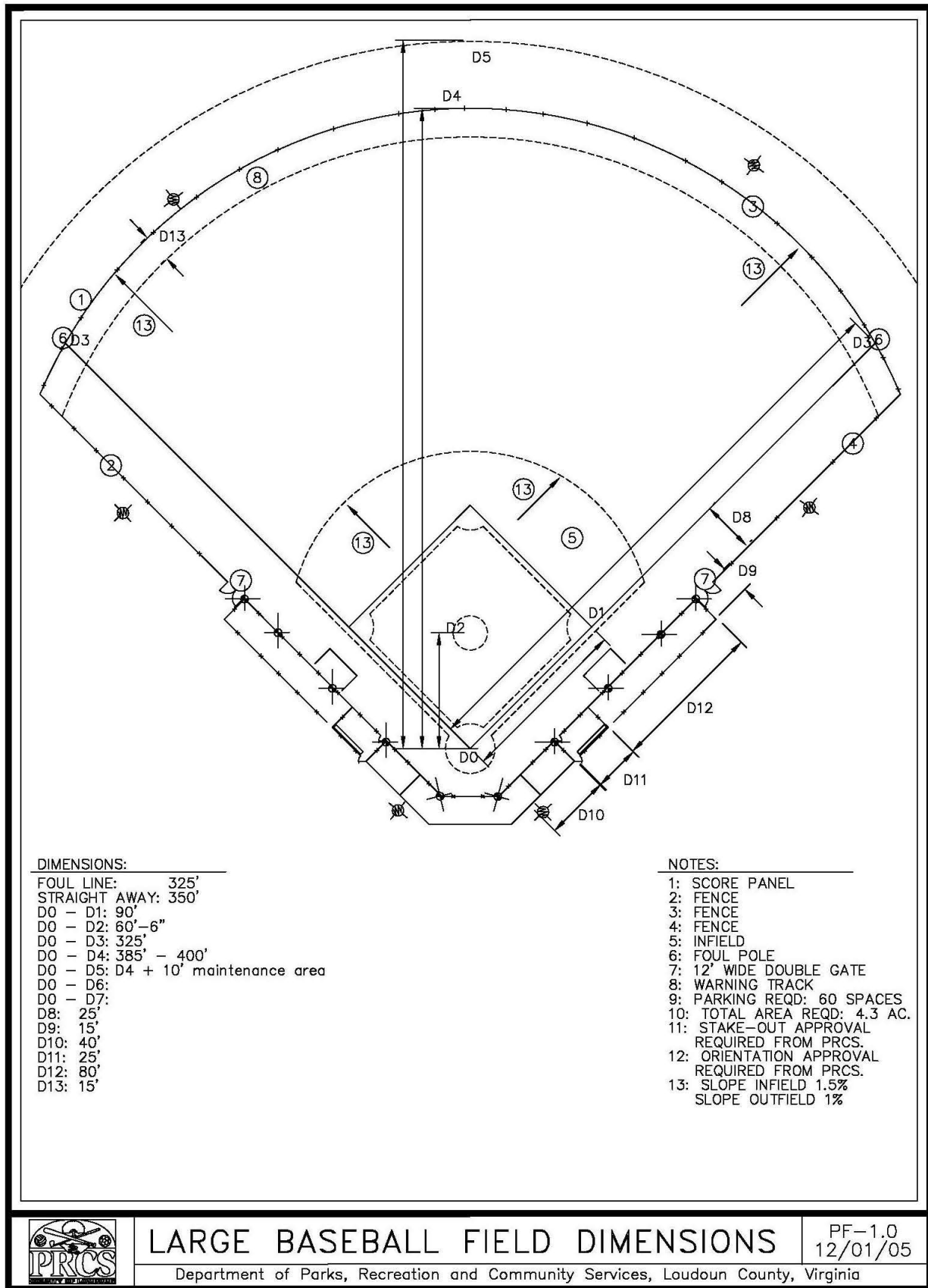
6. INSTALLATION

- 6.1 Main lines shall be trenched, minimum 18” deep, from water source to each valve.
 - 6.1.1 Wires shall be bundled and placed uniformly along side of pipe. Ditches shall be backfilled with clean material, no rocks larger than 2”, and compacted with tamper.
 - 6.1.2 Access through asphalt or concrete roadways and walkways shall be tunneled rather than cut and repaired.
- 6.2 Valves shall be secured in center of standard valve box. Wire connections shall be made with water tight device and secured in an orderly fashion. Box shall be flush with surface and hand tamped.
- 6.3 Lateral lines may be pulled or trenched 18” deep and compacted with tamper.
- 6.4 Heads shall be installed onto swing joint and flush with surface. Area should be hand tamped.
- 6.5 Disturbed areas shall be repaired to equal the conditions prior to irrigation installtion.

7. ACCEPTANCE

- 7.1 Upon completion, contractor shall review operating procedures, coverage areas, and turf conditions with PRCS Turfgrass Manager.

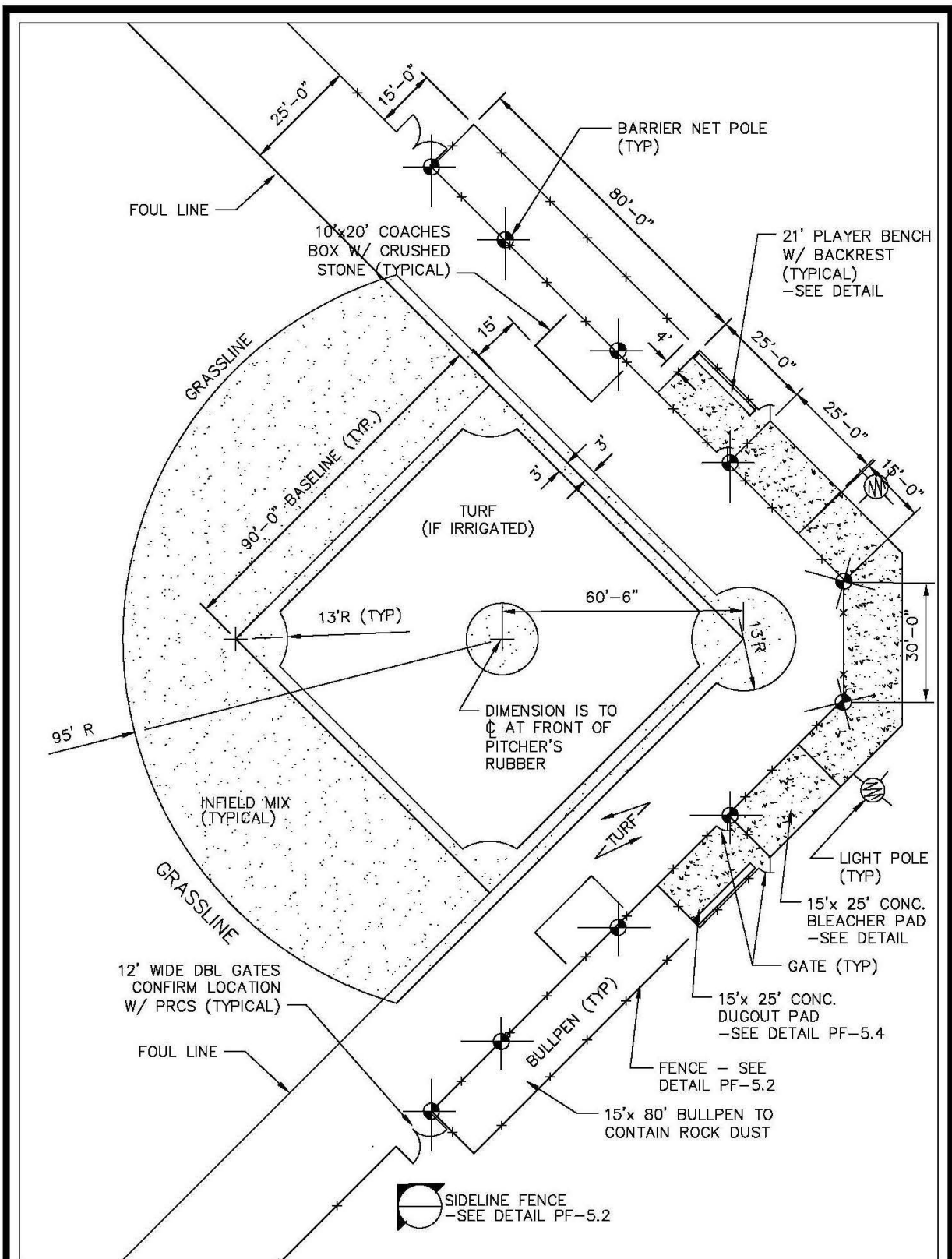
- 7.2 Contractor shall provide as-built plan, including wiring color code and zones.
- 7.3 Contractor shall provide all equipment documentation and warranty information.



LARGE BASEBALL FIELD DIMENSIONS

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-1.0
12/01/05

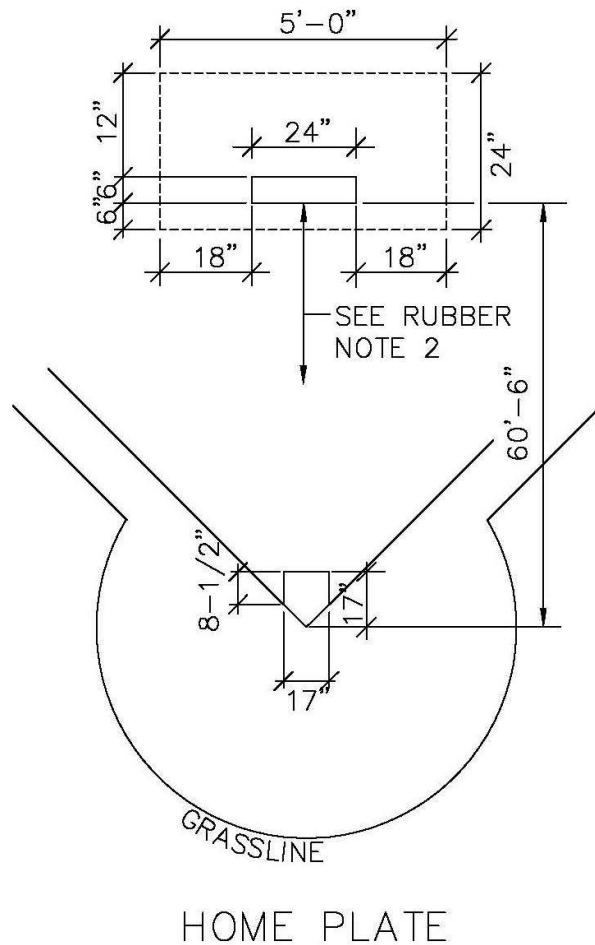


LARGE BASEBALL INFIELD LAYOUT

PF-1.1
12/01/05

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

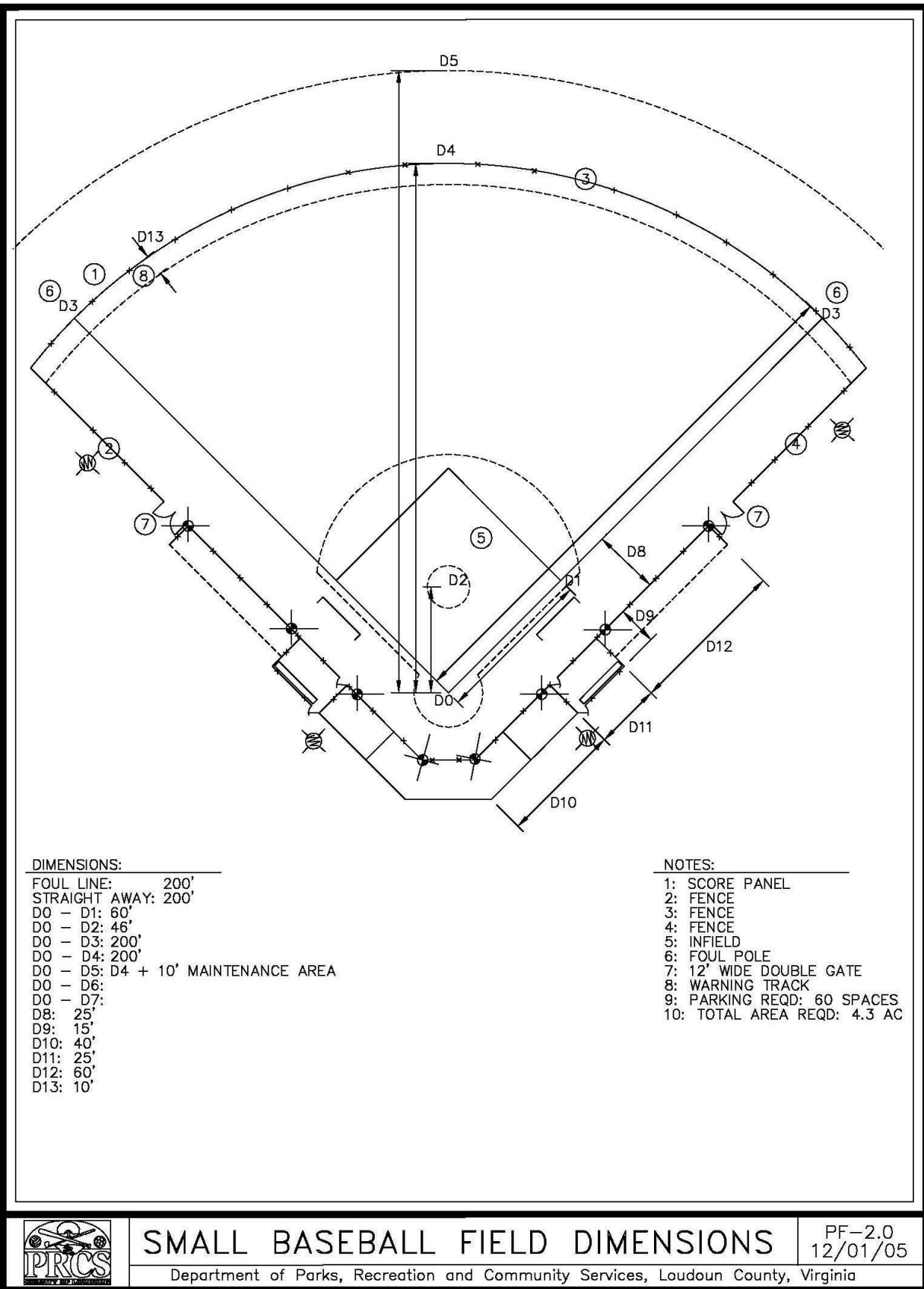
DETAIL OF FLAT
SURFACE OF
PITCHERS MOUND

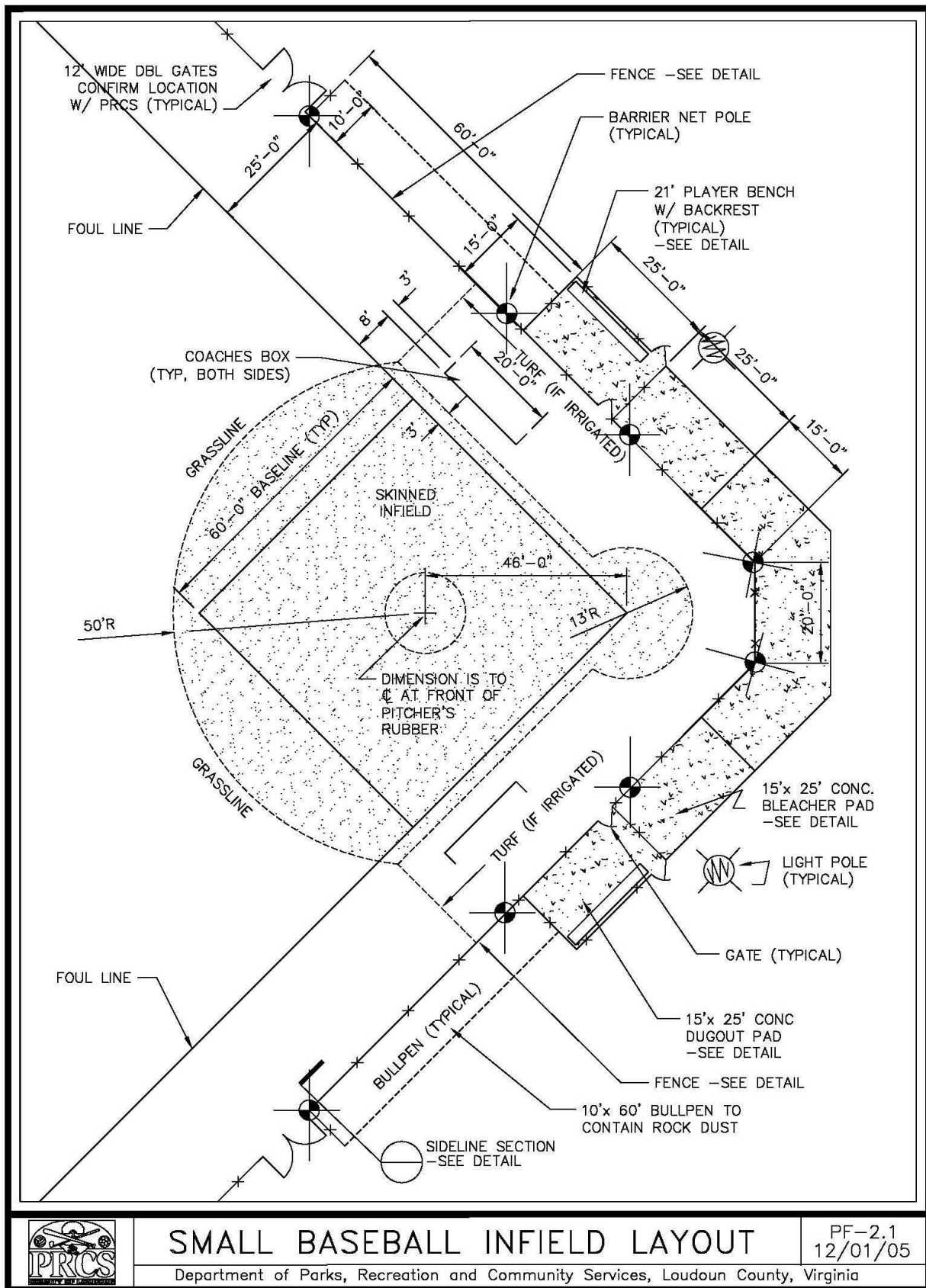


NOTES:

1. CENTER OF PITCHER'S MOUND (10' R) IS 12" FROM FRONT OF RUBBER.
2. THE PITCHER SHALL BE 10" ABOVE THE LEVEL OF HOME PLATE.





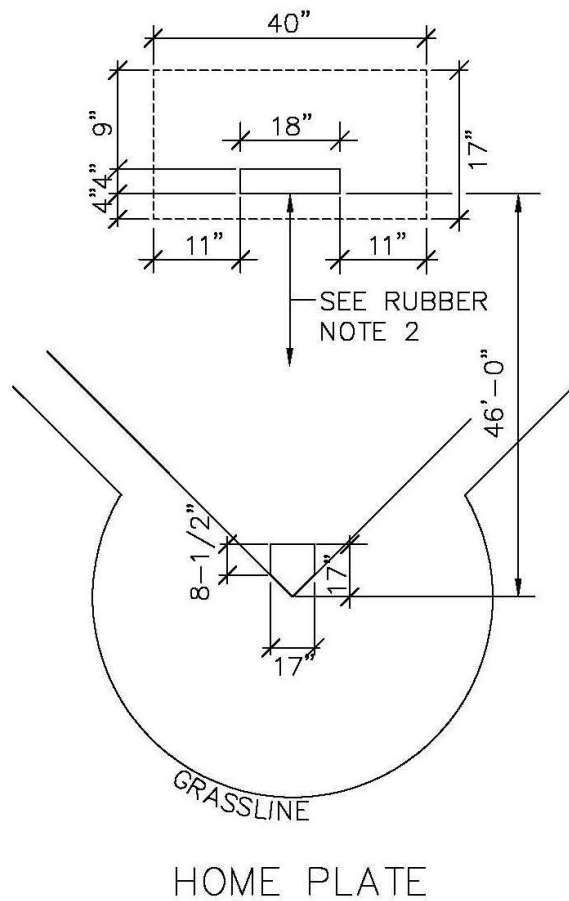


SMALL BASEBALL INFIELD LAYOUT

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-2.1
12/01/05

DETAIL OF FLAT SURFACE OF PITCHERS MOUND



NOTES:

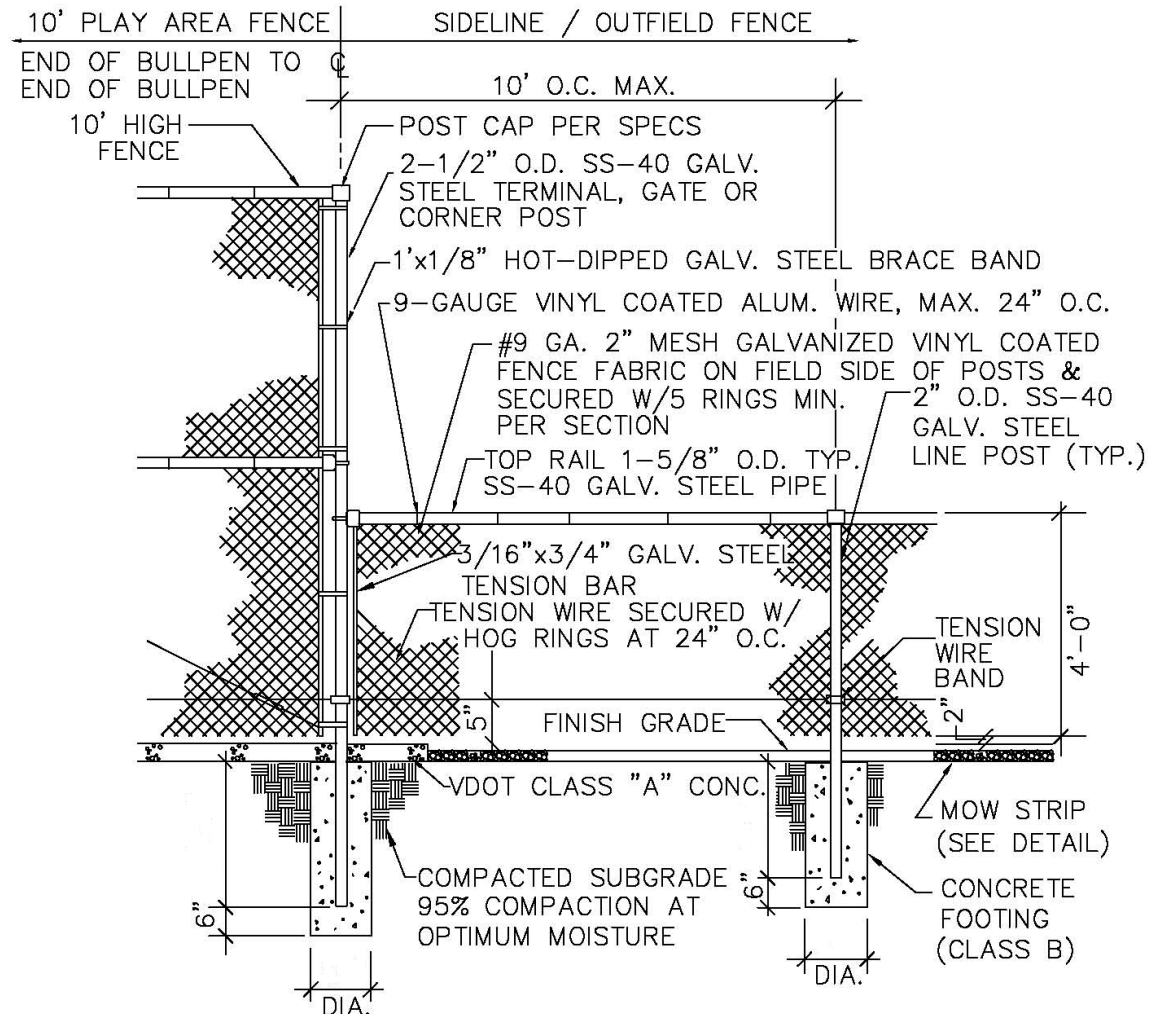
1. CENTER OF PITCHER'S MOUND (8' R) IS 12" FROM FRONT OF RUBBER.
2. THE PITCHER SHALL BE 6" ABOVE THE LEVEL OF HOME PLATE.



PITCHERS MOUND – SMALL FIELD

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-2.2
04/20/05



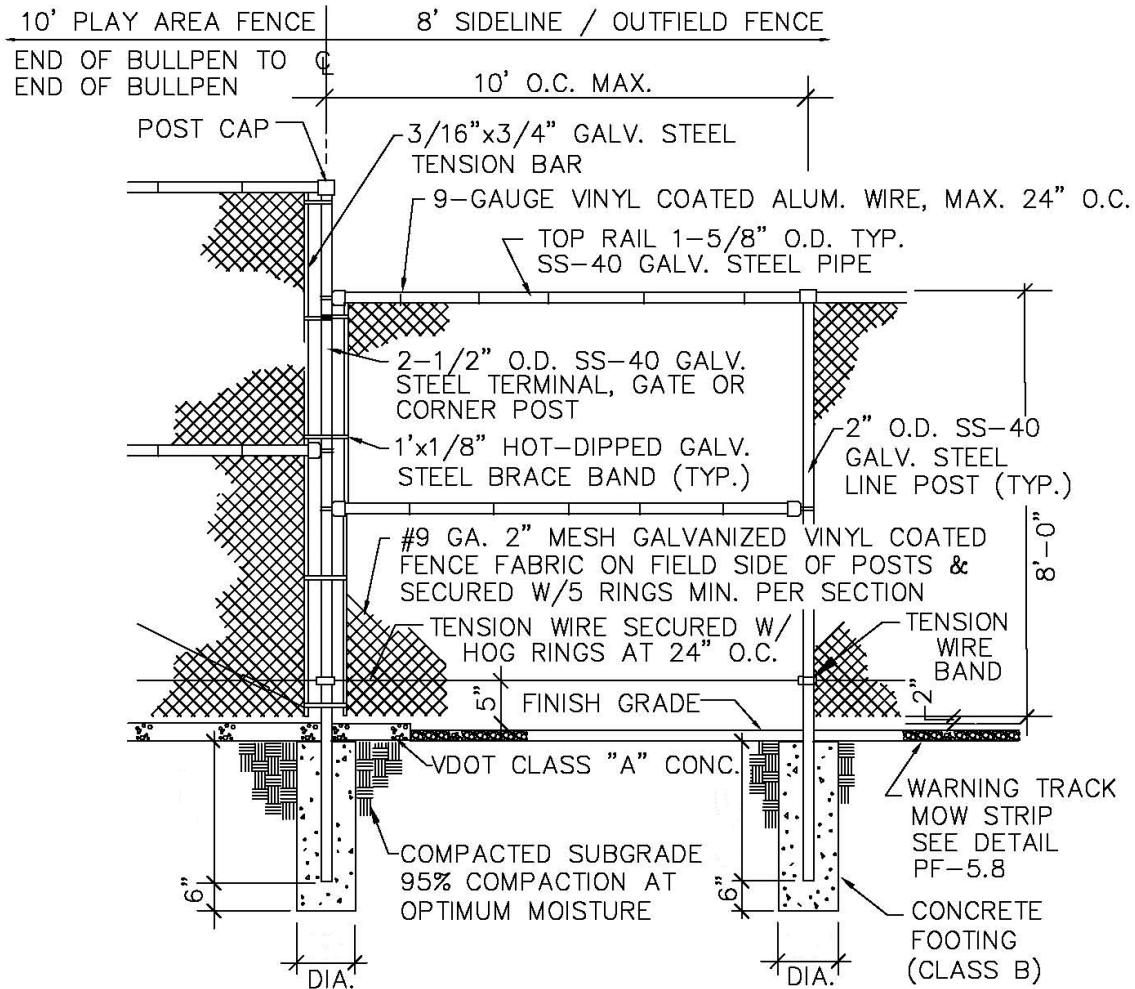
NOTES:

1. TERMINAL POSTS SHALL BE 2-1/2' O.D. AND LINE POST 2" O.D..
2. ALL POSTS SHALL BE SET PLUMB.
3. FABRIC SHALL HAVE KNUCKLED SELVAGE TOP & BOTTOM.
4. FABRIC SHALL BE ON INSIDE/FIELD SIDE OF POSTS.
5. 1/4" DIA. WEEP HOLES SHALL BE 1" ABOVE FINISH GRADE IN ALL POSTS.
6. INCLUDE ONE (1) 12'-0" WIDE, DOUBLE LEAF, 4'-0" HEIGHT GATE PER BALL FIELD. COORDINATE LOCATION WITH OWNER.
7. USE GALVANIZED BANDING IF POST-INSTALLATION COATED.

FENCE DETAIL @ SMALL BALL FIELD

PF-5.2
12/01/05

Department of Parks, Recreation and Community Services, Loudoun County, Virginia



NOTES:

1. TERMINAL POSTS SHALL BE 2-1/2' O.D. AND LINE POST 2" O.D..
2. ALL POSTS SHALL BE SET PLUMB.
3. FABRIC SHALL HAVE KNUCKLED SELVAGE TOP & BOTTOM.
4. FABRIC SHALL BE ON INSIDE/FIELD SIDE OF POSTS.
5. 1/4" DIA. WEEP HOLES SHALL BE 1" ABOVE FINISH GRADE IN ALL POSTS.
6. INCLUDE ONE (1) 12'-0" WIDE, DOUBLE LEAF, FULL HEIGHT GATE PER BALL FIELD. COORDINATE LOCATION WITH OWNER.
7. USE GALVANIZED BANDING IF POST-INSTULATION COATED.



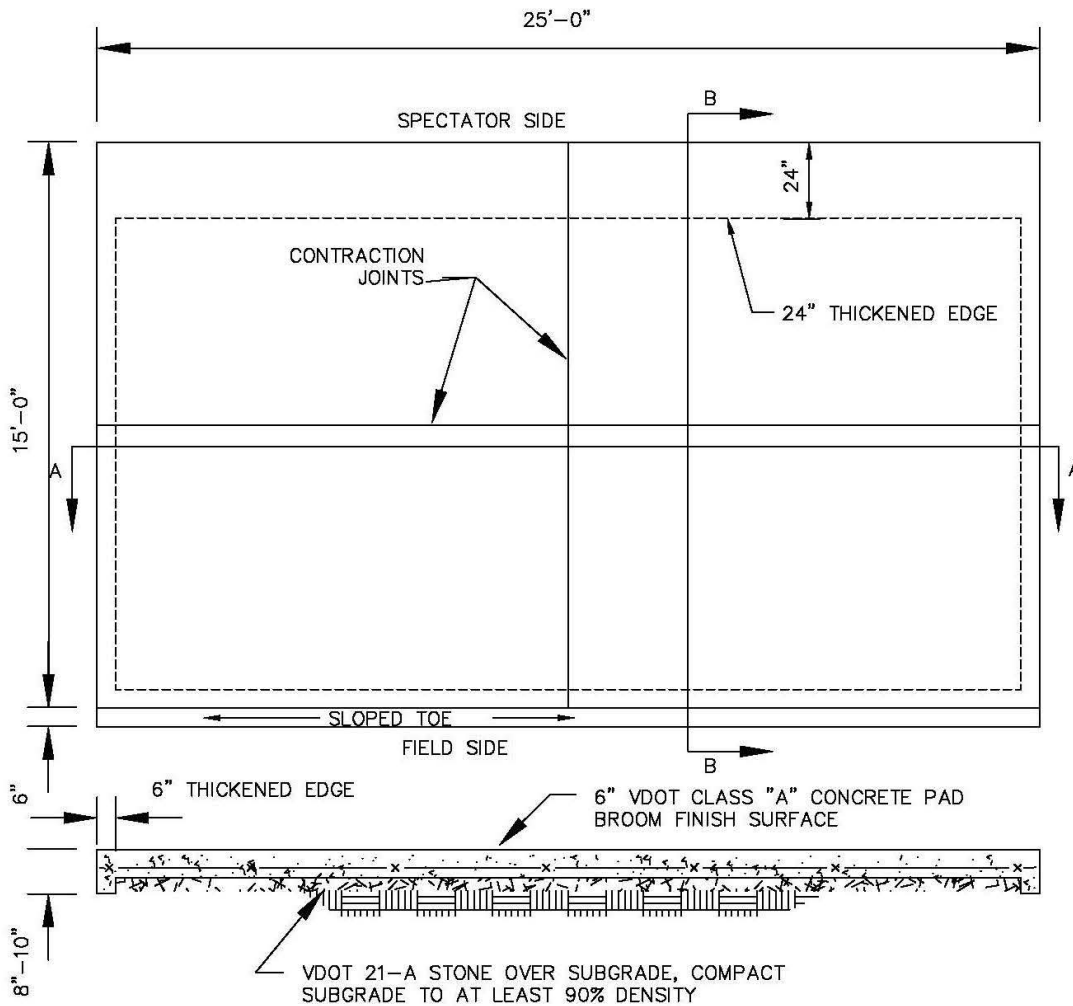
LARGE BALL FIELD FENCE DETAIL

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

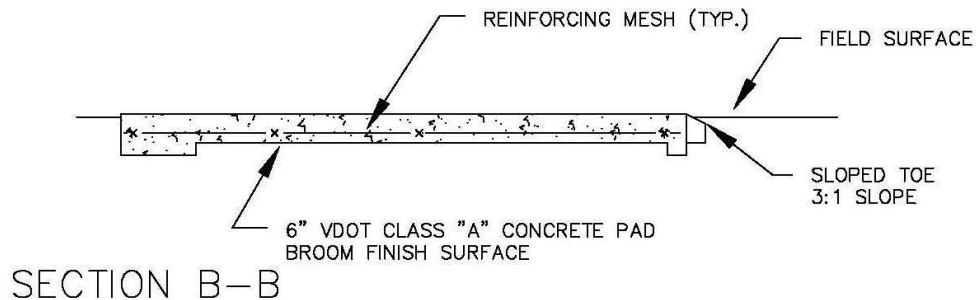
PF-5.3
04/20/05

NOTES:

1. BLEACHERS: BSN SPORTS 5 ROW BLEACHERS WITH FENCING, CATALOG #: BS-1049169 OR EQUAL
2. PLAYER BENCHES: BSN SPORTS PLAYER BENCH WITH BACK, CATALOG #: BS-BEN21WB OR EQUAL



SECTION A-A



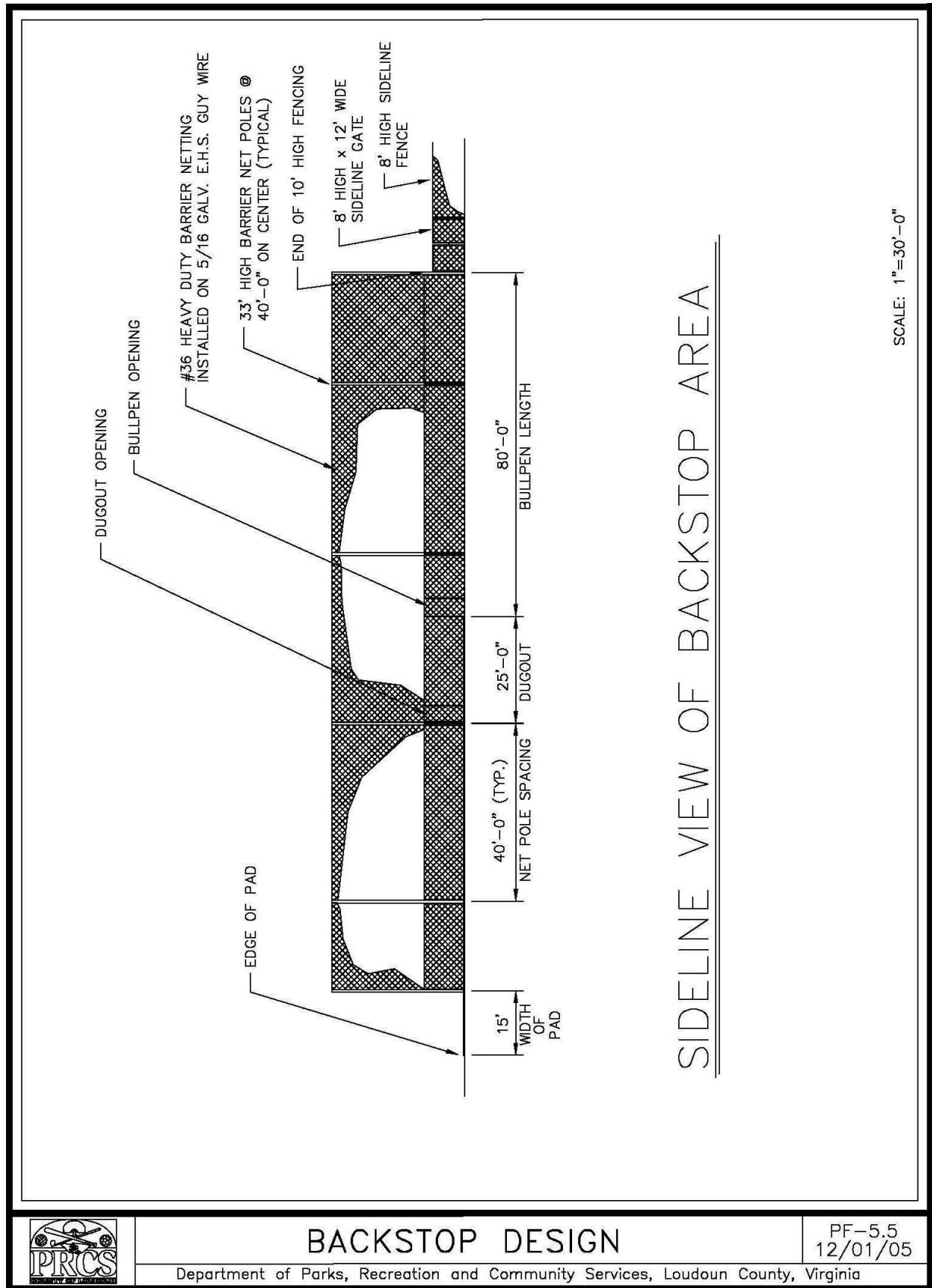
SECTION B-B

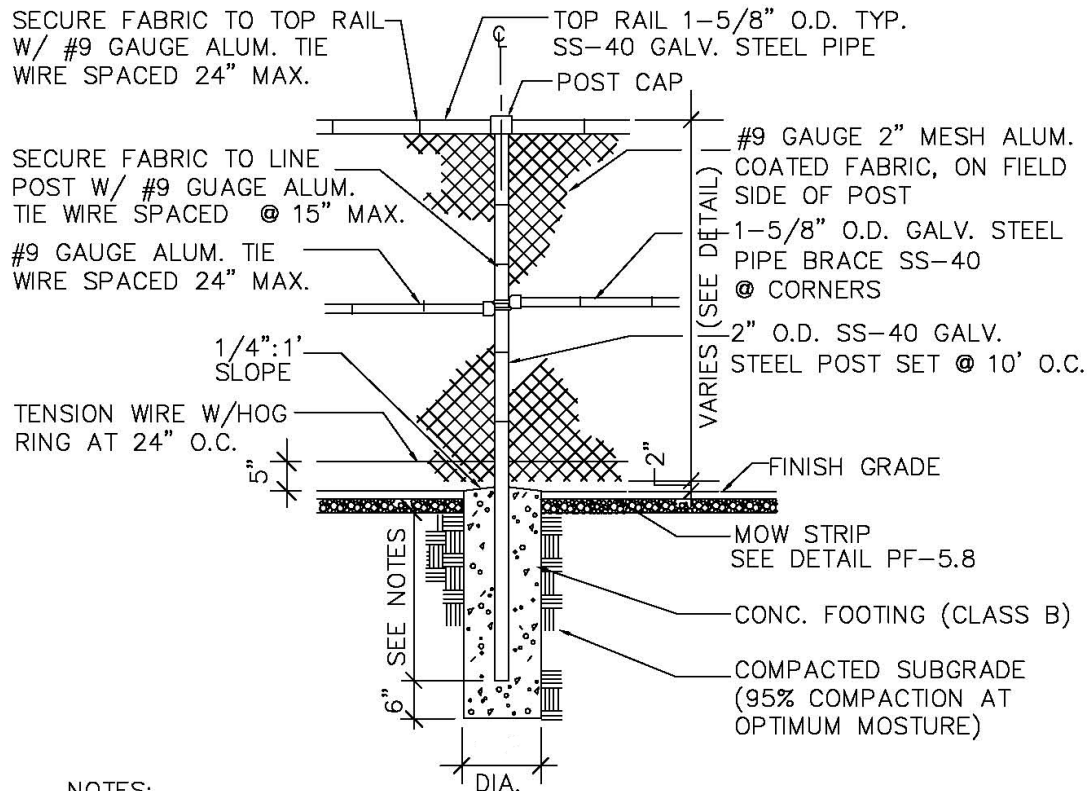


BLEACHER / PLAYER PAD

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-5.4
04/20/05





NOTES:

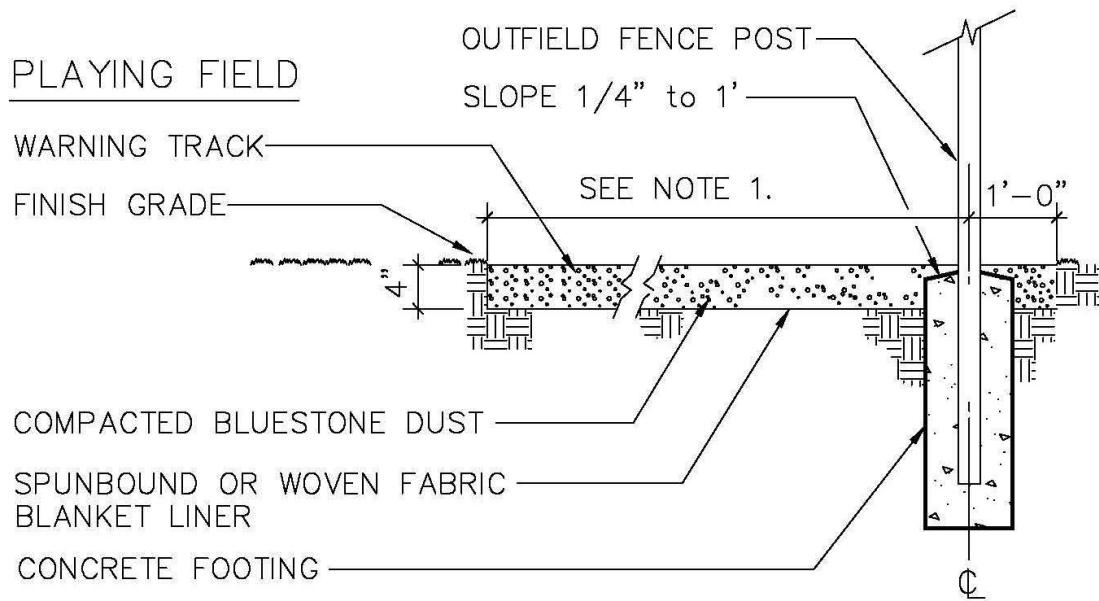
1. TERMINAL POST SHALL BE 2-1/2" O.D. AND LINE POST 2" O.D.
2. ALL POSTS SHALL BE SET PLUMB.
3. FABRIC SHALL HAVE KNUCKLED SELVAGE TOP & BOTTOM.
4. FABRIC SHALL BE ON INSIDE/FIELD SIDE OF POSTS.
5. 1/4" DIA. WEEP HOLES SHALL BE 1" ABOVE FINISH GRADE IN ALL POSTS.
6. INSTALL TERMINAL POST AND ATTACHMENTS (TRUSS ROD, TENSION BAR, BRACE, ETC.) SAME AS TERMINAL POST IN PLAYERS AREA.
7. FABRIC FOR SMALL BALL FIELD SIDELINE AND OUTFIELD FENCE SHALL BE 4' HIGH. POST EMBEDMENT SHALL BE 2'-0".
8. FABRIC FOR LARGE BALL FIELD SIDELINE AND OUTFIELD FENCE SHALL BE 10'-0" HIGH. POST EMBEDMENT SHALL BE 2'-6".



OUTFIELD FENCE DESIGN

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-5.7
04/20/05



NOTES:

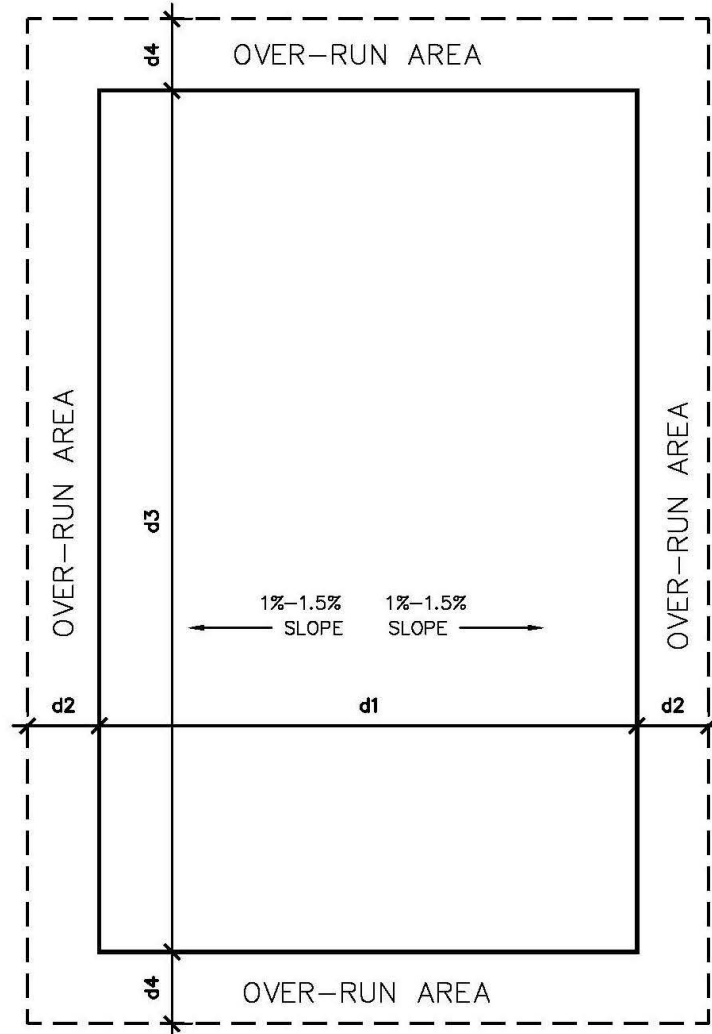
1. 15'-0" AT LARGE BALL FIELD, 10'-0" AT SMALL BALL FIELD



WARNING TRACK – SECTION

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-5.8
04/20/05



DIMENSIONS:

d1: 225'
d2: 30'
d3: 360'
d4: 30'

NOTES:

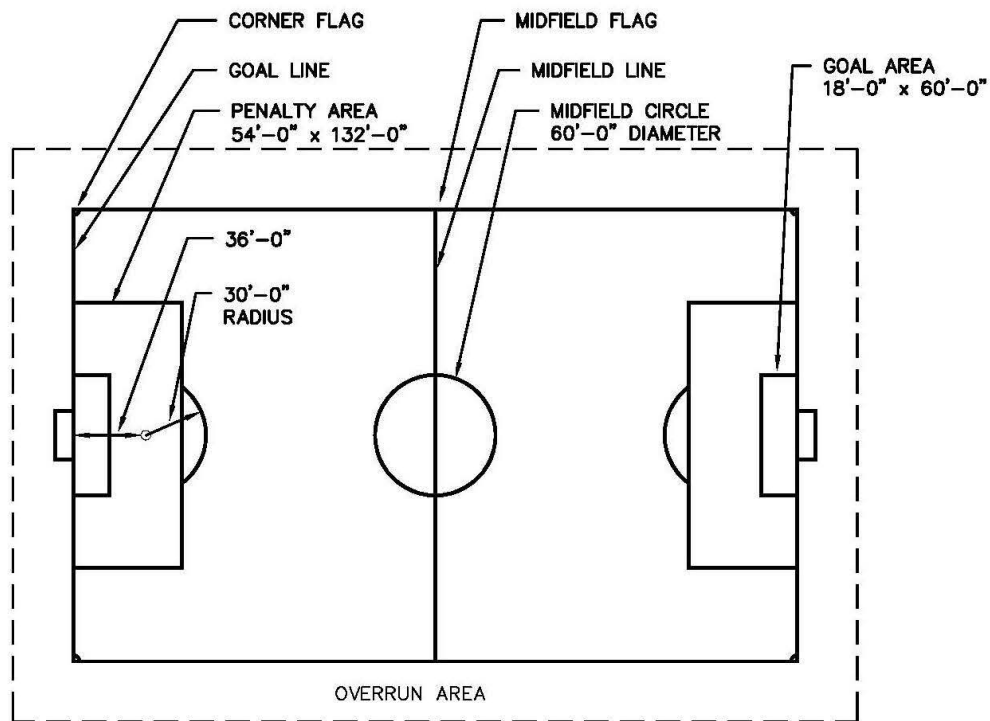
- 1: 30' OVER-RUN AREA ON ALL SIDES
DO NOT PLACE DRAINAGE FIXTURES OR OTHER
FIXTURES WITHIN FIELD OR OVER-RUN AREA.
- 2: AT MULTI-PLEXED FACILITIES, ADDITIONAL
CONSIDERATIONS MAY APPLY.
- 3: SLOPES TO BE BETWEEN 1% - 1.5%. SLOPES
CREATED BY LASER GRADING.
- 4: GOAL IS TO BE BSN SPORTS CATALOG NUMBER
BS-CLB248WT OR APPROVED EQUAL



LARGE SOCCER FIELD DIMENSIONS

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-6.0
12/01/05

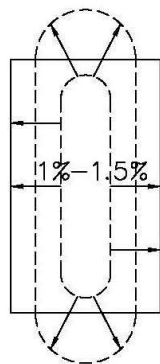


NOTES:

ALL DIMENSIONS ARE TO THE INSIDE EDGE OF LINES.

ALL LINES SHALL BE 2" WIDE AND MARKED WITH A WHITE NON-TOXIC MATERIAL WHICH IS NOT INJURIOUS TO THE EYES OR SKIN.

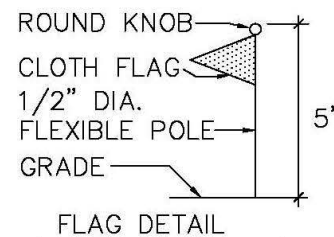
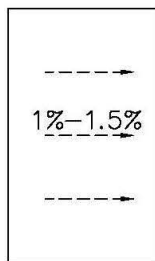
PREFERENCE IF FOR OVER-RUN AREA
NOT TO EXCEED 3% SLOPE



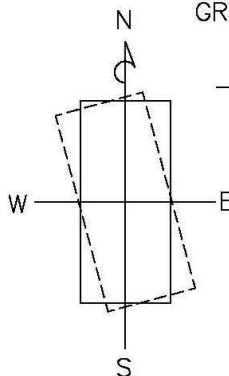
DRAINAGE

LEGEND

- 1ST PREFERENCE
- - - - 2ND PREFERENCE



FLAG DETAIL



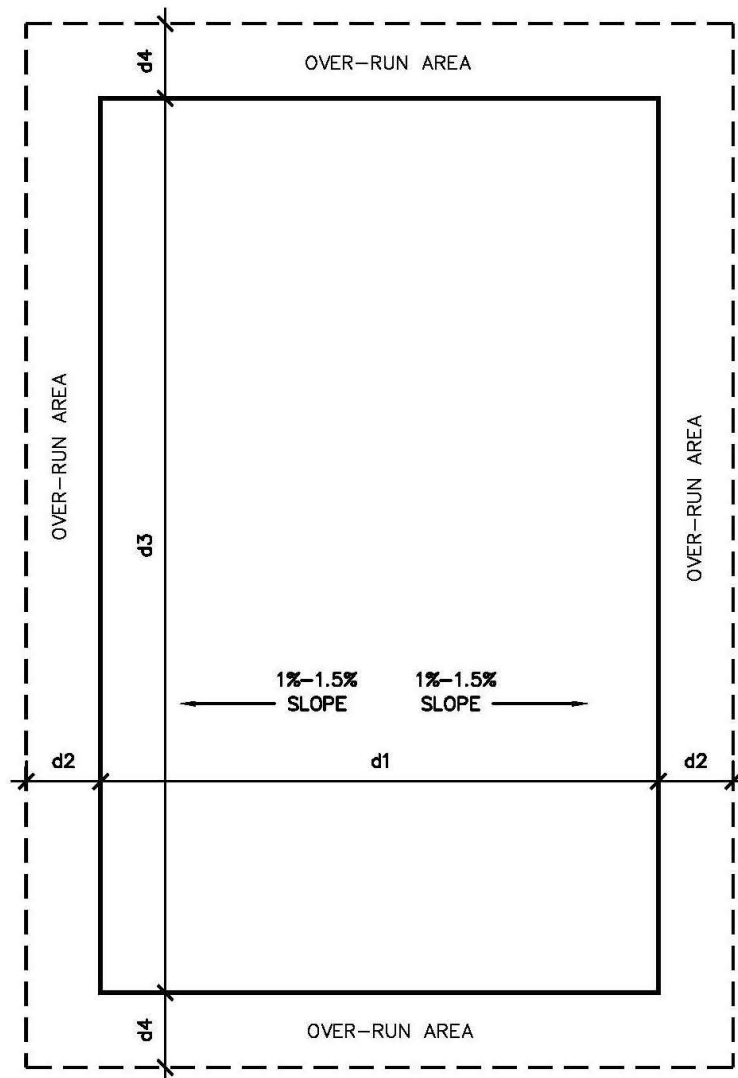
ORIENTATION



LARGE SOCCER FIELD LAYOUT

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-6.1
12/01/05



DIMENSIONS:

d1: 138'
d2: 30'
d3: 228'
d4: 30'

NOTES:

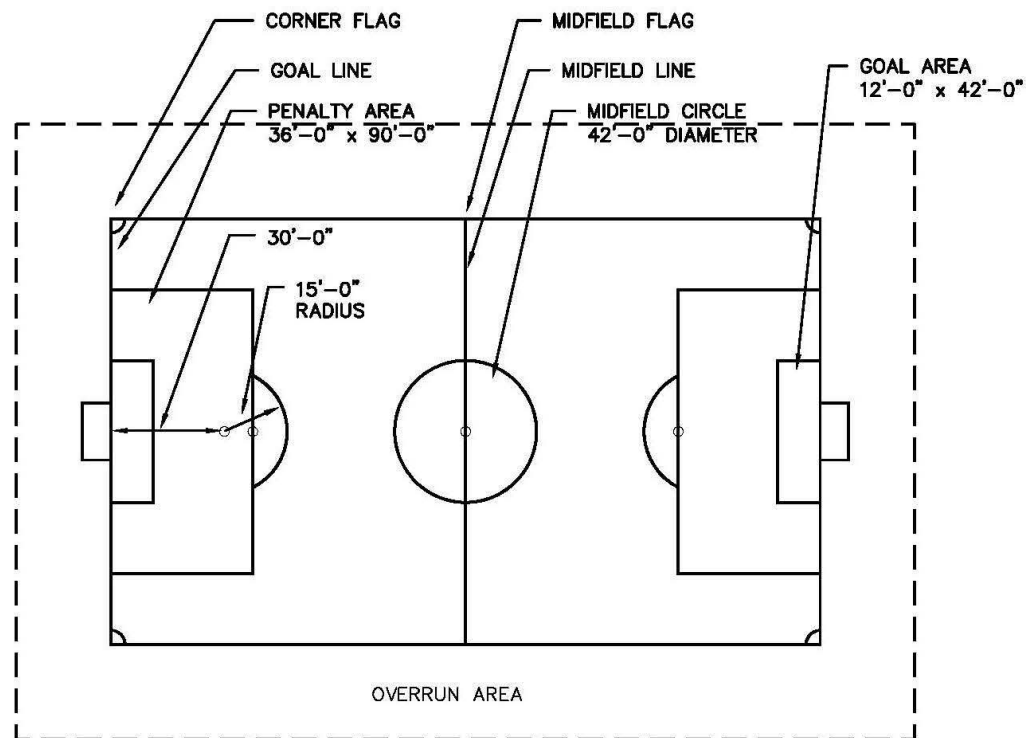
- 1: 30' OVER-RUN AREA ON ALL SIDES
DO NOT PLACE DRAINAGE FIXTURES OR OTHER
FIXTURES WITHIN FIELD OR OVER-RUN AREA.
- 2: AT MULTI-PLEXED FACILITIES, ADDITIONAL
CONSIDERATIONS MAY APPLY.
- 3: SLOPES TO BE BETWEEN 1% - 1.5%. SLOPES
CREATED BY LASER GRADING.
- 4: GOAL TO BE BSN SPORTS CATALOG NUMBER
BS-CLB248WT OR APPROVED EQUAL



SMALL SOCCER FIELD DIMENSIONS

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-6.2
12/01/05

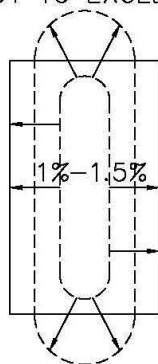


NOTES:

ALL DIMENSIONS ARE TO THE INSIDE EDGE OF LINES.

ALL LINES SHALL BE 2" WIDE AND MARKED WITH A WHITE NON-TOXIC MATERIAL WHICH IS NOT INJURIOUS TO THE EYES OR SKIN.

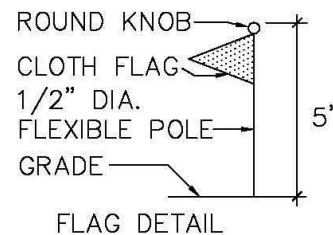
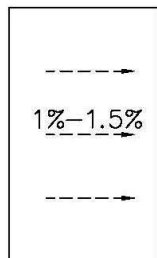
PREFERENCE IS FOR OVER-RUN AREA NOT TO EXCEED 3% SLOPE.



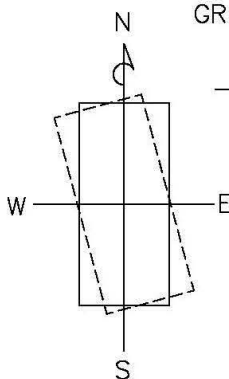
DRAINAGE

LEGEND

- 1ST PREFERENCE
- 2ND PREFERENCE



FLAG DETAIL



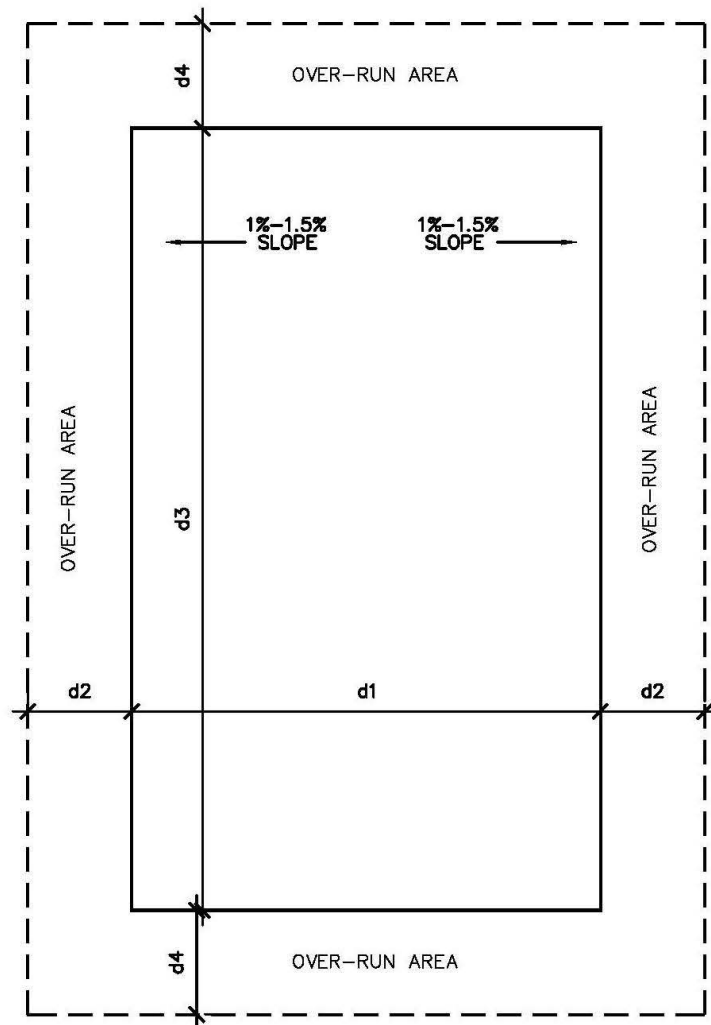
ORIENTATION



SMALL SOCCER FIELD LAYOUT

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-6.3
12/01/05



DIMENSIONS:

d1: 90'
d2: 20'
d3: 150'
d4: 20'

NOTES:

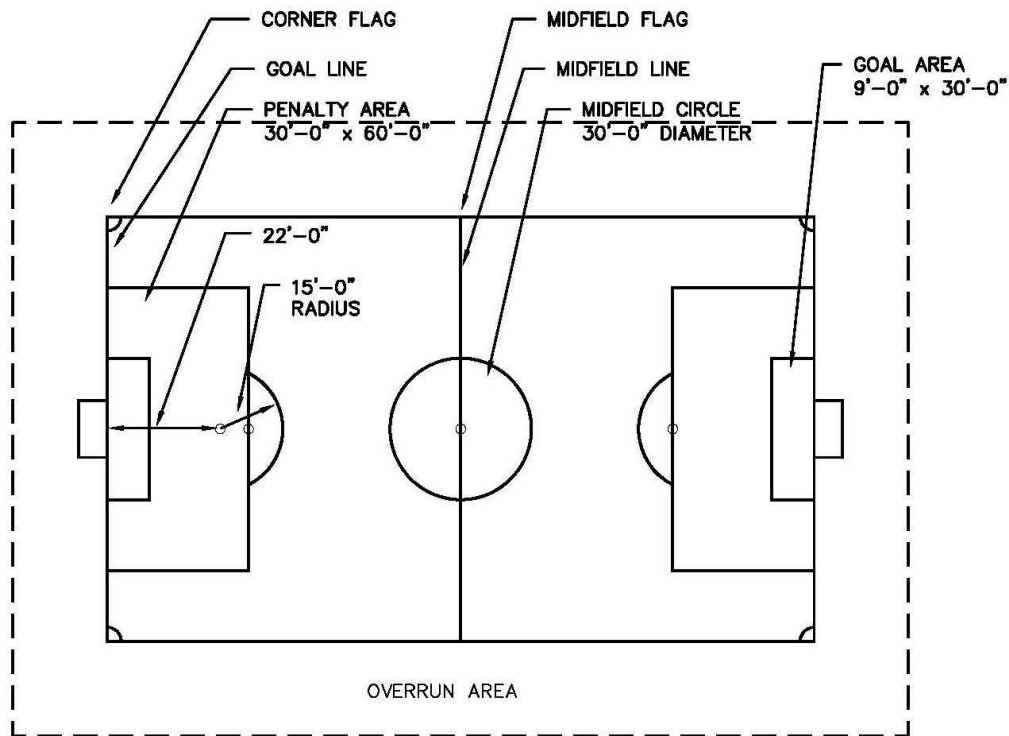
- 1: 20' OVER-RUN AREA ON ALL SIDES
DO NOT PLACE DRAINAGE FIXTURES OR OTHER FIXTURES WITHIN FIELD OR OVER-RUN AREA.
- 2: AT MULTI-PLEXED FACILITIES, ADDITIONAL CONSIDERATIONS MAY APPLY.
- 3: SLOPES TO BE BETWEEN 1% – 1.5%. SLOPES CREATED BY LASER GRADING.
- 4: GOAL TO BE BSN SPORTS CATALOG NUMBER BS-CLB248WT OR APPROVED EQUAL.



U8MICRO SOCCER FIELD DIMENSIONS

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-6.4
12/01/05

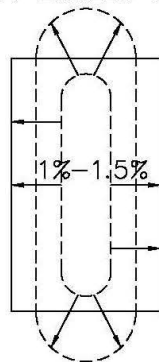


NOTES:

ALL DIMENSIONS ARE TO THE INSIDE EDGE OF LINES.

ALL LINES SHALL BE 2" WIDE AND MARKED WITH A WHITE NON-TOXIC MATERIAL WHICH IS NOT INJURIOUS TO THE EYES OR SKIN.

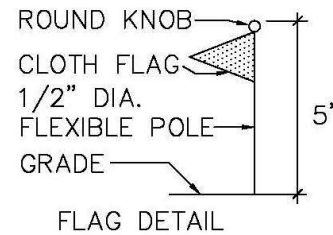
PREFERENCE IS FOR OVER-RUN AREA TO NOT EXCEED 3% SLOPE.



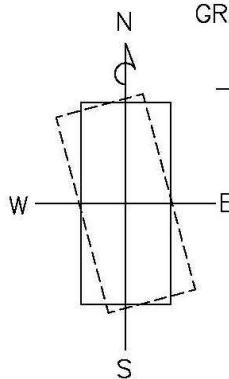
DRAINAGE

LEGEND

- 1ST PREFERENCE
- - - 2ND PREFERENCE



FLAG DETAIL



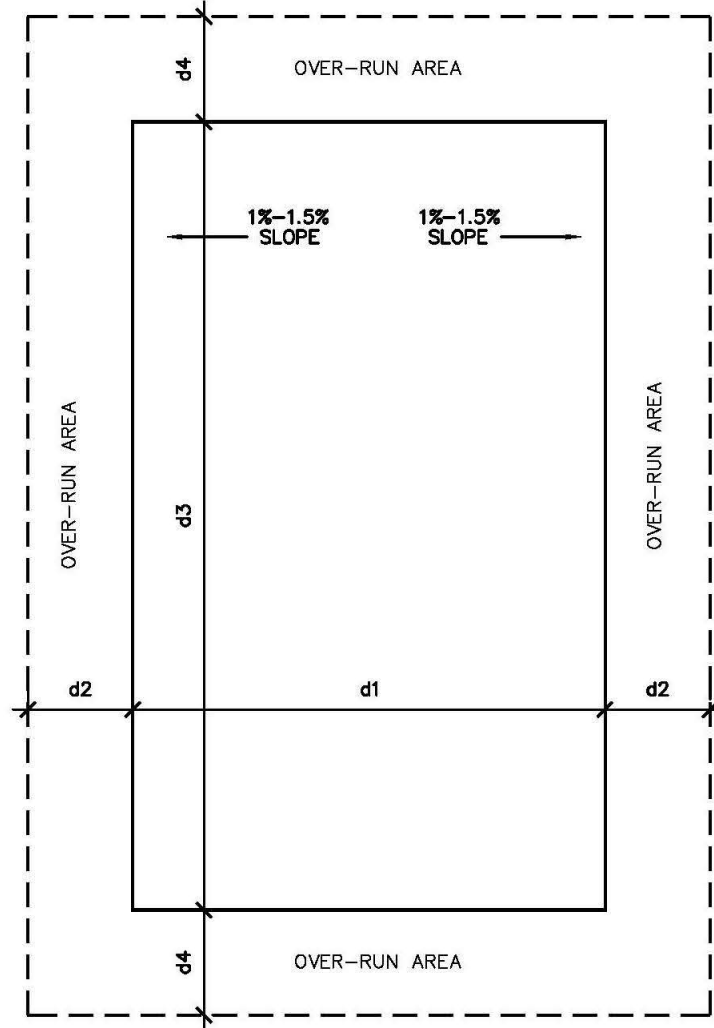
ORIENTATION



U8 SOCCER FIELD LAYOUT

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-6.5
12/01/05



DIMENSIONS:

d1: 75'
d2: 20'
d3: 105'
d4: 20'

NOTES:

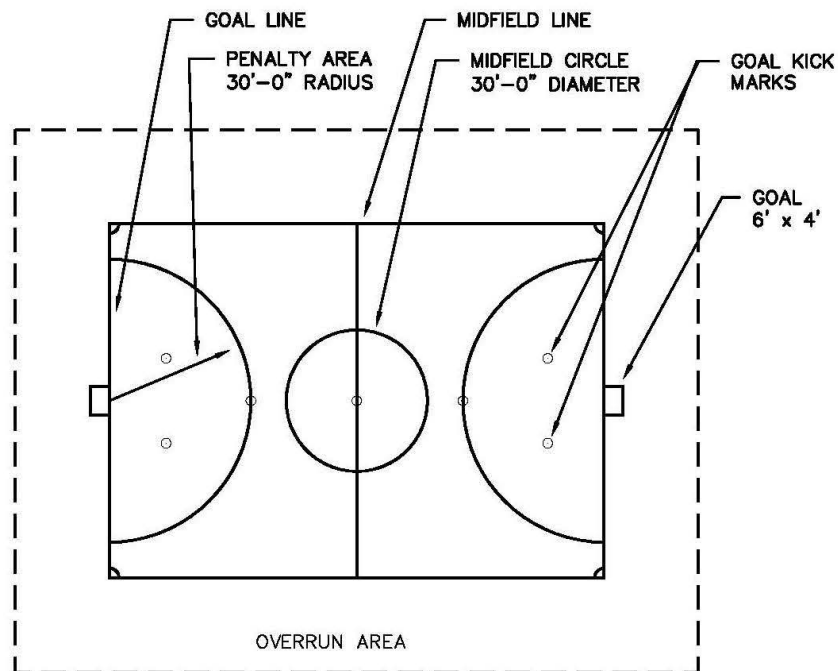
- 1: 20' SAFETY ZONE ON ALL SIDES
DO NOT PLACE DRAINAGE FIXTURES OR OTHER
FIXTURES WITHIN FIELD OR SAFETY ZONE AREA.
- 2: AT MULTI-PLEXED FACILITIES, ADDITIONAL
CONSIDERATIONS MAY APPLY.
- 3: SLOPES TO BE BETWEEN 1% - 1.5%. SLOPES
CREATED BY LASER GRADING.
- 4: GOAL TO BE BSN SPORTS CATALOG NUMBER
BS-CLB248WT OR APPROVED EQUAL.



U6/U7 SOCCER FIELD DIMENSIONS

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-6.6
12/01/05

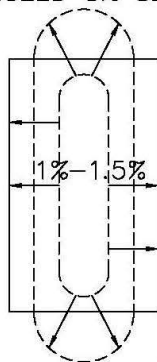


NOTES:

ALL DIMENSIONS ARE TO THE INSIDE EDGE OF LINES.

ALL LINES SHALL BE 2" WIDE AND MARKED WITH A WHITE NON-TOXIC MATERIAL WHICH IS NOT INJURIOUS TO THE EYES OR SKIN.

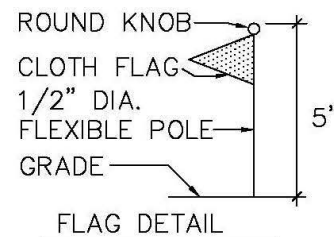
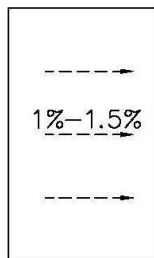
PREFERENCE IS FOR OVER-RUN AREA TO NOT EXCEED 3% SLOPE



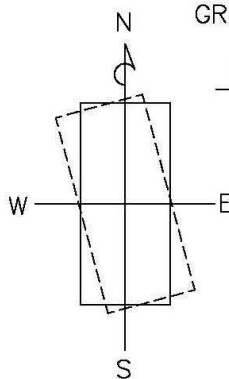
DRAINAGE

LEGEND

- 1ST PREFERENCE
- - - - 2ND PREFERENCE



FLAG DETAIL



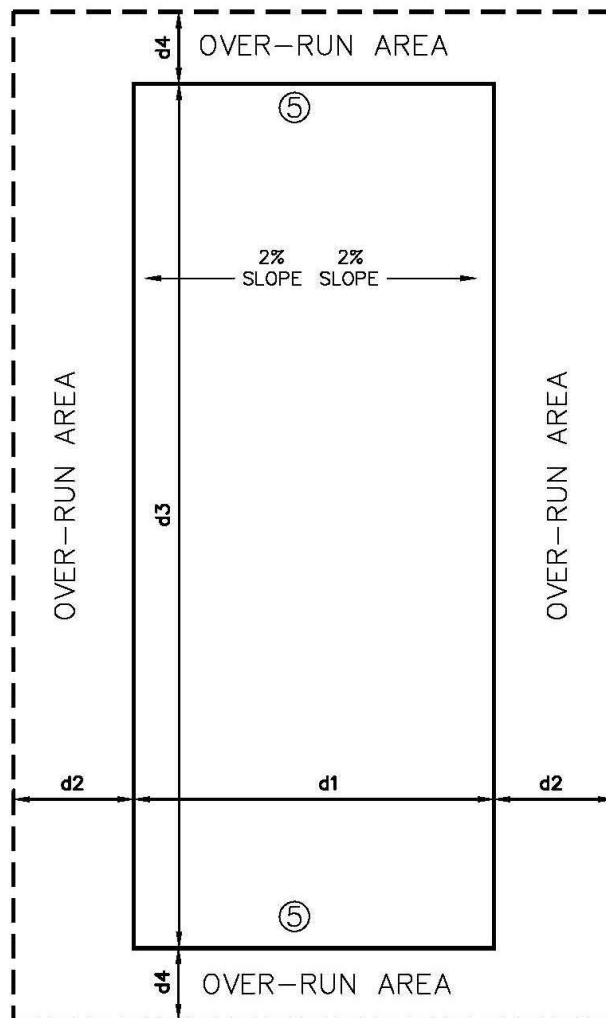
ORIENTATION



U6/U7 SOCCER FIELD LAYOUT

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-6.7
12/01/05



DIMENSIONS:

d1: 150'
d2: 50'
d3: 360'
d4: 30'

NOTES:

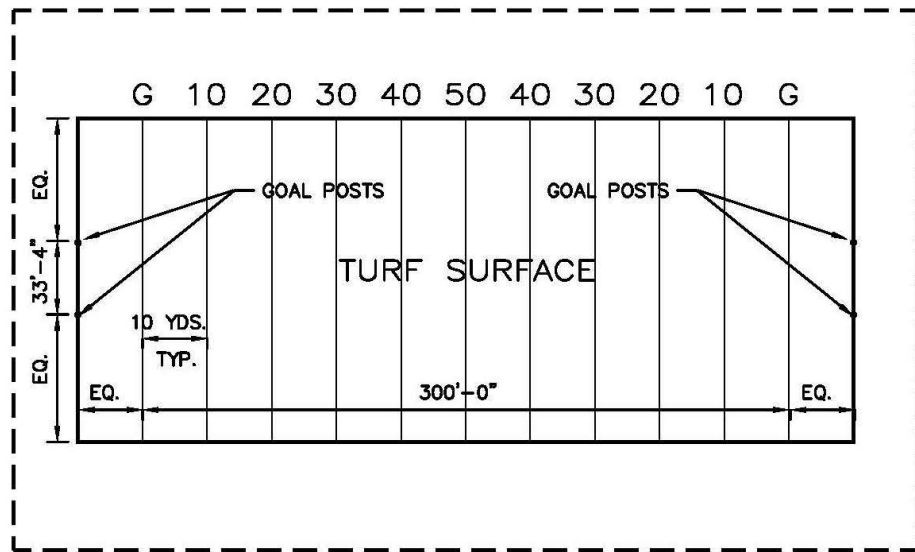
- 1: OVER-RUN AREA ON ALL SIDES
DO NOT PLACE DRAINAGE FIXTURES OR OTHER
FIXTURES WITHIN FIELD OR OVER-RUN AREA.
- 2: AT MULTI-PLEXED FACILITIES, ADDITIONAL
CONSIDERATIONS MAY APPLY.
- 3: SLOPES TO BE 2%. SLOPES TO BE CREATED BY
LASER GRADING IN TURTLEBACK OR SHED
FASHION. SEE PF-8.1
- 4: CONTACT PRCS MAINTENANCE DIVISION MANAGER
FOR LIST OF ACCESSORIES AND SOURCES.



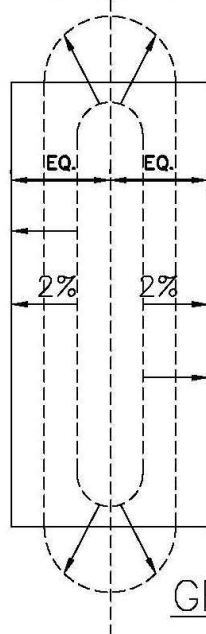
FOOTBALL FIELD DIMENSIONS

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

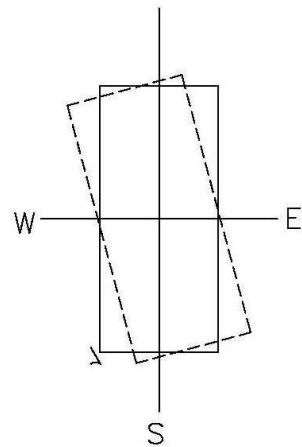
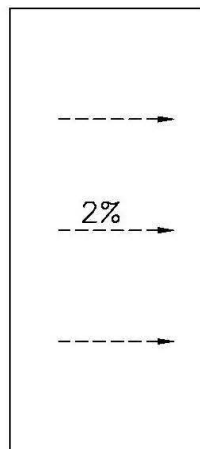
PF-8.0
12/01/05



TURTLE BACK GRADING



SHED GRADING



GRADING TYPES

LEGEND

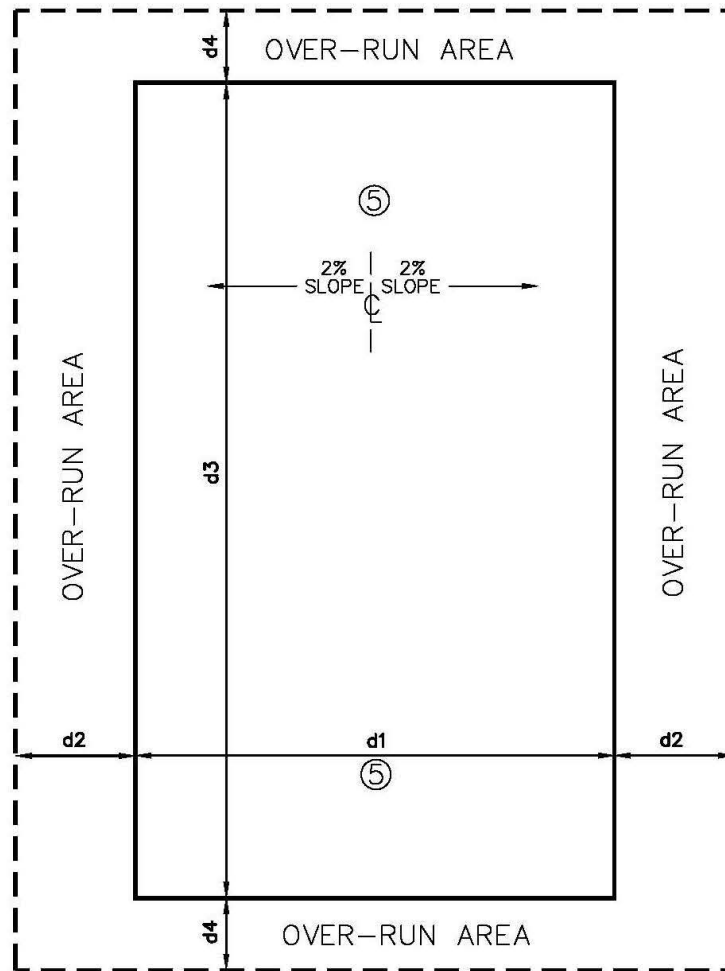
- 1ST PREFERENCE
- 2ND PREFERENCE



FOOTBALL FIELD LAYOUT

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-8.1
12/01/05



DIMENSIONS:

d1: 180'-210'
d2: 50'
d3: 330'-360'
d4: 30'

NOTES:

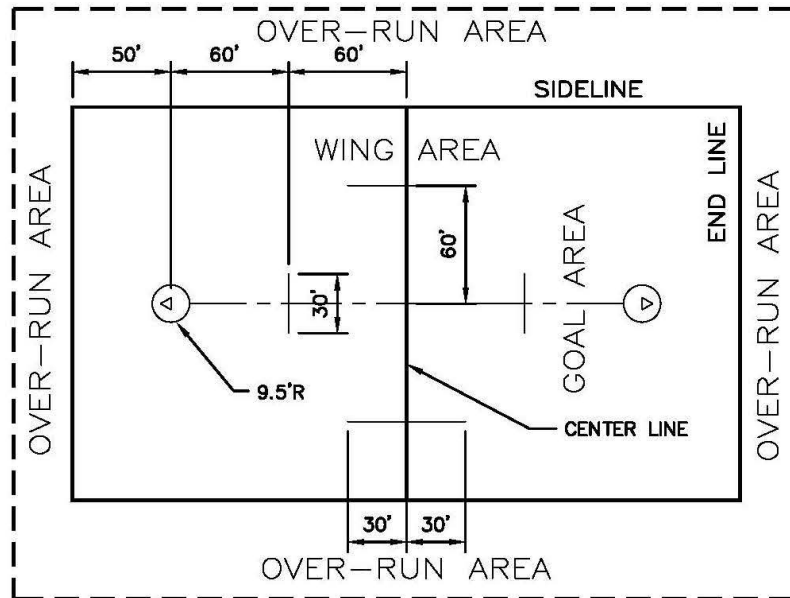
- 1: OVER-RUN AREA ON ALL SIDES – DO NOT PLACE DRAINAGE FIXTURES OR OTHER FIXTURES WITHIN FIELD OR OVER-RUN AREA.
- 2: AT MULTI-PLEXED FACILITIES, ADDITIONAL CONSIDERATIONS MAY APPLY.
- 3: SLOPES TO BE 2%. SLOPES CREATED BY LASER GRADING IN TURTLEBACK OR SHED FASHION. SEE PF-9.1.
- 4: CONTACT PRCS MAINTENANCE DIVISION MANAGER FOR LIST OF ACCESSORIES AND SOURCES.
- 5: GOAL AREA, SEE PF-9.1 FOR LAYOUT.



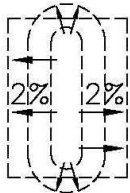
LACROSSE FIELD DIMENSIONS

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

PF-9.0
12/01/05

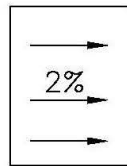


TURTLE-BACK
GRADING



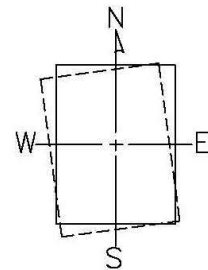
FIRST
PREFERENCE

SHED
GRADING



SECOND
PREFERENCE

GRADING TYPES



ORIENTATION

NOTES:

ALL DIMENSIONS ARE TO THE
INSIDE EDGE OF LINES.

ALL LINES SHALL BE 2" WIDE
AND MARKED WITH A WHITE
NON-TOXIC MATERIAL WHICH IS
NOT INJURIOUS TO EYES OR SKIN

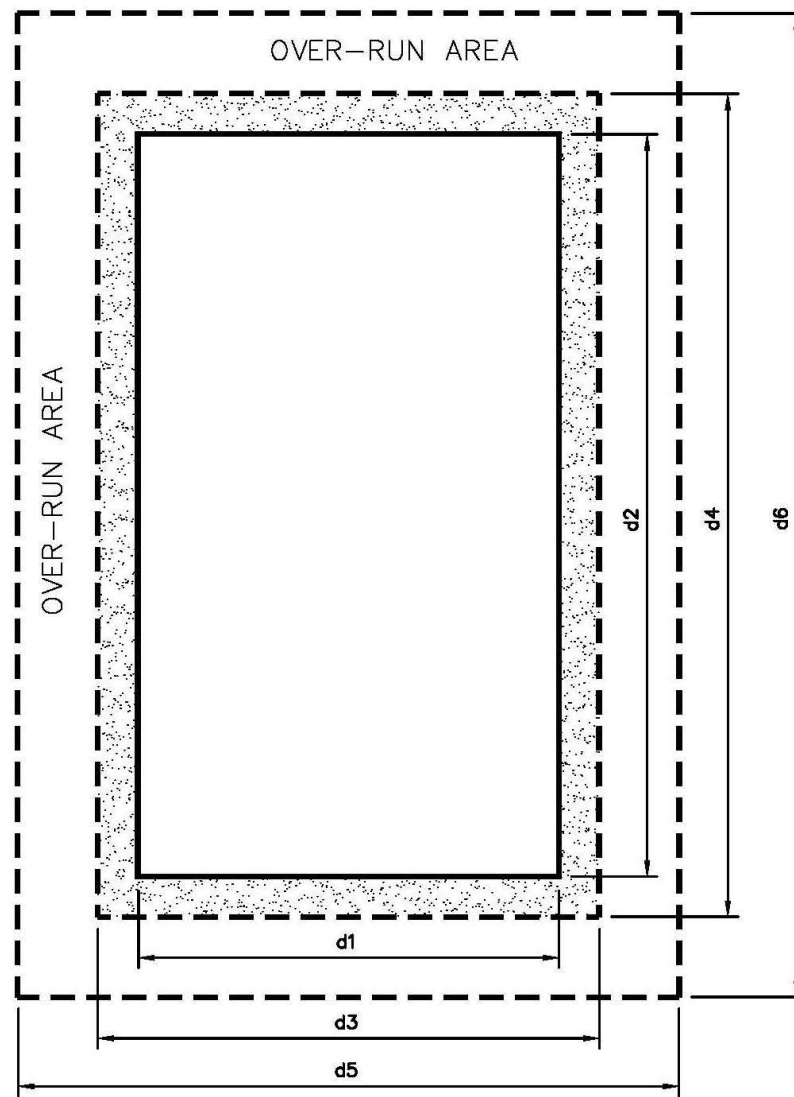
PREFERENCE IS FOR OVER-RUN
AREA TO NOT EXCEED 3% SLOPE.



LACROSSE FIELD LAYOUT

PF-9.1
12/01/05

Department of Parks, Recreation and Community Services, Loudoun County, Virginia



DIMENSIONS:

d1: 42'
d2: 74'
d3: 50'
d4: 82'
d5: 66'
d6: 98'

NOTES:

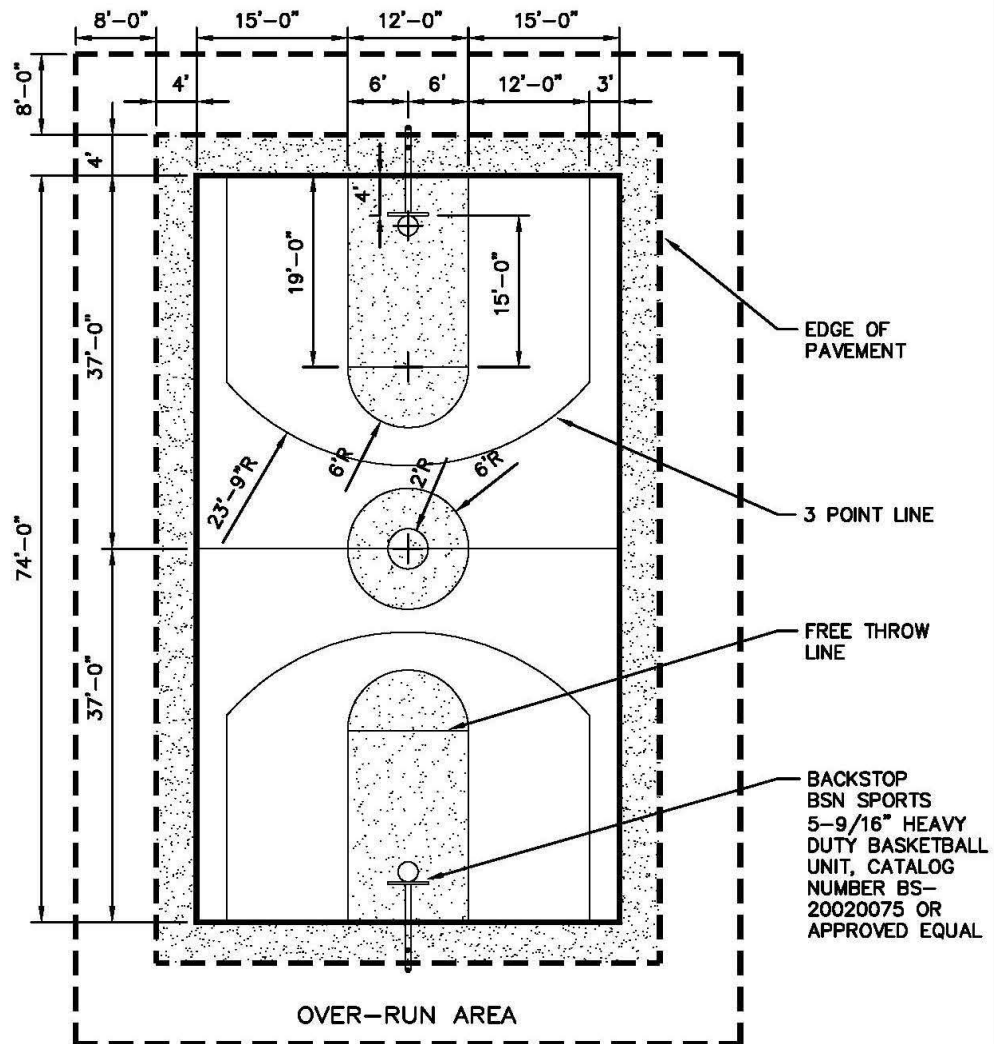
- 1: 12' OVER-RUN AREA ON ALL SIDES
DO NOT PLACE DRAINAGE FIXTURES OR OTHER
FIXTURES WITHIN FIELD OR OVER-RUN AREA.
- 2: AT MULTI-PLEXED FACILITIES, ADDITIONAL
CONSIDERATIONS MAY APPLY.
- 3: SLOPES TO BE BETWEEN 1% – 1.5%.



BASKETBALL COURT DIMENSIONS



CF-1.0
12/01/05

Department of Parks, Recreation and Community Services, Loudoun County, Virginia



NOTES:

- 1: DIMENSIONS ARE TO INSIDE OF 2" WHITE PAINTED LINE
- 2: DO NOT USE METAL NETTING AT HOOPS

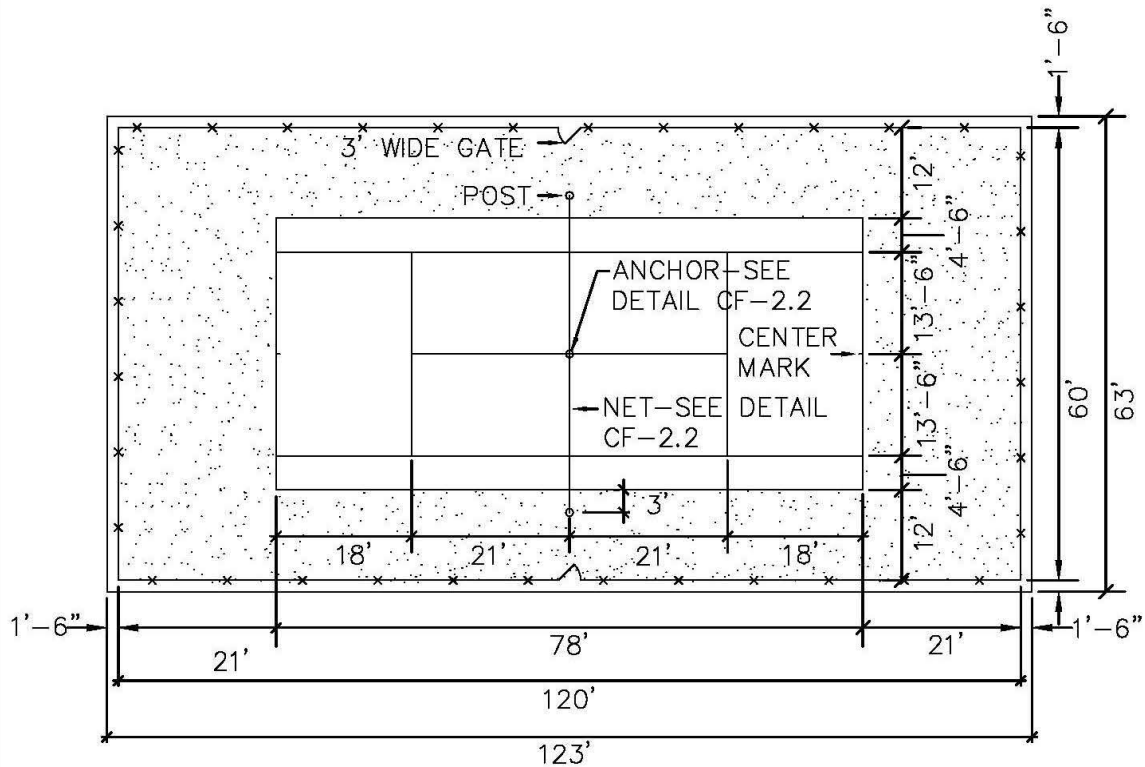
-  RED COLORCOAT
-  GREEN COLORCOAT





BASKETBALL COURT LAYOUT

CF-1.1
12/01/05

Department of Parks, Recreation and Community Services, Loudoun County, Virginia



-  COLOR COAT - RED
-  COLOR COAT - GREEN

NOTES:

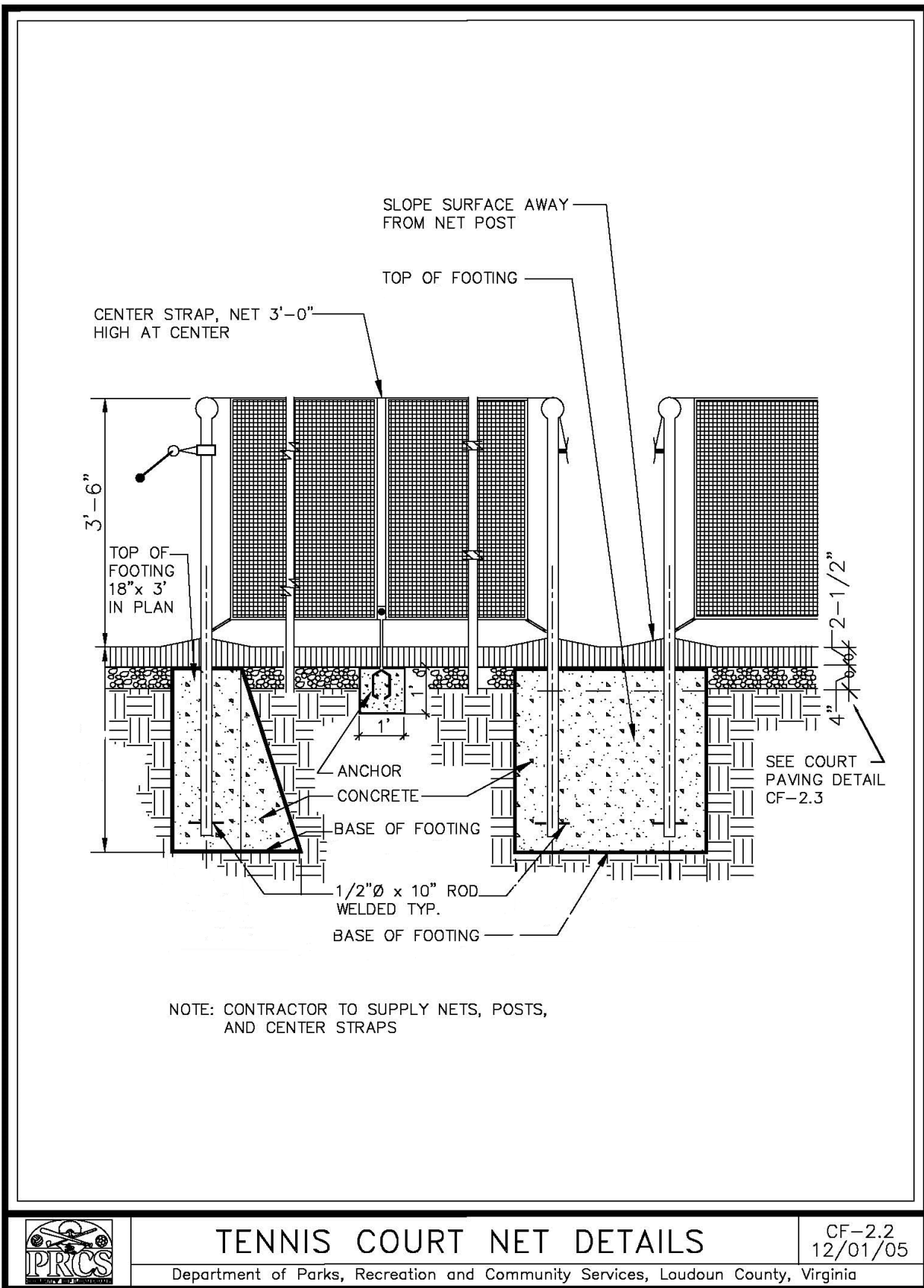
- 1: ALL MEASUREMENTS FOR COURT MARKINGS ARE TO THE OUTSIDE OF LINES EXCEPT FOR THOSE INVOLVING THE CENTER SERVICE LINE WHICH IS EQUALLY DIVIDED BETWEEN THE RIGHT AND LEFT SERVICE COURTS.
- 2: ALL COURT MARKINGS ARE TO BE 2" WIDE WHITE PAINTED LINES.
- 3: NO PREFERRED ORIENTATION.
- 4: SEE CF-2.3 FOR COURT PAVING DETAIL

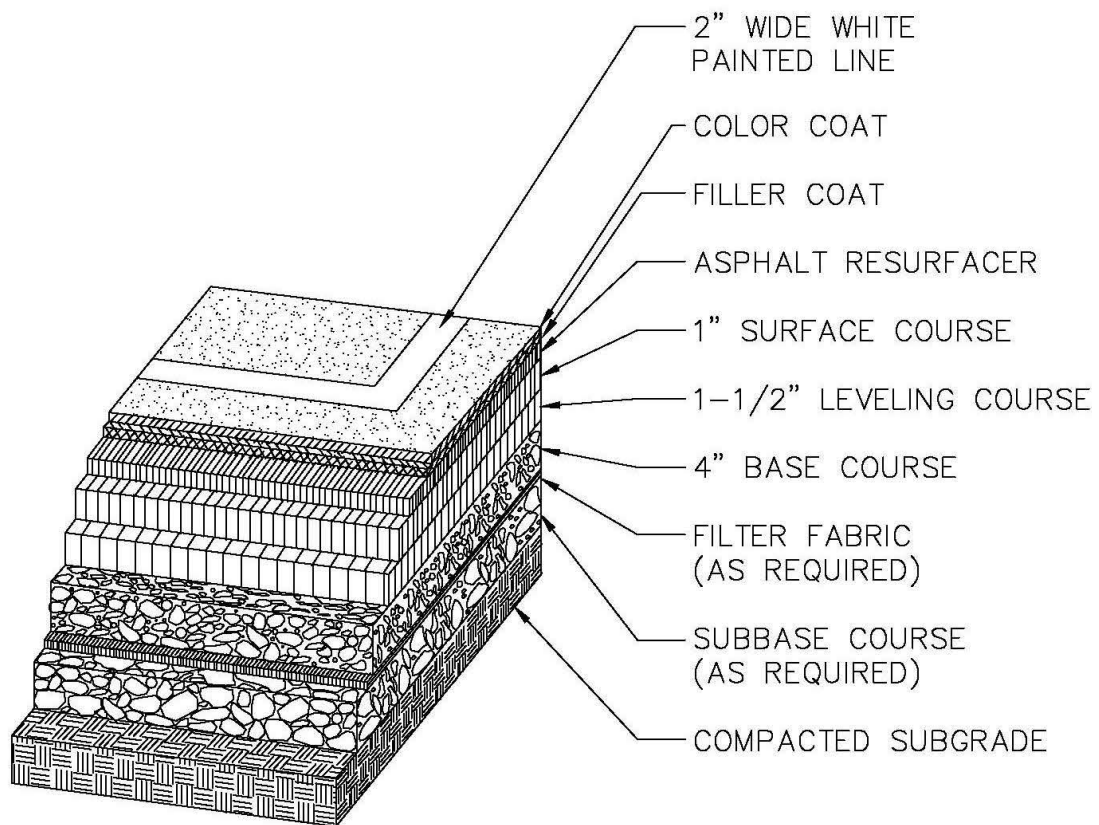


SINGLE TENNIS COURT LAYOUT

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

CF-2.0
12/01/05





COURT PAVING DETAIL

CF-2.3
12/01/05

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

Chapter 5

Roadway, Parking & Miscellaneous Paving

5.1 GENERAL

All work under this section is subject to the provisions of Chapter 1, “General References” for All Sections and the current edition of Virginia Department of Transportation (VDOT) Pavement Design Guide for Subdivision and Secondary Roads In Virginia.

5.2 Definitions

The following terms and abbreviations are commonly used in pavement design.

Ballast: Extra weight added to a machine such as iron weights mounted to the wheels or frame. Liquid material such as a water/calcium chloride solution placed in the tires can also serve as ballast.

Base course is an HMA or concrete pavement layer placed upon the compacted sub-base. A gravel base course can be designed and specified for low volume roadways (<2,000 vehicles per day) depending upon loading and other design considerations.

Binder – The liquid asphalt material in an HMA mixture that bonds the aggregate together.

Density: The weight of material in pounds or kilograms per unit of volume (cubic feet or meters).

Equivalent Single Axel Load (ESAL) – The conversion of mixed vehicular traffic into its equivalent single-axle, 18-Kip Load. The equivalence is based on the relative amount of pavement damage.

Flexible Pavement

A flexible pavement structure consists of the following layers – the sub-base, base course, intermediate course, surface course, and where determined necessary, a friction course.

Friction course is a specialized thin-lift wearing course which, when specified, is placed over the surface course. Friction courses provide improved vehicle skid resistance, but do not provide any structural value to the pavement. Typically friction courses are placed on high volume limited access roadways.

Grader: Any device either self-propelled or mounted on another machine used for final shaping and maintenance of earth or aggregate surfaces. Occasionally, a simple, towed drag-type device is referred to as a grader.

Gravel: A mix of stone, sand and fine-sized particles used as sub-base, base or surfacing on a road. In some regions, it may be defined as aggregate.

Intermediate course is an HMA pavement layer placed upon the base course.

Moisture Content: (in percent) that portion of the total weight of material that exists as water.

Moldboard: The part of the grader that is actually used to cut, mix, windrow and spread material.

Motor Grader: Any self-propelled machine designed primarily for the final mixing and shaping of dirt or surfacing material. Sometimes referred to as a maintainer, patrol, or simply a “blade.”

Optimum Moisture: The percentage of water (by weight) in material that allows it to be compacted to achieve greatest density.

Paved Road: Any road that has a semi-permanent surface placed on it such as asphalt or concrete. Gravel surfaced roads are virtually always referred to as unpaved roads.

Permanent pavement markings are durable pavement markings that, when installed, provide final traffic guidance after all operations related to the project are complete. Permanent pavement markings shall include skip-line and solid-line centerline markings, skip-line and solid-line lane-division markings and, solid-line edge-line markings installed on the newly-placed roadways once the surface has cured.

Pit: An area where a natural deposit of stone, sand and/or fine material is removed from the earth.

Quarry: An area where solid stone is removed from the earth generally by ripping, drilling and/or blasting. The stone is then crushed and processed into useable sizes.

Sub-base consists of granular material - gravel, crushed stone, reclaimed material or a combination of these materials.

surface course is the top HMA pavement layer and is placed upon the intermediate course.

Sub-grade – The undisturbed virgin substrate or embankment material which the pavement structure is placed upon.

Skid Resistance – A measure of the coefficient of friction between an automobile tire and the roadway surface.

Segregation: A problem that arises when the coarse and fine material separates and no longer forms a uniform blend of material.

Temporary construction pavement markings are construction zone pavement markings that, when installed, provide limited-duration traffic guidance until permanent pavement markings are installed in accordance with the latest edition of “VDOT Road and Bridge Specifications” and as specified as specified elsewhere in the Contract.

Windrow: A ridge or long, narrow pile of material placed by grader while performing construction or maintenance operations.

5.3 Pavement

5.3.1 General:

All new paved areas shall have positive drainage to eliminate ponding. Where new paved areas join existing, measures shall be taken to incorporate positive drainage to eliminate ponding.

5.3.2 Pavement Types

Different types of pavement are commonly used in the construction of roadways. There are three different types of pavement.

1. Flexible Pavement
2. Rigid Pavement
3. Composite Pavement

NOTE:

The pavement design procedures presented in this Section are for flexible pavements Hot Mix Asphalt (HMA) only.

5.3.3 MATERIAL

5.3.3.1 Aggregate Courses shall be per current VDOT Pavement Design Guide.

1. Aggregate Base Materials are of two types as indicated:

Type I - Aggregate base material (crushed material only) using #21-A, #21-B or #22 size aggregate.

Type II Aggregate base material (crushed or uncrushed material) using #21-A, or #22 size aggregate. When aggregate base material Type I is specified, the coarser graded aggregate, size #21-B, is preferable.

5.3.3.2 All untreated aggregate used in base or subbase courses shall be #21-B gradation, except on roads with an ADT(Average Daily Traffic) of 1000 or less; where #21-A or #21-B may be used. When the #21-B gradation is used, drainage concerns must be addressed. Use #21-A gradation if the aggregate is cement stabilized.

5.3.3.3 The wearing course is the top layer of a surfacing system that is in direct contact with traffic loads. The wearing course shall be designed to:

- 1 Provide resistance to abrasion
- 2 Provide a smooth ride
- 3 Resist plastic deformation
- 4 Resist water permeability
- 5 Resist fatigue
- 6 Resist thermal cracking

- 5.3.3.4 Hot Mix Asphalt (HMA, or asphalt concrete pavement) is the predominant type of wearing course used. A pavement that receives such a surfacing is called a flexible pavement. HMA is appropriate for highway pavements, parking lots, pathways, and sidewalks. HMA pavement structures shall be designed in accordance with the policies and design procedures in VDOT Pavement Design Guide. Use a minimum thickness of 2 inches for new and overlay HMA layers.
- 5.3.3.5 Recycled asphalt pavement is the process of recycling old asphalt into new pavement by in-place cold mixing process or hot mixing at a plant. Recycled asphalt pavement may be used if the minimum resilient modulus is greater than 300 ksi.
- 5.3.3.6 An Asphalt Surface Treatment (AST) is an asphalt/aggregate application to a road surface. Usually less than 1 inch thick, asphalt surface treatments may be used to provide friction and decrease dust generation. ASTs are appropriate when unstable embankments are present and/or for low- traffic roadways.
- 5.3.3.7 The binder course is the bottom layer of pavement below the wearing course. Binder courses are usually HMAs, but in the case of overlays, the original wearing course layer becomes a binder course layer when topped with a new HMA (Hot Mixed Asphalt)layer.
- 5.3.3.8 The base course is the layer of material placed on top of the subbase or subgrade that supports the wearing and binder courses. A base course can be stabilized or non-stabilized.

5.3.3.8.1 A bound stabilized base is required on all roadway construction, reconstruction, and rehabilitation projects.

Exception:

Projects is designed to change an existing Gravel road to a Paved road.

The contractor may apply for an exemption in writing to the PRCS. The rationale for an exemption may include:

1. Projects with a low AADT (Average Allowable Daily Traffic)
2. unstable foundations

5.3.4 CONSTRUCTION

- 5.3.4.1 Prepare Subgrade in accordance with VDOT pavement design guide.
- 5.3.4.2 The Contractor shall notify PRCS if the sub-grade is found to be unsuitable to be adequately leveled and compacted “presence of soft spots”.
- 5.3.4.3 The Existing subgrade material that can not be compacted as required shall be removed and replaced with satisfactory material to the depth indicated . used to bring the sub-grade to required grade and to replace the unsuitable material shall be of approved material .

- 5.3.4.3.1 Excavation required in the subgrade shall be completed before fine grading and compaction are performed.
 - 5.3.4.3.2 When excavation must be performed in completed subgrade, subsequent backfill and compaction shall be performed as directed by PRCS.
 - 5.3.4.3.3 Completed subgrade, after filling and compaction, shall be uniformly and properly graded and have a uniform stable density.
 - 5.3.4.4 Materials shall not be stored or stockpiled on prepared subgrade.
 - 5.3.4.5 Disposal of debris and other materials excavated and/or stripped, and material unsuitable for or in excess of requirements for completing the work shall be disposed of offsite by the Contractor as approved by PRCS.
 - 5.3.4.6 Graded and compacted subgrade shall be approved by PRCS before placement and preparation of the aggregate.
 - 5.3.4.7 Surface irregularities specified tolerances
 - 5.3.4.8 The subgrade and base course shall be kept clean and uncontaminated.
 - 5.3.4.9 Materials spilled outside pavement lines shall be removed and the area repaired.
- 5.3.5 Sub-grade shall be constructed in accordance with current VDOT Pavement Design Guide for Subdivision and Secondary Roads In Virginia.
- 5.3.6 Aggregate base course shall be constructed in accordance with VDOT standards to a depth as specified on the drawings or as specified per VDOT "Pavement Design Guide for Subdivision and Secondary Roads In Virginia and Standards and drawing specifications.
- 5.3.6.1 Primer shall be sprayed with a pressure distributor, under average conditions of accepted standards from 0.20 to 0.50 gallon per square yard on the prepared aggregate base course. The asphalt shall be entirely absorbed by the base course. If it is not absorbed within 24 hours after application, sand shall be spread over the surface to blot the excess asphalt. Care shall be taken to prevent over priming. The prime shall be fully set and cured before placing the surface treatment.
- 5.3.7 Surface course shall be constructed in accordance with current VDOT Pavement Design Guide for Subdivision and Secondary Roads In Virginia. Compaction shall meet the current VDOT standard and within the tolerances specified.

5.4 GRAVEL ROAD and PARKING

5.4.1 General-Road

The work shall consist of furnishing, transporting, and placing mineral aggregates for road surfacing.

5.4.2 Scope:

The work consists of the construction of a gravel parking or road surface, Excavation, Subgrade preparation, Installation of gravel, 2.4 Installation of pre-cast concrete wheel stops, Finish grading

5.4.3 Materials

1. Aggregate shall conform to the applicable requirements of ASTM D 1241 or as specified. The aggregate material shall be free from vegetable matter and other deleterious substances. The contractor shall provide documentation from the supplier that the aggregate meets the specification.
2. Test data and other certification information for the aggregate shall be furnished prior to the use of the material.

5.4.4 The gravel road surfacing shall meet the following requirements:

1. Percentage of Wear:
When tested in accordance with ASTM C 131, the percentage of wear shall not exceed 40 percent after 500 revolutions.
2. Plasticity Index:
When tested in accordance with ASTM D 4318, the plasticity index shall not be more than five (5).
3. Liquid Limit:
When tested in accordance with ASTM D 4318, the liquid limit shall not be more than 25 percent. The moisture content of the gravel mix material shall be maintained within the limits required to:
 - 3.1 The moisture content of the fill matrix at the time of compaction shall be neither less than one (1) percent below optimum moisture content nor one (1) percent above optimum moisture content.
 - 3.2 Meet mixing rates with the soil stabilizer and earth sealant additives as specified.

5.4.4.1 BASE PREPARATION,

the following shall apply: Roadbeds to be surfaced including the drainage ditches shall be scarified minimally to the top 3 inches of the road bases and treated with soil stabilization additives mixed with water to within $\pm 1\%$ optimum moisture and compacted as necessary to provide density of roadbase matrix not less than 95% maximum Proctor density (ASTM-698).

- 5.4.4.2 The use of alternative porous subbase materials may be considered to maintain a dust-free environment and reduce future maintenance costs. Materials shall be coordinated with and approved by PRCS for feasibility and site adaptability.

5.4.5 Construction:

1. The area to be surfaced shall be compacted as specified to the lines and grades shown on the drawings.

2. The surface shall be inspected and approved by the Engineer/owner or the third party inspector before any aggregate surfacing material is placed.
3. Any damage caused during construction shall be repaired before acceptance by PRCS.

5.4.6 PLACEMENT

1. The aggregate shall be deposited, spread, processed, and compacted on the prepared subgrade to the required thickness as shown on the drawings. After being spread, the material shall be watered, mixed, shaped to the required section, and compacted as specified.
2. In the event segregation occurs, the material shall be bladed until the various sizes of aggregate are uniformly and satisfactorily blended.
3. The completed course shall be smooth, true to grade and cross-section, and free from ruts, humps, depressions, and irregularities.
4. Workmanship and materials for such repair and replacement, except as otherwise noted, shall match as closely as possible those employed in existing work.

5.5 SIDEWALKS

Sidewalks shall have the following elements:

5.5.1 Clearing

Areas to be paved shall be cleared of all roots, sod, mulch and other debris not part of the soil, to a depth of at least one foot below finished grade.

5.5.2 Side walk Width

New sidewalks should be a minimum of 60" wide.

Exception:

Where this is not feasible, a minimum clear width of 48" may be considered as a design waiver with appropriate documentations, in writing. This dimension shall exclude the width of the curb.

5.5.3 Height Restrictions

1. Maintain a vertical clearance from the top of the sidewalk to the bottom of any sign to a minimum of 84" in accordance with the MUTCD.
2. The side walk shall not be located in locations where the guy wires and utility tie-downs cross the sidewalks at heights below 96".
3. The path along or within a sidewalk shall be clear of obstructions underfoot, overhead. There shall be no protrusion more than 4" into sidewalk's accessible route from the ground and within the standard head clearance, 80".

5.5.4 Slope

1. Sidewalk slope (grade) shall not exceed the general slope (grade) established for the adjacent street or highway.
2. The Cross slope shall not exceed 48:1.
3. When crossing driveways aprons may be constructed like a ramp with steep short side flares which can restrict that section of sidewalk impassible.

5.5.5 Surfaces

1. All material used for the surface of the sidewalk shall be approved by the PRCS and shall be placed in accordance with the specifications and plans if available.
1. The sidewalk surfaces shall be **stable, firm and slip resistant** and shall be generally in a continuous plane with a minimum of surface warping. Materials such as gravel, wood chips, or sand, can not generally be considered a slip-resistant nor constitute an accessible route.

Exception:

Alternate acceptable materials can be accepted in writing through PRCS.

5.6 SPECIAL REQUIREMENTS:

VDOT Road and Bridge Specifications requires that the Contractor have a Certified Materials Technician Present during the production, placement and testing of materials. or the project contract documents for the actual specifications.

Specifications are required for the following activities,

1. Certified Aggregate Plant Technician for the production of Central Mix Aggregate
2. Certified Asphalt Plant Technician for the production of Hot Mix Asphalt (HMA).
3. Certified Asphalt Mix Design Technician for development and adjustment of HMA mix designs.
4. Certified Concrete Plant Technician or Certified Concrete Batchers for the production of Concrete.
5. Development and adjustments of concrete mix designs shall be performed by a Certified Concrete Plant Technician.
6. Certified Asphalt Field Technician for the placement of HMA.
7. Certified Slurry Surfacing Technician for the placement of slurry seal.
8. Certified Concrete Field Technician for the placement of Concrete.
9. Certified Pavement Marking Technician for the placement of pavement markings.
10. Certified Surface Treatment Technician for the placement of surface treatment.

5.7 PAVEMENT MARKING

5.7.1 Scope:

All marking configurations shall be installed in accordance with the latest edition of the "Manual on Uniform Traffic Control Devices" (MUTCD), the Virginia Supplement to the MUTCD and the Virginia Work Area Protection Manual.

Markings shall be installed either under the guidance of the manufacturer's representative or by the manufacturer's certified installer.

5.7.2 Material Verification

1. Review the Material Specification to verify that the correct materials are supplied and used on the job.
2. Compare the material test results and/or products against specifications to ensure that they are correct.
3. Project manager and contractor shall be familiar with the application requirements for all the specified material.

5.7.3 Review of Pavement Marking Layout Details

1. The layout of all pavement markings shall be reviewed in detail.
2. Review all drawings and measurements for accuracy.
3. The layout shall be either included in the plans or referenced in the standard plans and drawings.
4. Discuss the acceptance procedures and specifications in general, during the pre-construction meeting.
5. The type of materials, methods of application, and other installation considerations shall be discussed.

5.7.4 PRE-INSTALLATION

1. Review the VA MUTCD and established specifications to determine the correct location and type of pavement marking to be installed.
2. Third Party Inspector or the Project Manager shall ensure:
 - 2.1 That weather and surface conditions comply with specifications.
 - 2.2 Periodic monitoring is performed at the start of the day and every 3 hours thereafter.
 - 2.3 Any unsatisfactory work is reported to the contractor immediately.
3. Third Party Inspector or the Project Manager shall ensure that the pavement marking field layout (pre- marking) conforms to plans and MUTCD requirements.
4. Third Party Inspector or the Project Manager shall ensure, through random inspection, that materials are applied in accordance with contract documents.

5.7.5 The contractor is responsible to:

1. Review the plans, contract, specifications, and MUTCD to determine the location and type of pavement markings to be installed.
2. A copy of the manufacturer's installation recommendations must be obtained and supplied by the contractor for the type of materials used.
3. The work shall not proceed unless a copy of the Material Safety Data Sheet is provided, as required by Occupational Safety and Health Administration (OSHA), for each type of material to be used.
4. Striping equipment shall be checked for proper calibration and obvious mechanical deficiencies. The contractor is required to demonstrate that all equipment is capable of performing the intended work prior to beginning actual application.

5.7.6 INSTALLATION

1. Traffic control must be constantly monitored to minimize disruption and to ensure compliance with the MUTCD.
2. The contractor shall measure the application thickness, color, and the bead application rate at the beginning of each workday and a minimum of every three hours thereafter, for paint, thermoplastic, and epoxy.
3. Clean pavement surfaces from grease, oil, mud and foreign materials prior to marking.
4. The surface of the pavement shall be dry prior to application of marking.
5. Material temperatures shall be randomly checked during application.
6. In order to prevent tracking, the applied material must be cured sufficiently to ensure tracking does not occur.
7. The contractor's quality control technician must constantly monitor the quality and workmanship of the material being applied. Line width, length, thickness, and

color shall be checked frequently to ensure compliance with the contract documents, and a written report (quality control report) shall be submitted to the agency's inspector.

8. Unacceptable work must be identified, reported to the contractor, and corrected prior to further application and final payment.
9. Payment for completed work shall be dependent on compliance to contract requirements and the quality of the work.
10. Protect completed paint marking from damage. Do not permit vehicular or pedestrian traffic on completed marking until paint has set and hardened.
11. Restore damaged paint marking per VA MUTCD requirements and as directed by PRCS

5.8 PRE-CAST CONCRETE WHEEL STOPS

General:

The pre-cast concrete wheel stops considered in this section shall be the type with raised base to allow for surface drainage.

5.8.1 SCOPE

This work shall include, but not necessarily is limited to, furnishing, placing, anchoring, labor, materials and services to install precast concrete wheel stops as indicated on the Plans or established by the Engineer and as specified in the Contract Documents.

5.8.2 INSTALLATION:

The precast concrete wheel stops shall be located as shown on the plan and installed in accordance with the manufacturer's standards at locations where wheeled vehicles may roll into pedestrian or hazardous area.

1. Thoroughly clean surfaces to receive wheel stops free of dirt, sand, oil, grease or other foreign matter.
2. Wheel stop locations shall not create a barrier for the handicapped.
3. Wheel stop layout shall be coordinated with site drainage to avoid ponding.
4. Establish are line the locations of the precast concrete wheelstops, per plans before installation.
5. The wheel stops shall be centered in space and be placed no closer than three feet (3') to end of space.
6. Pre-cast concrete wheel stops shall be utilized for all parking spaces in 8'-0"lengths maximum. The wheel stops shall be secured, to asphalt, with 2 pre drilled diameters (#5 bar).
7. The anchors shall be secured to **asphalt** pavement minimum 4".
8. The wheel stop shall be secured to **concrete** surfaces with adhesives per manufacturer's recommendation.
9. The anchors shall be driven into the pavement until the top of the anchor is flush with the top of the wheel stop.

5.8.3 QUALITY CONTROL:

The owner or owner's representative shall inspect all materials and work before and/or after installation to ensure compliance with the Contract Documents such as,

1. The Wheel stop locations shall be in accordance with plans and specification.
2. Verify layout of wheel stop locations with pavement marking layout.

3. Verify that paving and pavement marking is completed and ready for installation of wheel stops.
4. Ensure the wheel stops are securely anchored and in proper alignment
5. The wheel stops anchorage to **asphalt** pavement shall be with minimum two steel dowels embedded in the pre-drilled holes.
6. Anchors are flush with top surface of wheel stop.
7. Location and line shall be inspected and approved by the Inspector before installation.

5.8.4 FINAL CORRECTION

The owner reserves the right to inspect the work to determine if adjustments are necessary in grade, alignment, or layout. The contractor shall make such adjustments without further compensation.

5.8.5 CLEAN-UP

1. The contractor shall remove all debris, construction equipment and scrap material from all areas within the limit of work prior to the final inspection and acceptance.
2. The contractor shall clean all stains and patch all chips from the wheelstop surface.
3. Wheel stops which cannot be cleaned or repaired in a manner satisfactory to the owner shall be replaced.

5.9 SPEED HUMPS OR TRAFFIC CALMING DEVICES

5.9.1 Scope

Traffic calming devices are provided to reduce the speed in park streets.

5.9.2 LOCATIONS

1. Speed humps shall not be located over manholes, water valves, or when possible, within twenty-five feet of fire hydrants, as they prevent/impede access to these facilities.
2. Speed humps should be located five to ten feet away from driveways, when possible, to minimize their effect on driveway access.
3. Speed humps should be located on or near property lines, when possible, to minimize the impact on (access to) individual properties.
4. Speed humps should be located near streetlights, whenever possible, in order to enhance their visibility at night.
5. Speed humps should be located a minimum distance of 200 feet from corners.
6. Speed humps shall be spaced at a minimum interval of 250 feet and a maximum interval of 600 feet.
7. The maximum number of speed humps is dictated by street length and spacing requirements. No less than two speed humps will be placed on a parks street, as two humps are the minimum for effective speed control.
8. Speed humps shall not interfere with the street or parking natural drainage path.

5.10 Steel Gate

5.10.1 Material specification

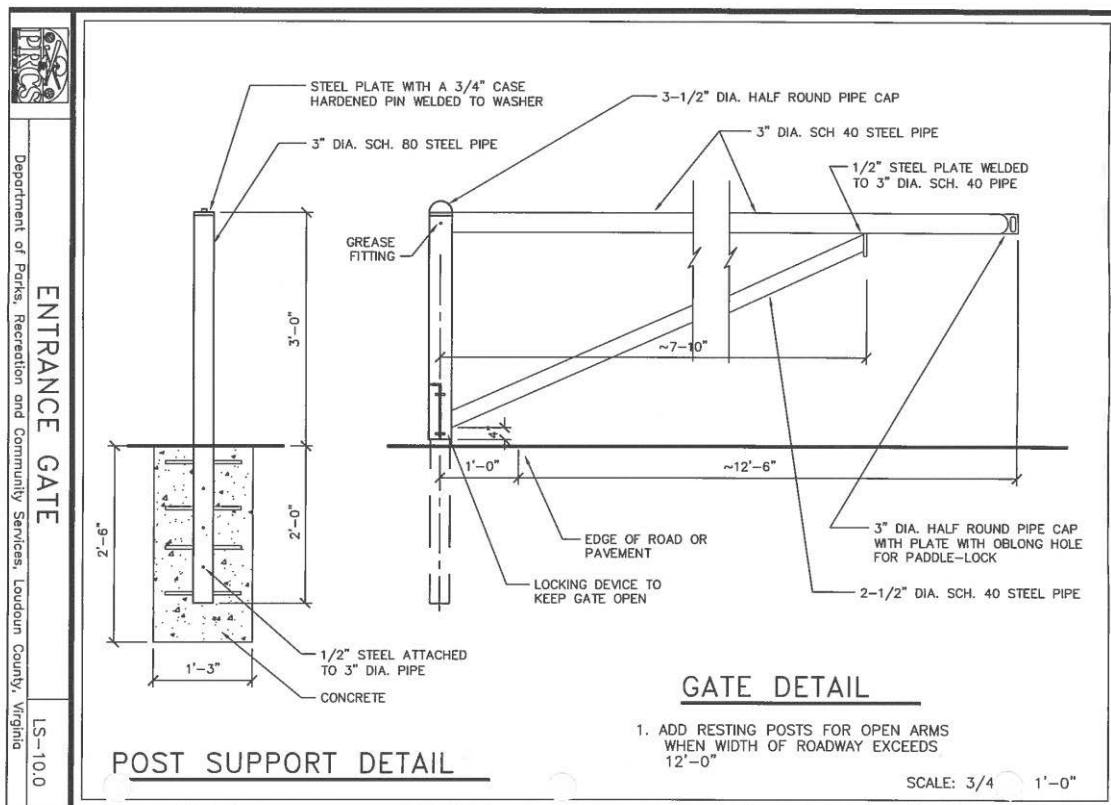
1. Steel gate posts shall be seamless galvanized steel tubing , round, six (6) inch in diameter and shall conform to ASTM A 501(This specification covers black and hot-dipped galvanized hot-formed welded and seamless carbon steel square, round, rectangular, or special shape structural tubing for welded, riveted, or bolted construction of bridges and buildings, and for general structural purposes).
2. Post Paint shall be Shop primed PER AASHTO M 72 type I. Finish paint, shall be per AASHTO M 67-74, foliage green/black, type I.
3. Posts Hardware shall be $\frac{3}{8}$ inch eye bolt, length required for installation indicated, and $\frac{3}{8}$ inch washers both with zinc coating finish, ASTM A 153 (This specification covers zinc coatings applied by the hot-dip process on iron and steel hardware).

5.10.2 INSTALLATION

1. Lay out posts at the locations indicated on the plans and in the field.
2. Posts shall be secured to ground with concrete footing/piers to the dimensions and depth as indicated on the plans and specifications.
3. The concrete strength for footings/piers shall be 3500 psi minimum. Pour concrete around the post and tamp to remove air gaps and voids. Plumb posts in concrete footing to the tolerances indicated. Pour concrete from the top and flush with outside edges flush with of finished grade, and trowel to a smooth finish.
4. Fill post with concrete as indicated before placing the post cap.
5. Use two self-tapping screws to secure the cap, if needed.
6. Contractor shall allow concrete footings to cure to the specified strength before removing the bracing.

5.10.3 FINISHING

1. Clean and prepare post surfaces in accordance with paint manufacturer's recommendations or as a minimum apply one (1) primer coat and one (1) finish coat in accordance with manufacturer's application instructions.
2. Drill eye bolt holes and install as indicated on the plans.
3. Center punch eye bolt ends to prevent nut loosening. Install chain between posts with two (2) round pin chain shackles and chain lock. Chain shall be of correct length for post spacing indicated, plus catenary curve sag not exceeding 10 inches, plus 12 inches for chain adjustments.



5.11 ROAD AND PARKING AREA SIGNS

5.11.1 All Parking Area and Fire Lane Signs including the accessible signs, for handicapped van and handicapped car parking spots shall be in accordance with Virginia Supplement to the latest MUTCD. The signs shall be obtained from Loudoun County Department of General Services. All sign Locations, of various sign types, shall be as indicated on Construction Drawings, and as directed by PRCS.

5.11.2 Parking Space Signs for Accessible Parking and Van Accessible Parking Sign Posts.

5.11.3 Scope

All posts used to mount the signs to, regardless of material, shall be supported with concrete footings to minimum frost depth established by Loudoun County.

5.11.49.4.1.2 Material

Wood posts shall be nominal 4"x 4" exterior grade, no. 2 or better, free of splinters, smooth cut, pressure treated. The top of the posts shall be cut into pyramidal shape.

5.12 BRICK PAVERS

5.12.1 GENERAL

All work under this section is subject to the provisions of Chapter 1, General References for All Sections.

5.12.2 Solid paver unit sidewalks shall be constructed in accordance with VDOT's Location and Design Instructional & Information Memoranda IIM-LD-218, Paver Units (Sidewalk and crosswalk), located at

1. <http://www.virginiadot.org/business/locdes/rd-ii-memoranda-index.asp>
2. and per technical standard specified by BIA (Brick Industry Association) <http://www.gobrick.com/Technical-Notes>
3. And per American with Disability Act <http://www.dol.gov/dol/topic/disability/ada.htm>

5.12.3 SCOPE

The work includes, but is not limited to, the provision of all material, services, labor, and equipment necessary to construct brick paved walks and other paving materials such as stone, slate, etc., including subgrade and base preparation, and shall include, but not be limited to, the adjustments of all public and private frames, grates, covers and utility boxes.

Requirements specified herein are for brick used in flexible and rigid pavements for light and heavy traffic conditions.

1. Flexible pavements bear on sand and a crushed stone base, are mortarless and do not rely on a rigid layer to distribute superimposed traffic loads to the subgrade.
2. Rigid pavements contain a rigid support base of either asphalt or concrete, a mortar bed and mortared joints between each unit.

5.12.4 Quality Assurance

1. Use a qualified paving contractor experienced in the installation of similar products.
2. All brick tests shall be performed by an independent certified testing laboratory.
3. All brick tests shall be in accordance with ASTM C67 latest edition.

5.12.5 SUBMITTALS:

Submit test report and certificate of conformance for each type and color of brick specified on contract documents for owner's or the owner's representative's approval.

The test reports shall include:

1. Compressive strength (10,500 psi, average of 5 brick testing)
2. Modulus of Rupture
3. 24 hour cold water absorption (less than 4%) hour boil
4. Saturation coefficient
5. Initial rate of absorption
6. Efflorescence
7. Weather classification
8. Paver type And the Certificate of conformance shall state that brick meet or exceed applicable ASTM specifications indicated on the contract document and specification.

5.12.6 Quality Control

1. A 4' x 4' sample panel shall be set up at the job site showing the proposed color range, texture, bond, workmanship and where applicable, mortar.

2. Upon acceptance of the sample panel, a field panel shall be laid up out of the actual material to be used on the job.
3. No brick shall be shipped from the manufacturer to the site until architect's acceptance of the field panel. Once the first 100 square feet of the job has been installed and approved, this becomes the accepted standard for workmanship, color and texture. Upon approval, the field panel may be removed.
4. All bricks shall comply with the tolerances specified in tables 6 thru 8.

5.12.6 SUBGRADE

The subgrade shall be prepared in accordance with the requirements of the ROUGH AND FINE GRADING, Any deterioration of originally prepared subgrade shall be repaired to the specified condition before proceeding with construction.

5.12.7 MATERIALS

5.12.7.1 Paving Brick

1. All brick shown on contract documents shall be colored, textured and patterned as specified by PRCS specifications and plans.
2. Dimensions width x height x length shall be as shown on the specification and acceptable tolerances as shown in the tables.
3. Maximum permissible variation on length is 1/8 inch Maximum permissible variation on width and height is 1/16 inch.
4. All replacement brick shall match in color and texture to existing brick.
5. All clay pavers shall be covered by ASTM C 902, *Specification for Pedestrian and Light Traffic Paving Brick*, and ASTM C 1272, *Specification for Heavy Vehicular Paving Brick*, can be installed on a sand setting bed.
6. The brick selection shall be per the appropriate Application, Type and Class of the paver for the project based on aesthetics, use, abrasion resistance and the required resistance to damage from weather exposure. The selection shall be per table 1 through table 5 and shall comply with tolerances set forth in table 6 thru 8 unless noted otherwise.

TABLE 1
Acceptable Paving Systems

Application	Typical Examples	Sand Setting Bed				Bituminous Setting Bed		Mortar Setting Bed	
		Aggregate Base	Asphalt Base ¹	Cement-Treated Aggregate Base	Concrete Base ¹	Asphalt Base ¹	Concrete Base ¹	Bonded Concrete Base ¹	Unbonded Concrete Base ¹
Residential	Patios and walks on property of a one- or two-family house or townhouse	A	A	A	A	A	A	A	A
	Driveways on property of a one- or two-family house or townhouse	A	A	A	A	A	A	A	NA
Commercial/ Pedestrian	Public plazas, courtyards or sidewalks	A	A	A	A	A	A	A	A
Light Duty Vehicular ³	Paving with low volume ² of heavy vehicles such as streets, parking areas, turn-arounds or passenger drop-offs	A	A	A	A	A	A	A	NA
Heavy Duty Vehicular ³	Paving with a high volume ² of heavy vehicles such as streets, commercial driveways or crosswalks across them	Refer to <i>Flexible Vehicular Brick Paving - A Heavy Duty Applications Guide</i>							

NOTES:

1. For a paving system that uses existing asphalt or concrete as base, verify that the condition of the base is acceptable.
2. For a definition of high volume of heavy vehicles, see Introduction.
3. For these applications, a design professional should design the paving system.

KEY:

A = Acceptable
NA = Not Acceptable

TABLE 2
Comparison of Pavements Made with Clay Pavers

Clay Pavers On:	Advantages	Disadvantages
Sand Setting Bed on Aggregate Base	<ul style="list-style-type: none"> • Most durable • Cost-effective • Easy access to repair underground utilities • Good as overlay to existing asphalt or concrete pavement • Allows use of semi-skilled labor • Can be designed as a permeable pavement 	<ul style="list-style-type: none"> • Intensive cleaning may erode joint sand • May require a thicker base
Sand Setting Bed on Asphalt Base	<ul style="list-style-type: none"> • Good as overlay to existing asphalt pavement 	<ul style="list-style-type: none"> • Intensive cleaning may erode joint sand
Sand Setting Bed on Cement-Treated Aggregate Base	<ul style="list-style-type: none"> • Good over poor soils or in small, confined areas • Good as overlay to existing concrete pavement 	<ul style="list-style-type: none"> • Intensive cleaning may erode joint sand
Sand Setting Bed on Concrete Base	<ul style="list-style-type: none"> • Good over poor soils or in small, confined areas • Good as overlay to existing concrete pavement 	<ul style="list-style-type: none"> • Intensive cleaning may erode joint sand • Requires good drainage above base • Susceptible to greater offset with subgrade movement
Bituminous Setting Bed on Asphalt Base	<ul style="list-style-type: none"> • Reduced horizontal movement and uplift • Enhanced water penetration resistance 	<ul style="list-style-type: none"> • Repairs are more difficult and expensive • Little tolerance for paver thickness variations or inaccurate base elevations
Bituminous Setting Bed on Concrete Base	<ul style="list-style-type: none"> • Reduced horizontal movement and uplift • Enhanced water penetration resistance • Good over poor soils or in small, confined areas 	<ul style="list-style-type: none"> • Repairs are more difficult and expensive • Little tolerance for paver thickness variations or inaccurate base elevations
Mortar Setting Bed Bonded to Concrete Base	<ul style="list-style-type: none"> • Greater tolerance for paver thickness variations or inaccurate base elevations • Can be used on steeper slopes and greater vehicle speeds • Drainage occurs on the surface 	<ul style="list-style-type: none"> • Movement joints must align through entire paving system • Least cost-effective • Mortar joint maintenance required • Repairs are most difficult and expensive
Mortar Setting Bed Unbonded to Concrete Base	<ul style="list-style-type: none"> • Greater tolerance for paver thickness variations or inaccurate base elevations • Movement joints in setting bed and base are not required to align • Preferred when used over elevated structural slab 	<ul style="list-style-type: none"> • Bond break must be used to avoid stresses caused by horizontal movement between layers • Least cost-effective • Mortar joint maintenance required • Repairs are most difficult and expensive

TABLE 3
Selection of Setting Bed and Base

Site Condition or Project Requirement	Sand Setting Bed				Bituminous Setting Bed		Mortar Setting Bed	
	Aggregate Base	Asphalt Base	Cement- Treated Aggregate Base	Concrete Base	Asphalt Base	Concrete Base	Bonded Concrete Base	Unbonded Concrete Base
Soft Soil in Subgrade	R	R	A	A	R	A	A	A
Tree Roots in/near Subgrade	R	A	NA	NA	A	NA	NA	NA
Expansive Soil in Subgrade	A ¹	R	A	NA	R	NA	NA	NA
Snow Melt System	A ²	A ²	A ²	R ²	A ¹	NA	R	R
Suspended Structural Slab	A ¹	NA	A ¹	R ¹	NA	R ¹	R	R
Good Surface Drainage	R	R	R	R	R	R	R	R
Poor Surface Drainage	R	R	R	R	R	R	NA	NA
Permeable Pavement	R	NA	NA	NA	NA	NA	NA	NA
Deep Frost Line	R ¹	R ¹	R ¹	R ¹	A ¹	A ¹	A	A
Freeze/Thaw	R ¹	R ¹	R ¹	R ¹	A ¹	A ¹	A	NA
Minimal Frosts	R	R	R	R	R	R	R	R
Pressure Washing	R ¹	R ¹	R ¹	R ¹	R ¹	R ¹	R	R
Vacuuming	R ¹	R ¹	R ¹	R ¹	R ¹	R ¹	R	R
Minimal Cleaning	R	R	R	R	R	R	R	R
ADA Compliance	R	R	R	R	R	R	A	A
Pedestrians Only	R	R	R	R	R	R	R	R
Light Vehicular Traffic	R ³	R ³	R ³	R ³	R ³	R ³	R	NA

NOTES:

1. Use stabilized joint sand
2. When snow melt system is in sand setting bed,
use stabilized sand in setting bed.
3. Use Application PS or PX pavers

KEY:

R = Recommended
A = Acceptable
NA = Not Acceptable

TABLE 4
Property Requirements

ASTM Standard		Minimum Compressive Strength, psi (Mpa)		Maximum Cold Water Absorption, %		Maximum Saturation Coefficient		Minimum Breaking Load, lb/in. (kN/mm)	
		Avg of 5 Brick	Individual	Avg of 5 Brick	Individual	Avg of 5 Brick	Individual	Avg of 5 Brick	Individual
C 902	Class SX	8,000 (55.2)	7,000 (48.3)	8.0	11.0	0.78	0.80	—	—
	Class SX (molded)	4,000 (27.6)	3,500 (24.1)	16.0	18.0	0.78	0.80	—	—
	Class MX	3,000 (20.7)	2,500 (17.2)	14.0	17.0	No Limit	No Limit	—	—
	Class NX	3,000 (20.7)	2,500 (17.2)	No Limit	No Limit	No Limit	No Limit	—	—
C 1272	Type R	8,000 (55.2)	7,000 (48.3)	6.0	7.0	—	—	—	—
	Type F	10,000 (69.0)	8,800 (60.7)	6.0	7.0	—	—	475 (83)	333 (58)

TABLE 5
Maximum Abrasion Requirements

ASTM Standard		Abrasion Index	Volume Abrasion Loss (cm ³ /cm ²)
C 902	Type I	0.11	1.7
	Type II	0.25	2.7
	Type III	0.50	4.0
C 1272	Type R & F	0.11	1.7

TABLE 6
Dimensional Tolerance Requirements

Dimension, in. (mm)	ASTM C 902 and C 1272		
	Application PS, in. (mm)	Application PX, in. (mm)	Application PA
3 (76) and under	1/8 (3.2)	1/16 (1.6)	no limit
over 3 to 5 (76 to 127)	3/16 (4.7)	3/32 (2.4)	no limit
over 5 to 8 (127 to 203)	1/4 (6.4)	1/8 (3.2)	no limit
over 8 (203)	5/16 (7.9)	7/32 (5.6)	no limit

TABLE 7
Maximum Chippage Requirements

ASTM Standard		Edge, in. (mm)	Corner, in. (mm)
C 902	Application PS	5/16 (7.9)	1/2 (12.7)
	Application PX	1/4 (6.4)	3/8 (9.5)
	Application PA	As specified by purchaser	As specified by purchaser
C 1272	Application PS & PX	5/16 (7.9)	1/2 (12.7)
	Application PA	No Limit	No Limit

TABLE 8
Tolerances on Distortion

Specified Dimension, in. (mm)	ASTM C 902 & C 1272 ¹		
	Maximum Permissible Distortion, in. (mm)		
	Application PX	Application PS	Application PA
8 (203) and under	1/16 (1.6)	3/32 (2.4)	no limit
Over 8 (203) to 12 (305)	3/32 (2.4)	1/8 (3.2)	no limit
Over 12 (305) to 16 (406)	1/8 (3.2)	5/32 (4.0)	no limit

¹ ASTM C 1272 Type F clay paver required to meet Application PX

5.12.7.1.1 Pedestrian and Light Traffic Brick

Light Traffic brick shall conform to ASTM C902 Class SX, Type 1.

1. Minimum compressive strength 10,000 psi.
2. Minimum Modulus of Rupture 1,000 psi.
3. Maximum cold water absorption 8 percent.
4. Maximum saturation coefficient .78.
5. Maximum Abrasion Index .10.

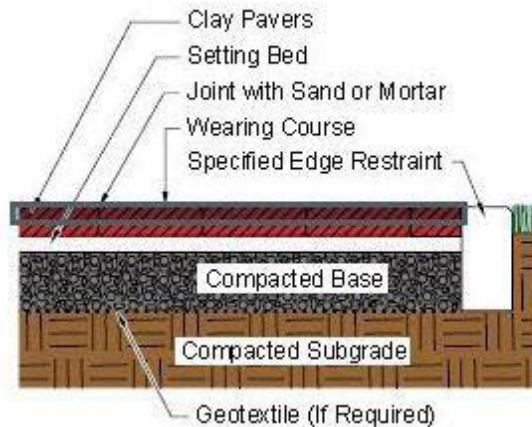
5.12.7.1.2 Heavy Traffic Brick

Heavy Traffic brick shall have the properties listed below:

1. Minimum compressive strength 10,000 psi.
2. Minimum Modulus of Rupture 1,500 psi.
3. Maximum cold water absorption 6 percent.
4. Minimum thickness 2.625 inches.
5. Maximum Abrasion Index .08.

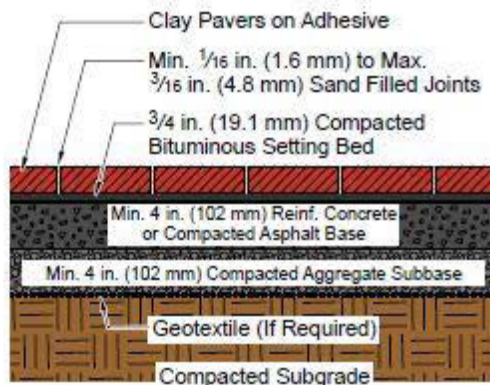


Pedestrian Plaza with Clay Pavers

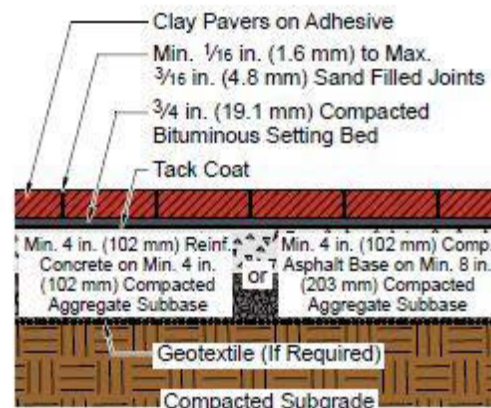


Typical Pavement Section

(courtesy of BIA Brick Institute of America)



Typical commercial/public walkway



Typical light vehicular traffic

(courtesy of BIA Brick Institute of America)

5.12.7.2 Bedding Sand

Bedding sand should be washed, well graded, angular, concrete, sand conforming to ASTM C33 with a 3/16 in. maximum aggregate size.

5.12.7.3 Jointing Sand

Jointing sand used between brick pavers should be washed, well graded mason sand conforming to ASTM C144.

5.12.7.4 Mortar

Mortar shall conform to ASTM C270. Type "M" mortar is recommended for severe weather conditions.

5.12.7.5 Base Material

Gravel base materials for pedestrian and light vehicular traffic should be well graded conforming to ASTM D2940. Base material supporting flexible brick pavements should maintain 3 to 8 percent fines passing the No. 200 sieve.

5.12.7.6 Drainage

1. Provide a minimum slope of 1/4 in. per foot (2 percent grade).
Three types of drainage potentially exist in clay paving systems: surface restricted, subsurface restricted and unrestricted. Surface restricted drainage occurs on the surface of the paving system. This type of drainage is typical of clay paving systems with a mortar setting bed. Subsurface restricted drainage occurs when water drains over the surface and immediately below the paving course. This type of drainage is typical of paving systems installed with a bituminous setting bed. Unrestricted drainage involves draining water from the surface, the subsurface and through the subgrade. This type of drainage requires a sand setting bed on an aggregate base. Drains should be selected and placed to adequately handle anticipated water flow. Drains serving paving systems should have openings not only on the surface but also on the sides. Such drains should be used for all paving systems to drain water from adjacent materials and to prevent capillary rise. Side openings should extend below the top of any impervious layer or membrane in the paving system. Drains placed in pavements with sand setting beds should have screens to prevent sand from entering the drain. Pavement edges that restrict water flow at the lowest point in the paving system where water is anticipated should have weeps at 16 in.
2. For concrete and impermeable bases, provide drainage:
 - 2.1 By installing weeps through base at inlets and other low points in the pavement to divert the water or increase the thickness of the subbase over subgrade soil that does not readily drain or can be subjected to freezing and thawing. Drainage openings can be formed by drilling 1 in. or larger diameter holes through the concrete base or side walls of drain inlets. Drainage openings should be filled with an open-graded aggregate to prevent their filling with setting bed material. Heat resistant tubing and drain mat materials may also be used but should not be located under wheel traffic.
 - 2.2 Or increase the thickness of the subbase over subgrade soil that does not readily drain or can be subjected to freezing and thawing.

5.12.7.7. Geotextiles

Geotextiles shall be used on top of silt or clay soils to help stabilize subgrades and under sand setting beds to prevent loss of sand through weep openings and other gaps in the pavement base or at edge restraints or penetrations.

5.12.7.7.1 Material

The preferred type of geotextile is a woven, polypropylene fabric complying with ASTM D 4751, *Test Method for*

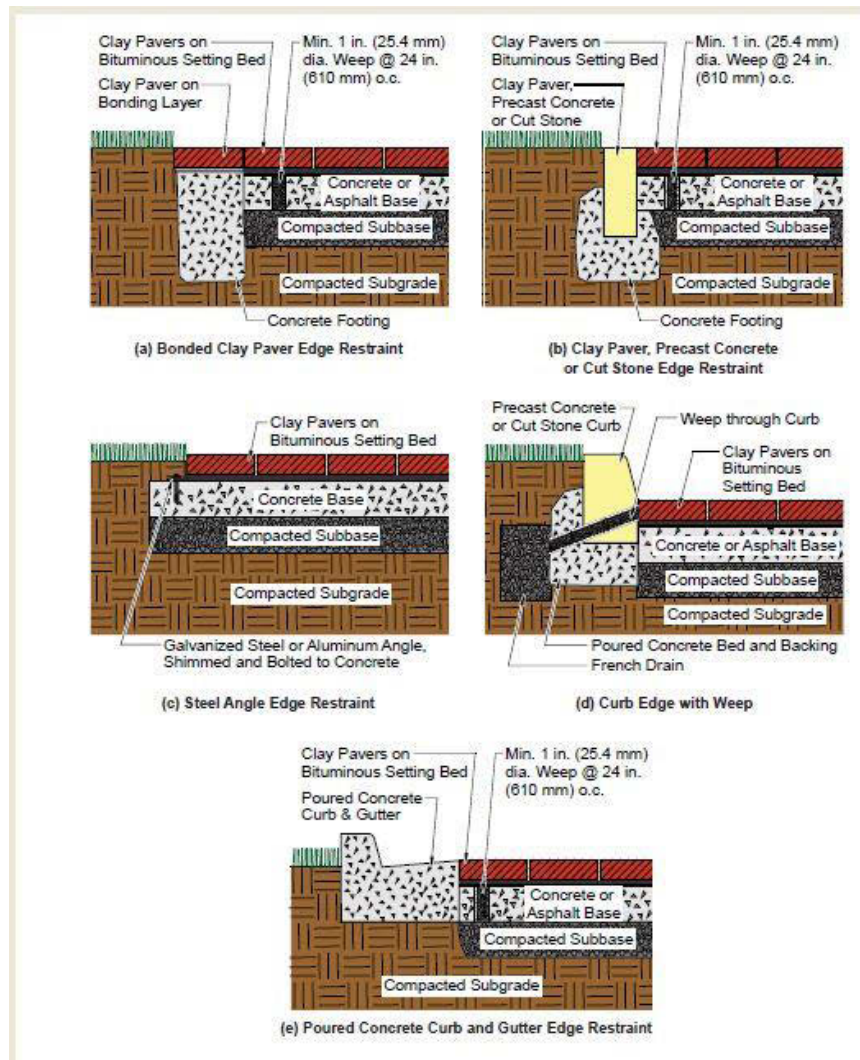
Determining Apparent Opening Size of a Geotextile, with an approximate opening size from a No. 70 to No. 100 sieve size.

Exception:

Nonwoven geotextiles can be used for light-traffic applications.

5.12.7.7.2 Construction

1. Geotextiles should be lapped at the sides and ends of rolls a minimum of 12 in. Do not locate laps directly under anticipated wheel paths.
2. Geotextiles should extend 6 in. beyond potential areas of sand loss.
3. Geotextiles should not be allowed to span over unfilled holes or pits in the surface of the base that are greater than 1 in.



Brick edge detail
(courtesy of BIA Brick Institute of America)

5.13 Flexible Pavement

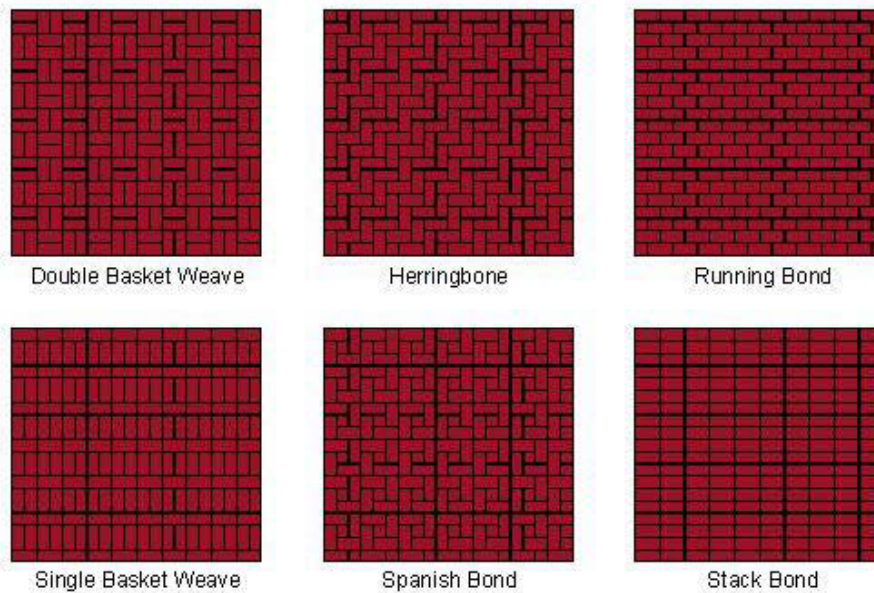
Are those pavements which reflect the deformation of subgrade and the subsequent layers to the surface.

5.13.1 Edge Restraint

Edge restraints are essential to the proper performance of flexible pavements. They are placed around the perimeter of the paved section and provide lateral restraint to the paving brick. This restraint supplies the force necessary to develop interlocking. Interlocking helps to resist vertical, rotational and horizontal displacements of the brick. Concrete, steel, wood and plastic are a few of the materials that can be used for edge restraint. The size and strength of the edge restraint must be increased as the traffic loads increase.

5.13.2 Bond Pattern

Brick can be placed in a variety of patterns. Basket weave, running bond, stack bond, and herringbone.



Brick Paving Bond Patterns
(courtesy of BIA Brick Institute of America)

5.13.4 Construction

Note:

Flexible pavements are not recommended for slopes greater than 10 percent.

1. Install all utilities, pipes and subsurface drainage prior to installing the base or subbase. Unsuitable, unstable materials should be removed and replaced with suitable materials when supporting heavy traffic.
2. Spread and compact base materials in uniform layers not exceeding 4 inches. Compact to 95 percent maximum proctor density. The surface of

the base materials should be close-knit to prevent bedding sand from filtering and eroding the base.

3. Geotextile fabrics may be used to prevent filtering of one material layer into another and also to help reinforce and stabilize the soil.
4. The finish surface and slope of the base should reflect the final paving surface.
5. Provide a minimum 2 percent slope for adequate drainage.
6. Install edge restraints. The base of the edge restraints should be placed at least as deep as the bedding course.
7. Place and screed the bedding sand to the desired contours. The bedding sand should not be used to fill large voids in the base course.
8. Install brick pavers in the desired pattern. For best results, “true pavers” should be used for flexible pavements. These brick are designed to be installed without mortar joints. The 4 x 8 true paver is the most versatile and allows for the largest variety of patterns.
9. Compact the surface of the brick using a mechanical plate vibrator. After the initial compaction, sweep fine jointing sand over the surface of the brick and compact.
10. Remove surplus jointing sand.
11. Slope the paving systems can be successfully used on slopes with up to a 10 percent gradient. For projects where site conditions involve slopes exceeding 10 percent, a design professional and Loudoun County FSM should be consulted.

5.14 SETTING BEDS

Setting beds provide a means to adjust for dimensional variations in the height of a paver. They also support the clay pavers and transfer load to the base.

5.14.1 Sand Setting Bed

Individual pavers in sand setting beds are held in position by the frictional interlock that is developed in each sand filled joint between adjacent pavers. The joints transfer vertical and horizontal forces, but can absorb expansion and contraction of the individual pavers. If the pavement deflects slightly, the pavers will realign themselves to the new profile without significant loss in structural capacity. Interlock is developed by properly sized joints filled with consolidated joint sand. Sand setting beds may be installed directly on an aggregate base, asphalt base, cement treated aggregate (CTA) base or concrete base.

5.14.2 Bituminous Setting Bed

In pavements with a bituminous setting bed, less interlock is developed by the joint material than in a pavement with a sand setting bed. However, additional restraint is provided by the adhesive nature of the tack coat. Bituminous setting beds can be set on an asphalt base or concrete base.

5.14.3 Mortar Setting Bed

Pavers in a mortar setting bed are bonded to the underlying mortar bed and transfer most of the vertical load through direct bearing. Mortar setting beds

should be used only with a concrete base and may be bonded or unbonded to it. The joints between pavers are filled with mortar that transfers horizontal load. However, mortar will not absorb expansion and contraction of individual pavers. If the pavement deflects significantly, the pavement may crack along mortar lines or across pavers.

5.15 BASES

The base layer in the pavement is the primary structural layer. It is subjected to the compressive, tensile and shearing stresses transmitted through the wearing course. Materials in the base layer need to be capable of resisting these stresses. Pedestrian loading is sufficiently light that a base thickness of only 4 in. is required when no specific site conditions dictate a thicker base. Vehicular loading requires a thicker base. Including a subbase often provides economic benefits when the subgrade is of low strength or is susceptible to frost. Because it is lower in the pavement section, the subbase is subjected to lower stresses than the base course. A subbase also can serve as a working platform to prevent subgrade damage from construction equipment. Subbase material also may be added to increase the depth of the pavement section in frost susceptible soils. A subbase is not usually required for light duty vehicular pavements. Pedestrian-only pavements generally do not include a subbase.

5.15.1 Aggregate Subbase and Base

Aggregate subbase materials are typically medium-quality graded aggregates or clean sand-and-gravel mixtures. They should not be susceptible to deterioration from moisture or freezing. Subbase materials are covered by ASTM D 2940, *Specification for Graded Aggregate Material for Bases or Sub-bases for Highways or Airports*. Typical gradation envelopes are prescribed, along with other properties such as durability and plasticity. Aggregate subbase materials generally are graded from 1½ in. to No. 200 sizes. Aggregate subbase materials may be used directly over the subgrade soil or on top of a geotextile.

Aggregate base materials are typically high-quality, crushed, dense-graded aggregates. They usually are specified in ASTM D 2940.

Aggregate base materials generally are graded from ¾ in. to No. 200 sizes. An aggregate base may be placed directly on the subgrade or over an aggregate subbase. A sand setting bed may be installed directly on an aggregate base.

It is important to compact aggregate subbase and base layers. Each layer should be compacted in accordance with ASTM D 698 to 95 percent maximum density.

5.15.2 Asphalt Base

Asphalt base materials consist of mixtures of aggregates and asphalt cement that are produced at a central hotmix plant. The materials are proportioned to comply with a mix design, and the materials usually are specified in state or local standards and in ASTM D 3515, *Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures*. Asphalt aggregates usually are blended to achieve a gradation from ½ in. or ⅜ in. to No.

200. An asphalt base may be placed directly on the subgrade but is more commonly laid over an aggregate subbase or base. It creates a relatively stiff and impermeable base layer.

5.15.3 Cement-Treated Aggregate Base

A cement-treated aggregate base material is a relatively dry, lean mixture of aggregate and portland cement that creates a stiff and impermeable base layer. These materials should be mixed at a concrete plant and laid by machine. Cement contents vary between 5 and 12 percent with sufficient water added to achieve required compaction and full hydration of cement. Compressive strengths typically are around 750 psi . A cement-treated aggregate base may be placed directly on the subgrade but is more commonly laid over an aggregate subbase. This type of base does not include reinforcement, and because of the low water and cement content, can be laid without movement joints.

5.15.4 Concrete Base

The compressive strength of a concrete base shall be at least 4,000 psi. Concrete bases may be plain or reinforced, incorporating a grid of movement joints with load transfer devices, such as dowels. Movement joints placed more than 12 ft apart should extend through the entire pavement to prevent damage to the pavers unless using an unbonded system. A concrete base should be placed over an aggregate subbase or base.

5.16 SUBGRADE

- 5.16.1 The subgrade is classified by the existing soil conditions, the environment and drainage. For vehicular applications, the existing soil conditions for the project should be determined by a geotechnical engineer before design of the paving system.
- 5.16.2 For pedestrian and residential applications, a geotechnical engineer should be used as necessary to verify suitability of existing soil for the proposed paving system.
- 5.16.3 Environmental conditions and the quality of drainage can affect the support provided by the subgrade.
- 5.16.4 In wet climates, poorly drained areas or those that experience freezing conditions, the support from the subgrade is likely to be reduced during certain periods of the paving system's life. Conversely, in arid climates or well-drained areas, it is likely that a higher degree of subgrade support will be experienced during part of the paving system's life. Where water can penetrate the subgrade, it is important to drain water quickly to alleviate any potential fluctuations in soil moisture content.
- 5.16.5 Soils are typically classified into different groups to represent their engineering properties. In general, soils consisting primarily of gravel and sand can be used to support most paving systems. In general, soil consisting of clay can usually be used to support a paving system as long as it is located in a dry environment or is drained. Soils classified as organic are not suitable for subgrade and should be removed and replaced.

5.17 GEOTEXTILE

Geotextiles are formed from plastic yarns or filaments such as polypropylene and polyester. They may be woven or nonwoven fabrics supplied in rolls. A geotextile may be used between fine-grained subgrade materials and base or subbase layers, particularly where moist conditions are anticipated.

The geotextile is used to:

1. Separates the two layers, preventing the intrusion of fine soil particles into the overlying granular layer and preventing larger aggregates from punching down into the subgrade.
2. This enables the base to retain its strength over a longer period.
3. Geotextiles also can provide limited reinforcement to the overlying pavement layer. As the subgrade begins to deform, the geotextile is put into tension, which reduces the loading on the subgrade, slowing rut development.
4. The geotextile manufacturer's recommendations should be sought during selection of the appropriate geotextile for particular soil conditions.

5.18 Rigid Pavement

Rigid pavement provides high bending resistance and distributes loads to the foundation over a relatively large area

5.18.1 Material

5.18.1.1 Mortar

1. Brick that are mortared to a rigid base should be placed in a single operation bedding and joint filling method.
2. For severe weather regions, a mortar consisting of 1 part cement to 3 parts sand is recommended.
3. The mortar bed thickness should range between 5/8 inch and 3/4 inch.

5.18.1.2 Brick

Brick that are specified for rigid pavements should be sized to allow for a standard mortar joint of 3/8 inch. A common modular sized brick that allows the most flexibility in pattern layout is the 3-5/8 x 7-5/8 paving brick.

5.18.1.3 Construction

1. Install all utilities, pipes, and proper subgrade as required to support rigid base.
2. Rigid brick paving is permeable and will not prohibit water from reaching the subsurface. Install subsurface drainage as required. Slope the surface of the rigid base to the sub-surface drains.
3. Place expansion and control joints in the rigid base as required and continue joints to the surface of the brick pavement.
4. Spread the mortar bed to the proper thickness and install the brick pavers
5. Using a trowel or grout bag, fill all voids between brick pavers.
6. Compress and tool joints using a concave tooled joint.
7. Allow the mortar to become thumbprint hard before tooling.
8. Scrape and remove excess mortar from brick. Brush clean.
9. Clean brick within 2 to 4 weeks.

5.18.2 Control and expansion joints

1. Expansion and control joints shall be provided for rigid pavement. The design shall consider the movement of both the base and surface and detail expansion and control joints for the controlling case.
2. Expansion or contraction joints shall be placed in the base and in the brick to prevent cracks due to movements at the base.
3. Standard expansion joint shall be installed using a compressible joint filler and joint breaker shall be placed in the movement joint and a durable tack free sealant placed over the joint flush with the surface of the pavement.
4. The paver joints shall be filled crushed stone dust or commercial grade polymeric stabilizing sand, or as specified on the plans or as directed by the specifications and PRCS.
5. The base material for mortar set brick shall be Portland Cement Concrete.
6. Transverse expansion joint material shall be an approved product per specification.
7. The expansion joint used between the curb and concrete/brick shall be closed cell foam with peel-off top or approved equivalent. The joints using closed cell foam material shall be sealed with polyurethane type joint sealant, or approved equivalent per owner's direction.
8. Edge restraints shall be provided per specifications or approved equivalent presented in writing.

5.19 Efflorescence

- 5.19.1 Efflorescence is the formation of soluble salts on the surface of the pavement. As moisture enters the pavement, free salts are wicked through the brick to the surface of the pavement and appear as a white milky powder.

5.20 Snow Removal

Clearing snow from clay pavements can be achieved by using plows, snow blowers, shovels and brushes as used for other pavements. Care must be taken to ensure that the blades of the equipment do not scrape the pavement surface in a manner that might cause chipping. Rubber or urethane blade edges can be used, or proper blade height can be maintained above the pavement surface using guide wheels. Any residual snow can be cleared with brushes. Some snow-clearing procedures use heavy equipment to stockpile and subsequently remove the snow from the property. If such equipment is used, the load capacity of the pavement should be adequately designed.

5.21 Accessibility

5.21.1 Surface.

The Americans With Disabilities Act Accessibility Guidelines (ADAAG) require an accessible surface to be firm, stable and slipresistant. Smoothness also may be an important criterion, because a pedestrian in a wheelchair may be more sensitive to vibration or trip hazards. Properly designed, installed and maintained clay paver surfaces achieve these properties. Besides, inadequate design, installation or maintenance, all pavement systems may be subject to heaving and settlement of underlying soils that result in changes in level. Research has shown that the vibration

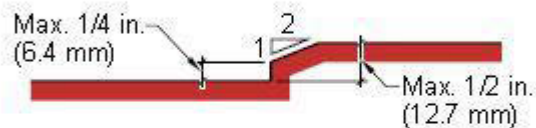
on clay paver surfaces is comparable to or less than that of poured concrete and other common paving materials

5.21.2 Changes in Level.

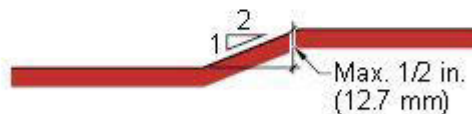
Both the ADAAG allow a change in level (surface discontinuity) up to 1/4 in. The ADAAG allow a change in level between 1/4 in. minimum and 1/2 in. maximum. The ADAAG requires this change in level to be sloped (beveled) not steeper than 1:2. The maximum slope (bevel) of 1:2 for this change in level, but further mandates that the slope (bevel) be applied across the entire change in level. With respect to pavers, sudden changes in level (differences in elevation of the top surfaces of adjacent pavers) should be kept to a minimum through careful design and installation and should be maintained as part of a regular maintenance program. Changes in level can result from heaving or settling of the pavement; uneven joints or can occur at frames and manhole covers.



a) ADAAG & Draft PROWAG
Change in Level
up to 1/4 in. (6.4 mm)



b) ADAAG Vertical Change
between 1/4 and 1/2 in.
(6.4 and 12.7 mm)



c) Draft PROWAG Vertical Change
between 1/4 and 1/2 in.
(6.4 and 12.7 mm)

For Vertical Changes Greater Than
1/2 in. (12.7 mm), Use Ramp

Requirements for Making Changes in Elevation
(courtesy of BIA Brick Institute of America)

5.21.3 Joints.

The ADAAG does not specifically cover joints, but it does have requirements for openings in gratings, which could be considered as being similar. The ADAAG has requirements for horizontal openings in walkway joints and gratings. Both guidelines allow openings up to 1/2 in. wide, more

than twice the typical width of joints between pavers in pavements with sand and bituminous setting beds that are typically 1/16 in. to 3/16 in. wide. Joints between pavers in a mortar setting bed are generally 3/8 in. to 1/2 in. wide, but would not be considered an opening.

5.21.4 Detectable Warning Surfaces.

1. The ADAAG require detectable warning surfaces consisting of truncated domes sized to have a base diameter of 0.9 in. minimum and 1.4 in. maximum, a top diameter of a minimum of 50 percent to a maximum of 65 percent of the base diameter, and a height of 0.2 in.. Clay pavers can be made with truncated domes.
2. The ADAAG requires truncated domes to be placed on a square grid with a center-to-center spacing of 1.6 in. minimum and 2.4 in. maximum, and a base-to-base spacing of 0.65 in. minimum, measured between the most adjacent domes.
3. The guideline require detectable warning surfaces to extend 24 in. from rail platform boarding edges.
4. The ADAAG requires curb ramps and blended transitions that are not covered in the ADAAG. Curb ramps and blended transitions require detectable warning surfaces to extend 24 in. minimum in the direction of travel for their full width. Flares of curb ramps are not required to have a detectable warning surface.

6.0 LANDSCAPE INSTALLATION

6.1 GENERAL

This Section includes specifications for: Trees, shrubs, turf, ground covers and herbaceous perennials. Refer to Project Management-Note coordination and submittals requirement, and Site Preparation and Earthwork-Note specification for soil materials, backfill, protection of trees to remain, progress, cleaning and rough and fine grading.

6.2 MATERIALS

Provide submittals for all plants, seed and materials to PRCS as required in PROJECT MANAGEMENT section.

6.2.1 Packaged material should be delivered to site containers showing weight, analysis, and name of manufacturer. Protect plants and materials from damage and deterioration during delivery and while stored at site.

6.2.2. Nursery Stock

6.2.2.1. Trees, shrubs and herbaceous perennials should comply with size, genus, species, and variety specified on approved plans. Any substitutions should be approved by PRCS.

6.2.2.2. Size and quality measurements of trees and shrubs should comply with ANSI Z60.1 "American Standard for Nursery Stock."

The root flare of trees and shrubs should be visible or evident at the top of the root ball or the container.

1. Plants should be vigorous, healthy and free of insects and disease. Trunks and branches of trees and shrubs should be free of injury and mechanical damage.

6.3. Turf and Grasses

6.3.1. Seed should be delivered in original sealed, labeled, and undamaged containers.

6.3.2. Seed quality should comply with tolerances for purity and germination established by Official Seed Analysis of North America. Seed mixture shall have minimum purity of 98% and minimum germination of 90%. Seed should be "Blue Tag" certified by the Virginia Crop Improvement Association.

6.3.3. Seed mix should include cultivars chosen from latest recommendations from Virginia Tech, in the following mixtures: Turf in sunny and part-shade areas – 80-90% Turf-Type Tall Fescue – at least three (3) cultivars in equal percentages (currently acceptable cultivars include: Avenger, Endeavor, Masterpiece and Raptor) and 10-20% Perennial Ryegrass (Applaud, Catalina II, and Inspire are some currently acceptable cultivars). Turf in shade – 100% Fine Fescue – at least two (2) cultivars in equal percentages (currently acceptable cultivars include: Berkshire, Chariot and Longfellow II).

6.3.4. Sod should be harvested, delivered, stored, and handled according to the current standards of the American Sod Producers Association's (ASPA) "Specifications for Turfgrass Sod Materials and transplanting/Installing."

6.3.5. Sod should be at least two (2) years old, healthy, vigorous, free of weeds and undesirable grasses, and machine cut to pad thickness of $\frac{3}{4}$ " (plus or minus $\frac{1}{4}$ "), excluding top growth and thatch. Sod should be composed principally of following: 90% Turf-Type Tall Fescue and 10% Kentucky Bluegrass, and should be "Blue Tag" certified by the Virginia Crop Improvement Association.

6.4. TOPSOIL IN DISTURBED AREAS

6.4.1. Topsoil should be clay-loam, with a pH range of 5.5 to 7 and contain 2% minimum organic material. It should be free of stones 1" or larger in any dimension, and other extraneous materials harmful to plant growth. Surface soil can be re-used, if suitable.

6.4.2. Submit soil test results to PRCS to verify suitability of existing and imported materials to be used as topsoil.

6.5. SOIL AMENDMENTS

6.5.1. Leaf compost: Fine granular texture.

6.5.2. Pine-bark fines.

6.5.3. Ground Limestone: Minimum 50% total oxides of calcium and magnesium, 50% passing through size 100 mesh and 98% through size 20 mesh.

6.5.4. Fertilizer: Agricultural grade 10-10-10 or slow-release, at least 35%WIN.

6.6. MULCH AND EROSION-CONTROL MATERIALS

6.6.1. Trees, shrubs and beds.

6.6.1.1. Shredded pine bark.

6.6.1.2. Composted wood chips.

6.6.2. Seeded areas

6.6.2.1. Straw

6.6.2.2. Biodegradable wood excelsior or coconut-fiber mat (enclosed in a photodegradable plastic mesh), untreated woven jute fabric. Include manufacturer's recommended steel wire staples, 6" long.

6.7. STAKES AND GUYS

6.7.1 Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects, 2" by 2" length indicated, pointed at one end.

6.7.2. Guy and tie wire: ASTM A 641, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106" in diameter.

6.7.3. Bark chafing guard: Woven textile straps, at least 1" wide, for attaching staking wires to tree trunks.

6.8 EXECUTION

6.8.1. SOIL PREPARATION

6.8.1.1. Ensure that topsoil is present to a depth of 4" in turf areas and 6" in tree, shrub and other planting areas. If existing soil does not meet specifications, it may be amended; or it may be replaced with imported topsoil.

6.8.1.2. Where rock, impermeable clay or unsuitable materials are encountered in tree or shrub planting areas, the materials should be removed to a depth of 18", and replaced with suitable soil. Where plantings are to be installed in

groups, unsuitable materials should be removed from the entire area, not individual planting holes.

- 6.8.1.3. Existing topsoil in turf and planting areas should be loosened by disking, tilling, subsoiling or an equally effective method. Stones larger than 1" in any dimension should be removed from loosened soil, along with sticks, roots, rubbish and other extraneous materials.

6.9. PLANTING TREES AND SHRUBS

Refer to end of section for details LS-1.0, LS-2.0, LS-3.0.

- 6.9.1. Planting holes should be excavated so that sides slope outward at least 45 degrees from a vertical line at the center of the excavation. For trees, excavate so that top of hole is a minimum of 18" wider than ball or container on all sides; for shrubs, 12". Excavation depth should be equal to distance from root flare to base of ball or container.
- 6.9.2. Installed plants should be set plumb and in center of excavation with root.
- 6.9.3. Burlap, rope, twine and wire baskets should be removed from tops of balls and at least half of the sides.
- 6.9.4. Matted or girdling roots and those growing across top of root ball are likely
- 6.9.5. Backfill around ball should be free of voids and air pockets.
- 6.9.6. No soil saucer should be present around excavation, except on downhill side of extreme slopes. Top surface of root ball shall remain free of any backfill or other soil. When planting is complete, no backfill soil shall be higher than surrounding, undisturbed grade. Excess soil should not be present in planting area.
- 6.9.7. When stock is planted on an extreme slope, form 3-6" high saucer, using backfill soil, on downhill side only, outside excavated area.
- 6.9.8. No pruning should be done except to remove broken branches. When removing broken branches, pruning cuts shall be made outside branch collar.

6.10. TREE AND SHRUB GUYING AND STAKING

- 6.10.1. Stake trees of less than 3" caliper only as required to prevent wind tip-out. Trees of 3-6" may be staked. Use a minimum of 2 stakes of length required to penetrate at least 18" below bottom of backfilled excavation and to extend at least 60" above grade. Avoid penetrating balls or root masses. Support trees with two (2) strands of tie wire attached to woven straps at contact points with tree trunk. Tension of wires shall be such that trees are not rigidly restrained. Some trunk movement should be permitted to encourage rooting.
- 6.10.2. Guy trees exceeding 6" caliper or where upright staking is impractical. Securely attach no fewer than 3 guys to stakes 30" long, driven to grade. Attach flags to each guy wire, 30" above finish grade.

6.11. GROUND COVER AND HERBACEOUS PLANTS

- 6.11.1. Plant herbaceous plants with crown at surface of soil.
- 6.11.2. Prior to planting, biodegradable pots shall be broken up and any aboveground portion removed.
- 6.11.3. Install plants so that roots are surrounded by soil. Do not cover root ball with soil.
- 6.11.4. Water plants thoroughly, within maximum of four (4) hours of installation.

6.12. MULCHING

- 6.12.1.** Mulch backfilled areas around plantings, planting beds and other areas indicated on plans.
- 6.12.2.** Planting beds shall be surrounded by an edged trench, 2 – 6" deep and roughly V-shaped. The trench shall be filled to grade with slightly compacted mulch.
- 6.12.3.** Apply mulch at 2 – 4" thickness.
- 6.12.4.** Mulch should be placed no closer than 4 – 6" to trunks or stems.

6.13. SEEDING NEW TURF AREAS

- 6.13.1.** Evenly distribute seed by sowing quantities in two (2) directions at right angles to each other. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage.
- 6.13.2.** Sow seed at the following rates: 5 to 8 lb. per 1000 sq. ft.
- 6.13.3.** Rake seed lightly into top ¼" of topsoil, roll lightly, and water with fine spray.
- 6.13.4.** Protect seeded areas against erosion by spreading straw mulch after completion of seeding operations. Spread uniformly at a minimum rate of 1-2 tons per acre to form a continuous, 1 ½" loose depth over seeded areas.
- 6.13.5.** Avoid placing seed or straw in mulched areas.

6.14. HYDROSEEDING NEW TURF AREAS

- 6.14.1.** Hydroseeding: Mix specified seed, starter fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
- 6.14.2.** Mix slurry with nonasphaltic tackifier.
- 6.14.3.** Apply slurry uniformly only to areas to be seeded in a one (1) step process. Apply mulch at the minimum rate of 1500 lb per acre dry weight but not less than the rate required to obtain specified seed-sowing rate. Clean slurry off any non-turf surface.

6.15. SODDING NEW TURF AREAS

- 6.15.1.** Lay sod within 24 hours of harvest. Do not lay sod if dormant or if ground is frozen.
- 6.15.2.** Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade, eliminate air pockets and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.
- 6.15.3.** Lay sod across angle of slopes exceeding 1:3.
- 6.15.4.** Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- 6.15.5.** Saturate sod with fine water spray within two (2) hours of planting. During first week, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1 ½" below the sod.

6.16 CLEANUP, PROTECTION, DISPOSAL OF SURPLUS AND WASTE

- 6.16.1.** During landscaping, keep pavements clean and work area in an orderly condition.
- 6.16.2.** Protect grounds from damage due to landscape operations. Endeavor to protect plants from damage from operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods.
- 6.16.3.** Protect turf by installing temporary barricade fence to exclude traffic around perimeter of turf area.
- 6.16.4.** Disposal: Remove waste material, including excess soil, unsuitable soil, trash, and debris, and legally dispose of it off PRCS property.

6.17 MAINTENANCE

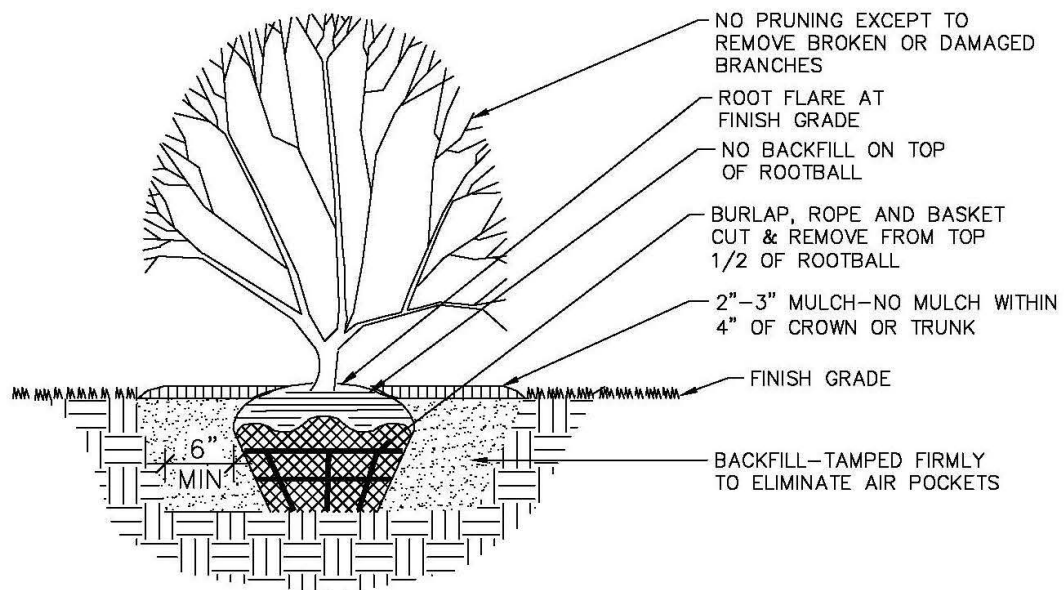
- 6.17.1.** Begin maintenance immediately after planting.
- 6.17.2.** Maintain turf, trees, shrubs, and other plants until final acceptance.
- 6.17.3.** Maintain trees, shrubs, and other plants by watering as required for healthy growth. Maintain specified mulch depth and remove all weeds. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical positions as required. Do not prune except to remove broken branches.
- 6.17.4.** Maintain turf by watering, fertilizing, weeding, weekly mowing to 3", trimming, and other operations such as rolling, re-grading and replanting as required to establish a smooth, healthy, uniform stand of grass. Acceptable turf shall have grass coverage of at least 90% density and be essentially free of weeds and bare areas.

6.18. INSPECTION AND ACCEPTANCE

- 6.18.1.** When landscape work is completed, including maintenance, PRCS will, upon request, make an inspection to determine acceptability.
- 6.18.2.** When inspected landscape work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by PRCS and found to be acceptable. Remove rejected plants and materials promptly from project site.

6.19. WARRANTY

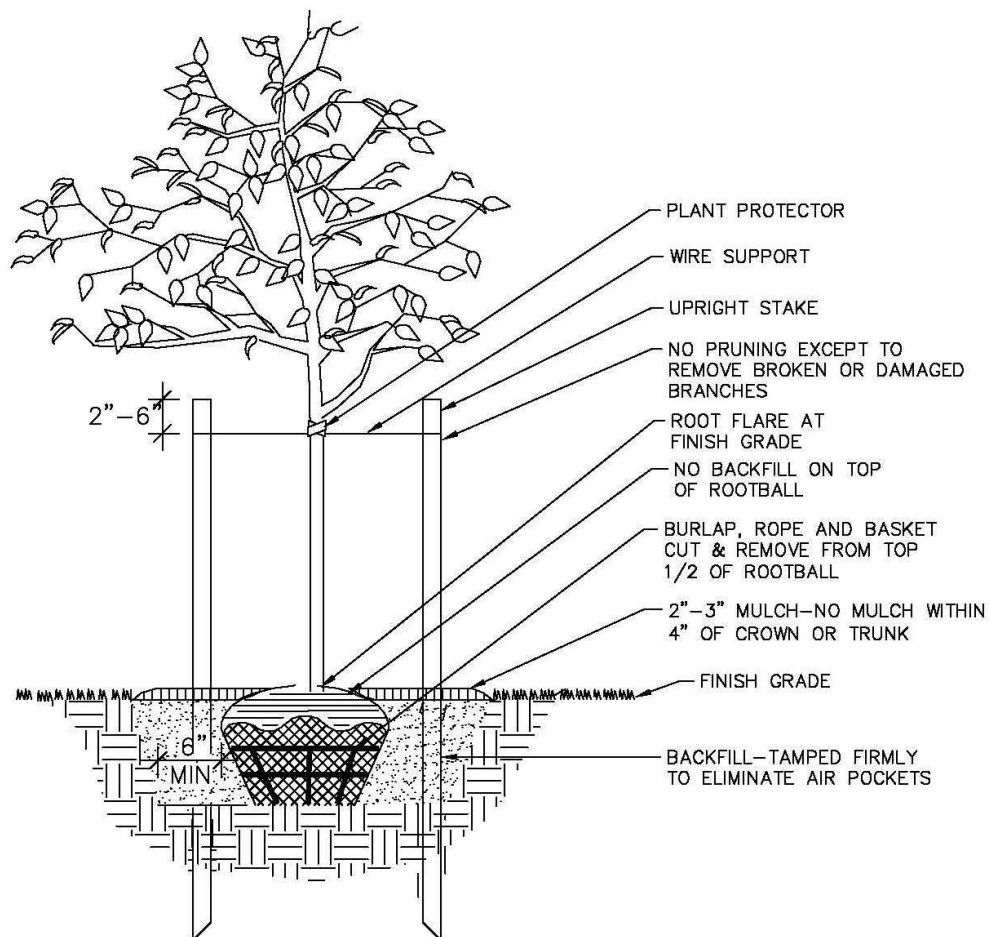
- 6.19.1.** Warrant turf through specified turf maintenance period as specified in, and until final acceptance.
- 6.19.2.** Warrant trees and shrubs, for a period of one year, after date of acceptance, against defects including death, unsatisfactory growth, and greater than 25% dieback. Defects resulting from neglect by PRCS, abuse or damage by others, or unusual phenomena or incidents which are beyond contractor's control are exempted.



SHRUB PLANTING DETAIL

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

LS-1.0
04/20/05



NOTES:

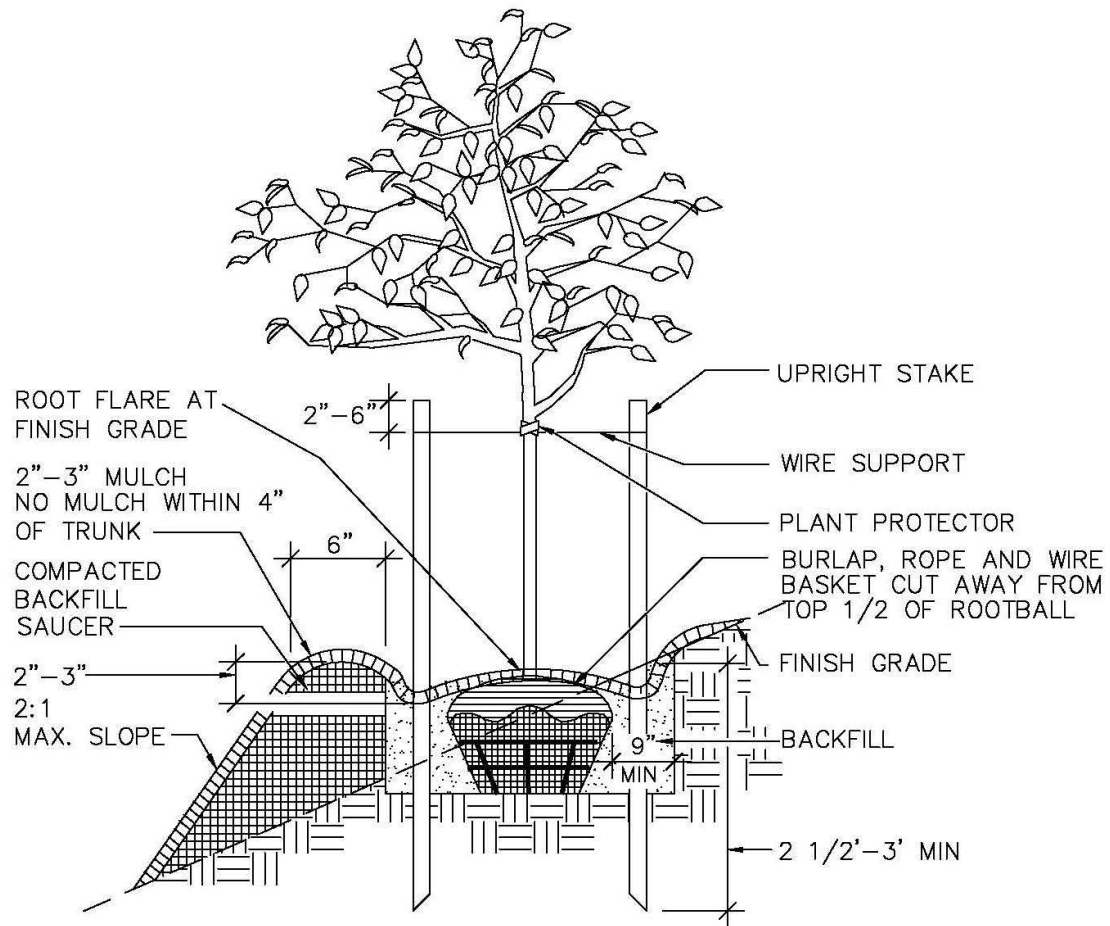
- 1: STAKING SHOWN ABOVE IS FOR TREES UP TO 3-1/2" CALIPER.
- 2: STAKING FOR TREES ABOVE 3-1/2" CALIPER TO BE TRIPLE GUYED WITH ANGLED STAKES.



TREE PLANTING & STAKING DETAIL

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

LS-2.0
04/20/05



NOTES:

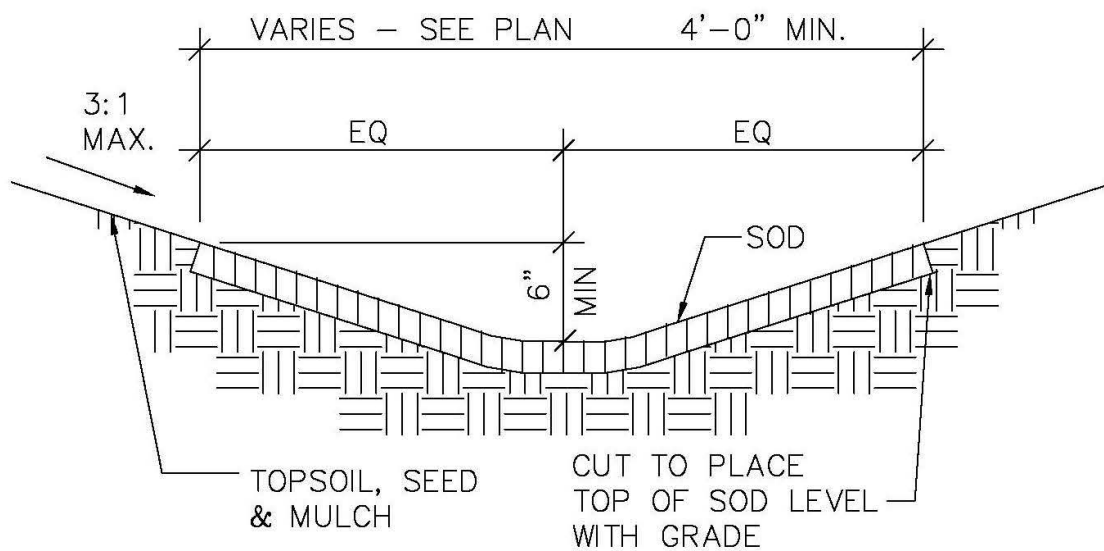
- 1: STAKING SHOWN ABOVE IS FOR TREES UP TO 3-1/2" CALIPER.
- 2: STAKING FOR TREES ABOVE 3-1/2" CALIPER TO BE TRIPLE GUYED WITH ANGLED STAKES.



TREE PLANTING SLOPE AREA

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

LS-3.0
04/20/05



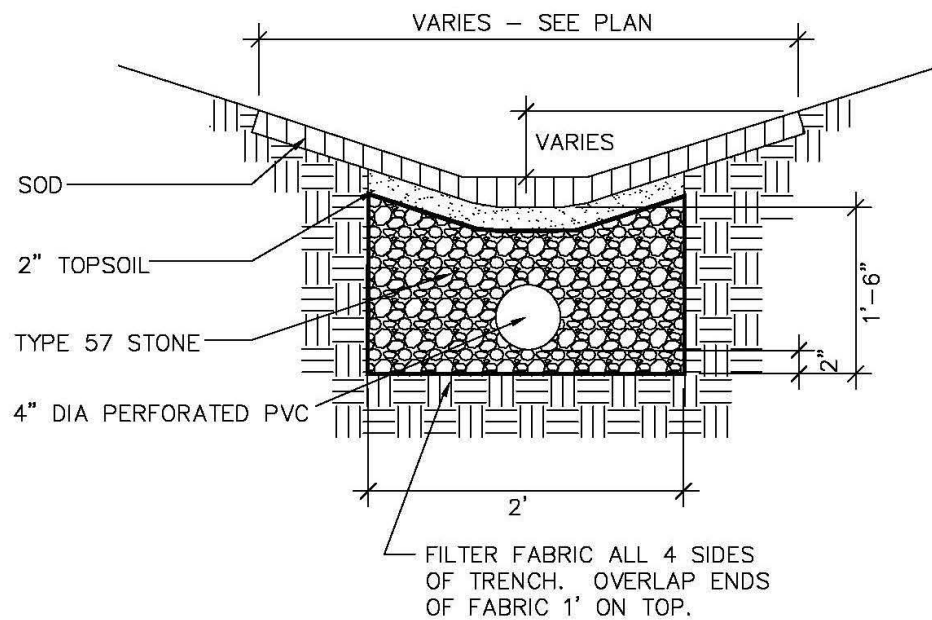
1. LAY SOD PERPENDICULAR TO FLOW OF WATER.
2. SOD TO BE PINNED IN PLACE.



SODDED SWALE

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

LS-4.0
04/20/05



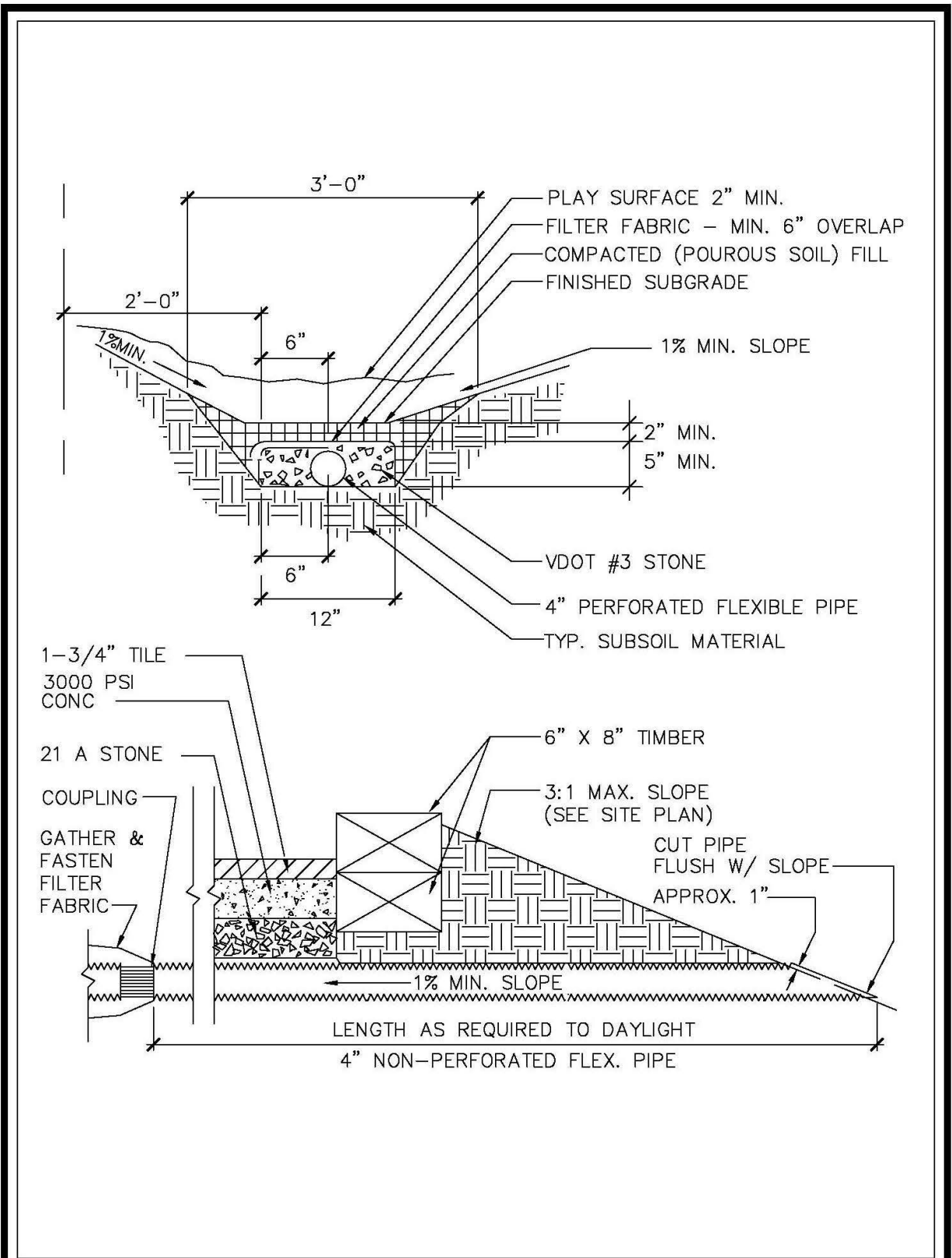
1. LAY SOD PERPENDICULAR TO FLOW OF WATER.
2. SOD TO BE PINNED IN PLACE.
3. SIZE UNDERDRAIN AND PIPE TO CATCHMENT AREA AND LONGITUDEINAL SLOPE.



UNDERDRAIN DETAIL

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

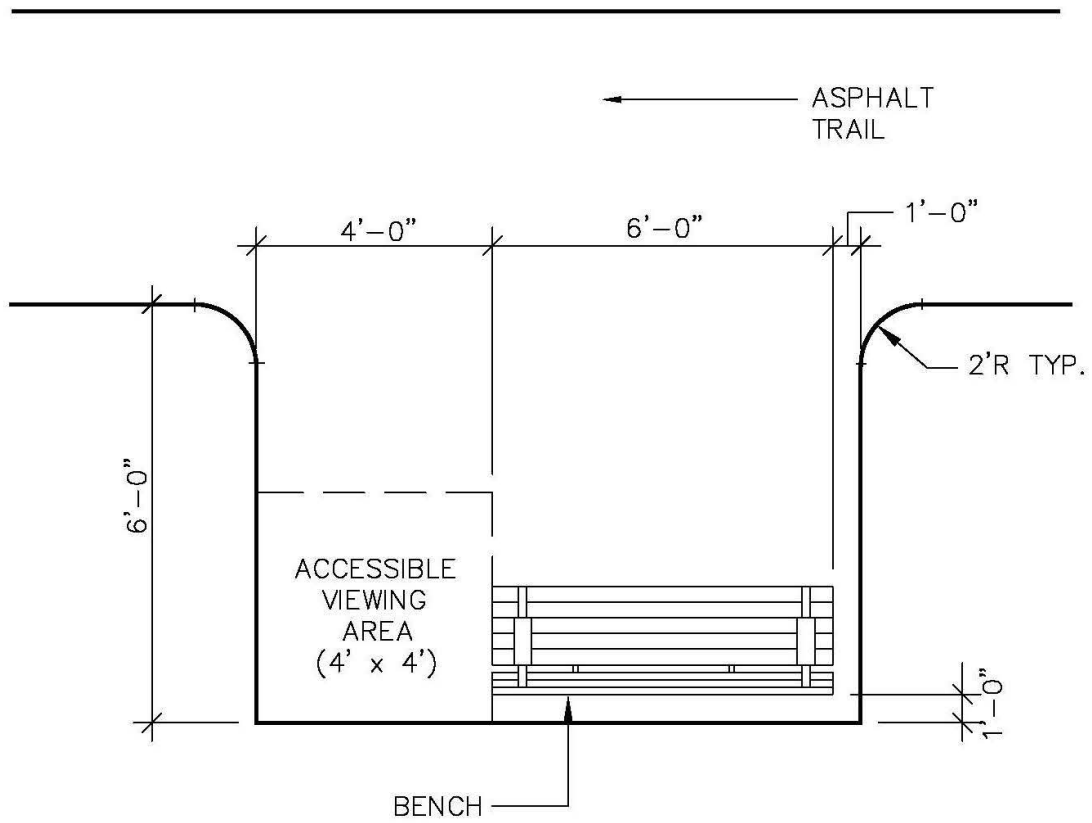
LS-5.0
04/20/05



UNDERDRAIN

LS-6.0
04/20/05

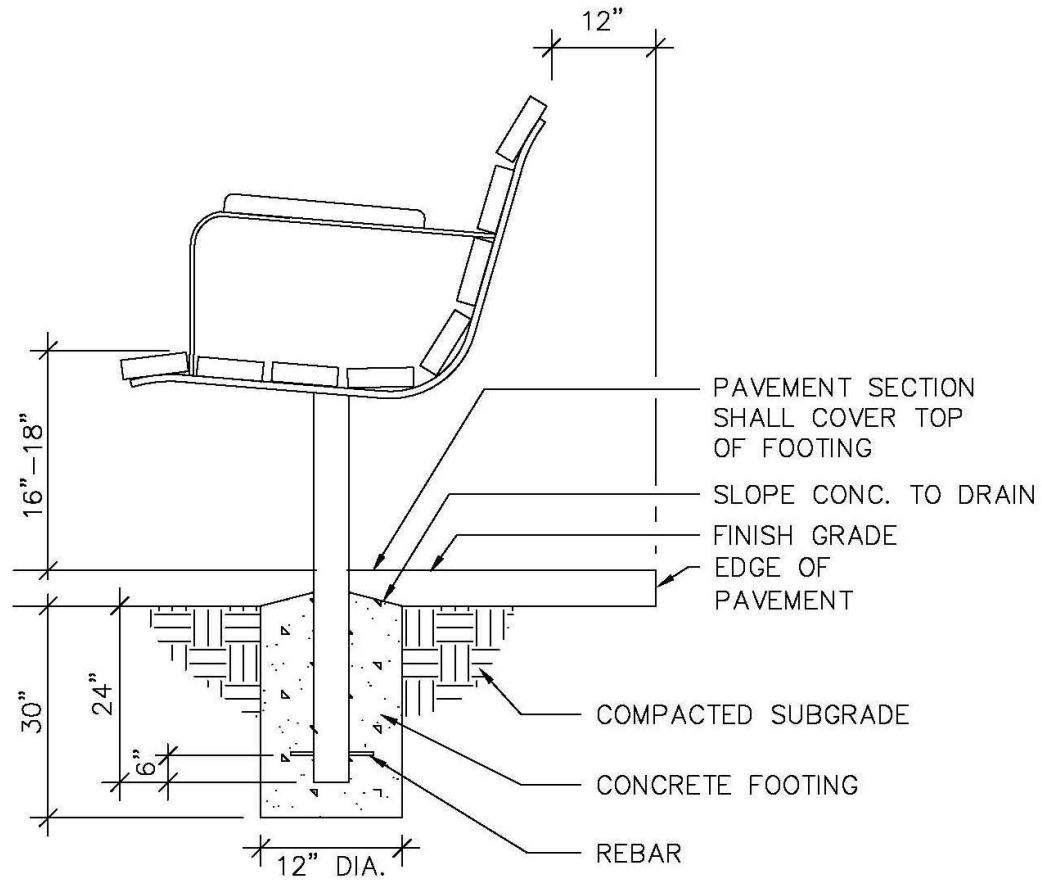
Department of Parks, Recreation and Community Services, Loudoun County, Virginia



BENCH ADJACENT TO TRAIL

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

LS-7.0
04/20/05



NOTE: CONTRACTOR MUST ORDER BENCH WITH SUPPORT POSTS TO BE OF SUFFICIENT LENGTH TO BE INSTALLED AS SHOWN.



BENCH FOOTING / PAVED AREA

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

LS-8.0
04/20/05

PLANT PALETTE STANDARDS

N* = plants that are native to the Mid-Atlantic Region.

CANOPY TREES

Acer rubrum – Red Maple N*
Betula nigra – River Birch N*
Catalpa bignonioides – Southern Catalpa N*
Celtis occidentalis – Hackberry N*
Cladrastis lutea – Yellowwood N*
Diospyros virginiana – Persimmon N*
Fagus grandifolia – American Beech N*
Fagus sylvatica – European Beech
Fraxinus pennsylvanica - Green Ash N*
Liquidambar styraciflua – Sweet Gum N*
Liriodendron tulipifera – Tulip Poplar N*
Magnolia virginiana – Sweet Bay Magnolia N*
Metasequoia glyptostroboides – Dawn Redwood
Nyssa sylvatica – Black Gum N*
Platanus occidentalis – Sycamore N*
Quercus acutissima – Sawtooth Oak
Quercus alba – White Oak N*
Quercus palustris – Pin Oak N*
Quercus phellos – Willow Oak N*
Quercus rubra – Red Oak N*
Sophora japonica – Pagoda Tree
Taxodium distichum – Bald Cypress N*
Tilia cordata – Littleleaf Linden
Zelkova serrata – Zelkova

UNDERSTORY TREES

Acer palmatum – Japanese Maple
Amelanchier laevis – Juneberry N*
Asimina triloba – Pawpaw N*
Carpinus caroliniana – Ironwood N*
Cercis canadensis – Redbud N*
Chionanthus virginicus – Fringe Tree N*
Cornus kousa – Korean Dogwood
Cornus mas – Cornelian Cherry
Cotinus coggygria – Smoke Tree
Crataegus viridis ‘Winter King’ – Winter King Hawthorn N*
Halesia tetraptera – Silverbell N*
Hamamelis mollis – Hybrid Witch Hazel
Hamamelis virginiana – Witch-hazel N*
Ilex decidua – Possumhaw N*
Magnolia X loebneri ‘Dr. Merrill’, ‘Leonard Messel’ – Loebner Magnolia
Magnolia stellata – Star Magnolia

Ostrya virginiana – Hop Hornbeam N*
Oxydendron arboreum – Sourwood N*
Phellodendron amurense – Amur Cork Tree
Prunus cerasifera ‘Thundercloud’ – Purple Plum
Stewartia pseudocamellia – Japanese Stewartia
Styrax japonica - Snowbell
Viburnum prunifolium – Black Haw N*

EVERGREEN TREES

Cryptomeria japonica – Japanese Cedar
Ilex X attenuata ‘Foster #2’ – Foster Holly
Ilex X ‘Dragon Lady’ – Dragon Lady Holly
Ilex opaca – American Holly N*
Juniperus virginiana – Red Cedar N*
Picea omorika – Serbian Spruce
Pinus resinosa – Red Pine N*
Pinus strobus – White Pine N*
Pinus virginiana – Virginia Pine N*
Thuja occidentalis – American Arborvitae N*

SHRUBS/GRASSES

Aronia arbutifolia ‘Brilliantissima’ – Chokeberry N*
Aronia melanocarpa – Black Chokeberry N*
Buddleia davidii – Butterfly Bush
Callicarpa dichotoma, *C. japonica* – Beautyberry
Caryopteris X clandonensis – Blue Mist Shrub
Clethra alnifolia - Summersweet N*
Cornus stolonifera ‘Kelsey’, ‘Cardinal’, ‘Aurea’ – Red/yellow Twig Dogwood N*
Fothergilla gardenii Witch Alder N*
Hydrangea arborescens ‘Annabelle’, ‘Hills of Snow’ – White Hydrangea N*
Hydrangea macrophylla – House Hydrangea
Hydrangea paniculata – Panicle Hydrangea
Hydrangea quercifolia – Oakleaf Hydrangea N*
Ilex glabra – Inkberry N*
Ilex glabra ‘Compacta’ – Dwarf Inkberry N*
Ilex verticillata – Winterberry Holly N*
Ilex X ‘China Girl’, ‘China Boy’ – China Holly
Ilex X meserveae ‘Blue Angel’, ‘Blue Princess’ – Blue Holly
Ilex X ‘Sparkleberry’ – Sparkleberry Holly
Itea virginica – Sweet Spire N*
Lagerstroemia indica – Crape Myrtle
Mahonia bealei – Leatherleaf Mahonia
Miscanthus sinensis – Silver Grass
Nandina domestica - Nandina
Panicum virgatum – Switch Grass N*
Pieris japonica - Andromeda
Potentilla fruticosa - Cinquefoil
Prunus laurocerasis ‘Otto Luykens’, ‘Schipkaensis’, ‘Zabeliana’ – Cherry Laurel
Rhododendron carolinianum – Carolina Rhododendron N*

Rhododendron maximum – Rosebay Rhododendron N*
Rhododendron periclymenoides – Pinxter Azalea N*
Rhododendron viscosum – Swamp Azalea N*
Rhododendron X *PJM* – *PJM* Rhododendron
Spiraea X *bumalda*, *S. japonica* – Dwarf Spirea
Taxus baccata ‘Repandens’ – English Weeping Yew
Taxus cuspidata ‘Capitata’ – Pyramidal Japanese Yew
Taxus X *media* ‘Hicksii’ – Columnar Yew
Vaccinium corymbosum – Highbush Blueberry N*
Viburnum X *burkwoodii* ‘Mohawk’ – Mohawk Viburnum
Viburnum dentatum – Arrowwood Viburnum N*
Viburnum plicatum tomentosum – Doublefile Viburnum
Viburnum X *pragense* – Prague Viburnum
Viburnum setigerum – Tea Viburnum

7.0 Fencing & Site Furnishing

7.1 GENERAL FENCING AND GATES

The work consists of providing all labor, materials, equipment and services necessary to install fencing (wooden or chain link) including necessary gates, terminal posts and fittings as shown on the drawings and specified herein.

7.2 SCOPE

The following definitions and requirements apply to Chain link Fence as required by PRCS.

The contractor to ensure all county permits and requirements are obtained prior to erection of the fences and a copy of such permits shall be submitted to PRCS.

7.3 DEFINITION

Chain link fabric – A fencing material consisting of wire helically wound and interwoven in such a manner as to provide a continuous mesh without knots or ties except in the form of knuckling or twisting at the top and bottom of the mesh to form the fabric selvage.

Selvage-The top and bottom edge finish on woven chain link formed by joining adjacent pairs of wire pickets. The selvage may be knuckled or twisted.

Knuckled selvage* refers to bending the adjacent pairs of wire back into a tight loop.

Twisted selvage* refers to twisting the adjacent pairs of wire together in a close helix of 1 ½ machine turns, which is equivalent to three full twists.

Mesh size – The minimum clear distance between the wires forming the parallel sides of the mesh.

Terminal post – A post to which the chain link fabric is terminated using specific fittings; end post, corner post, gate post and pull post (a terminal post used to accommodate a gate or placed at intervals on long stretches of fence).

Line post- Intermediate posts set no greater than 10 feet on center between the terminal posts.

7.4 Material

The following drawings and tables depicts various fence fittings; tension bar, truss rod, tension band, brace band, rail end and barb arm.

7.4.1 Fence Fabric

The fence fabric shall comply with ASTM A392 galvanized, ASTM A491 aluminum coated, ASTM F1345 zinc-5% aluminum- mesh metal alloy, ASTM F668 polymer coated

7.4.1.1 Less than 1" fence fabric

7.4.1.2 VINYL FABRIC

- 7.4.1.2.1.1** Vinyl coated chain link fabric will be woven out of wire with a core of galvanized steel to which a 7 mils coating of polyvinyl chloride (PVC) has been bonded by the thermal fusion method. The vinyl in the coating will be applied free of blisters. The color of the coating will be black or as approved by PRCS.
- 7.4.1.2.1.2** Tension wire will be vinyl coated in the same manner as the chain link fabric.
- 7.4.1.2.1.3** The color of the coating will match the fabric.
- 7.4.1.2.1.4** The framework consisting of terminal posts, line posts, corner posts, top rails, braces, and gate frames will be coated with a PVC coating which has been bonded to the metal surface using the thermal fusion method. The thickness of the PVC coating will be 10 to 15 mils. The vinyl shall be plasticized and thoroughly compounded so there are no undispersed pigments, stabilizers, or other discrete particles present. The color will match the fabric unless specified otherwise.

**KNUCKLE SELVAGE*****TWIST SELVAGE*****WIRE GAUGE/THICKNESS****BREAKING STRENGTH OF STEEL WIRE**

Note: *polymer coated core wire gauge is specified gauge reference not the coated finished diameter

6 gauge -0.192"	[4.88 mm]	2170 lbf [9650 N]
9 gauge- 0.148"	[3.76 mm]	1290 lbf [5740 N]
11 gauge- 0.120"	[3.05 mm]	850 lbf [3780 N]
11 ½ gauge- 0.113"	[2.87 mm]	750 lbf [3340 N]
12 gauge- 0.105"	[2.67 mm]	650 lbf [2890 N]
14 gauge- 0.080"	[2.03 mm]	380 lbf [1690 N]

THICKNESS OF ASTM F668 FABRIC POLYMER COATING

Minimum/Maximum	Class 1 & Class 2a	Class 2b
Minimum @ any point	0.015 in. [0.38 mm]	0.006 in. [0.15 mm]
Maximum @ any	0.025 in. [0.64 mm]	0.010 in. [0.25 mm]

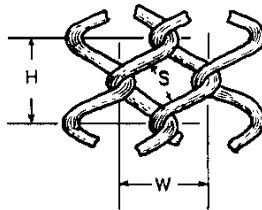
STANDARD 1" & LARGER MESH SIZES AND GAUGES FOR CHAIN LINK FABRIC

Size of mesh	Gauge*	Nominal Diameter	
Recommended Usage			
2 1/8" [54 mm]	11 ½	0.113" [2.87 mm]	Residential
2" [50 mm]	11	0.120" [3.05 mm]	
Residential/light commercial			
2" [50 mm]	9	0.148" [3.76 mm]	
Residential /commercial/ind.			
2" [50 mm]	6	0.192" [4.88 mm]	
Commercial/ind./security			
1 ¾" [44 mm]	11	0.120" [3.05 mm]	Tennis court
1 ¾" [44 mm]	9	0.148" [3.76 mm]	Heavy commercial/industrial

1 ¾" [44 mm]	6	0.192" [4.88 mm]	Security
1 ¼" [32 mm] Residential/swimming pool	11	0.120" [3.05 mm]	
1 ¼" [32 mm] industrial /Security	9	0.148" [3.76 mm]	Heavy
1" [25 mm]	11	0.120" [3.05 mm]	Industrial
1" [25 mm] industrial/ Security	9	0.148" [3.76 mm]	Heavy

Note: *polymer coated core wire gauge is specified gauge reference not the coated finished diameter

7.4.1.2 Mesh Dimensions for small security chain link fabric



Mesh Size "S"	Height "H"	Width "W"
3/8 in. [9 mm]	3/4 in. [19 mm]	3/4 in. [19 mm]
1/2 in. [13 mm]	15/16 in. [24 mm]	15/16 in. [24 mm]
5/8 in. [16 mm]	1 1/8 in. [29 mm]	1 1/8 in. [29 mm]

7.4.2 Steel post

7.4.4 All support posts shall be galvanized with diameter and wall thickness as shown in the following tables based on the maximum load applied and height of the support posts.

7.4.4.1 All line posts shall be galvanized

7.4.4.2 Line or intermediate post - 2½" OD, black 9 gauge vinyl coated pipe.

7.4.4.3 Post size ranges based on mesh size, wire gauge, location, icing, wind speed, wind load Consult the CLFMI "Chain Link Fence Wind Load Guide for the Selection of Line Post and Line Post Spacing (WLG 2445)".

7.4.4.4 Pipe terminal posts are generally one size larger in outside diameter than the line posts Group IV alternative products are available; require manufacturer to provide documentation, dimensions, strength calculations and compliance certification to ASTM F1043

7.4.4.5 Terminal (corner end and pull) post - 3" ID, vinyl coated pipe

GALVANIZED STEEL POST DIMENSIONS AND STRENGTH CHARACTERISTICS

ASTM F1043 Group IA Regular Strength Grade ASTM F1083 30,000 psi yield steel schedule 40 pipe															
Trade	Decimal O.D. Equivalent		Pipe wall Thickness		Weight		Section Modulus		Min. Yield Strength		=	Max Bending	Calculated Load (lbs)		
	O.D.	inche (mm)	inche (mm)		lb./ft (kg/	inche (mm)		p (MP)	=	Lb.In.	10' Free	Cantilever			
1	1.31	33.4	0.13	3.38	1.68	2	0.132	3.37	3000	205	=	3985	1	8	5
1	1.66	42.1	0.14	3.56	2.27	3.38	0.234	5.96	3000	205	=	7038	2	147	9
1	1.90	48.2	0.14	3.68	2.72	4.05	0.326	8.29	3000	205	=	9786	3	204	1
2	2.37	60.3	0.15	3.91	3.65	5.43	.5606	14.2	3000	205	=	16819	5	350	2
2	2.87	73.0	0.20	5.16	5.80	8.62	1.064	27.0	3000	205	=	31921	1064	665	4
3	3.50	88.9	0.21	5.49	7.58	11.2	1.724	43.7	3000	205	=	51723	1724	107	7
4	4.00	101.6	0.22	5.74	9.12	13.5	2.393	60.8	3000	205	=	71816	2394	149	9
4	4.50	114.3	0.23	6.02	10.8	16.0	3.214	81.6	3000	205	=	96435	3214	200	1339
5	5.56	141.3	0.25	6.55	14.6	21.7	5.451	138.4	3000	205	=	163533	5451	340	2271
6	6.62	168.2	0.28	7.11	18.9	28.2	8.495	215.7	3000	205	=	254873	8496	531	3540
8	8.62	219.0	0.32	8.18	28.5	42.4	16.80	426.9	3000	205	=	504274	16809	1050	7004

GALVANIZED STEEL POST DIMENSIONS AND STRENGTH CHARACTERISTICS (cont.)

ASTM F1043 Group IA Intermediate Strength Grade ASTM F1083 50,000 psi yield steel schedule 40 pipe															
Tra de	Decimal O.D. Equivalent		Pipe wall Thickness		Weight		Section Modulus		Min. Yield Strength		=	Max Bending	Calculated Load (lbs)		
O.D.	inche	(mm	inche	(mm	lb./ft	(kg/	inche	(mm	p	(MP	=	Lb.In.	10' Free	Cantilever	
6	6.62	168.2	0.28	7.11	18.9	28.2	8.495	215.7	5000	345	=	424789	14160	590	2360
ASTM F1043 Group IC Electric Resistant Welded 50,000 psi yield steel pipe															
									5000	345	=	840457	28015	1167	4669
Tra de	Decimal O.D. Equivalent		Pipe wall Thickness		Weight		Section Modulus		Min. Yield Strength		=	Max Bending	Calculated Load (lbs)		
O.D.	inche	(mm	inche	(mm	lb./ft	(kg/	inche	(mm	p	(Mpa	=	Lb.In.	10' Free	4	6
1	1.66	42.1	0.11	2.82	1.84	2.74	0.196	4.98	5000	345	=	9810	3	204	1
1	1.90	48.2	0.12	3.05	2.28	3.39	0.281	7.14	5000	345	=	14050	4	293	1
2	2.37	60.3	0.13	3.30	3.12	4.64	0.488	12.4	5000	345	=	24405	8	508	3
2	2.87	73.0	0.16	4.06	4.64	6.91	0.877	22.3	5000	345	=	43890	1463	914	6
3	3.50	88.9	0.16	4.06	5.71	8.50	1.340	34.0	5000	345	=	67042	2235	139	9
4	4.00	101.6	0.16	4.06	6.57	9.78	1.782	45.2	5000	345	=	89098	2970	185	1237
4	4.50	114.3	0.16	4.14	7.42	11.0	2.285	57.9	5000	345	=	114295	3810	548	1587

ASTM F1043 Group IA High Strength 83000 Grade ASTM F1083 83,000 psi yield steel schedule 40 pipe																
Trade	Decimal O.D. Equivalent		Pipe wall Thickness		Weight		Section Modulus		Min. Yield Strength		=	Max Bending	Calculated Load (lbs)			
	O.D.	inches	(mm)	inches	(mm)	lb./ft	(kg/	inches	(m	p	(MP	=	Lb.in.	10' Free	Cantilever	
1	1.66	42.1	0.14	3.56	2.27	3.38	0.234	5.9	8300	572	=	19471	6	270	1	
1	1.90	48.2	0.14	3.68	2.72	4.05	0.326	8.2	8300	572	=	27075	9	376	1	
2	2.37	60.3	0.15	3.91	3.65	5.43	0.560	14.	8300	572	=	46532	1551	646	2	
2	2.87	73.0	0.20	5.16	5.80	8.62	1.064	27.	8300	572	=	88315	2944	122	4	
3	3.50	88.9	0.21	5.49	7.58	11.2	1.724	43.	8300	572	=	143100	4770	198	7	
4	4.00	101.6	0.22	5.74	9.12	13.5	2.393	60.	8300	572	=	198691	6623	276	1104	

GUIDE FOR SELECTION OF ASTM F1043/F1083 LINE POST

Fence Fabric Height	Group IA ASTM F1083 Sch. 40	Group IC Elec. Resistance Welded Pipe	Group II Rolled Formed C-Section
	Min/Max	Min/Max O.D.	Min. Max.
up to 6' 0"	1.900 - 3.500"	1.900 - 3.500"	1.875x1.625" 2.25x1.70"
over 6' 0" to 8' 0"	2.375 - 4.000"	2.375 - 4.000"	1.875x1.625" 3.25x2.50"
over 8' 0" to 10' 0"	2.875 - 6.625"	2.875 - 4.000"	2.25x1.70" 3.25x2.50"
over 10' 0" to 12' 0"	2.875 - 6.625"	2.875 - 4.000"	3.25x2.50" N/A
over 12' 0" to 14' 0"	3.500 -	3.500 - 4.500"	N/A

7.4.5 Minimum required material list

7.4.5.1 All material shall be galvanized and meet the minimum size requirement as specified below:

1. Chain link fabric - 9 gauge, 2" mesh, vinyl coated, knuckled selvage top and bottom. Base shall be commercial quality steel wire.
2. Bottom wire if provided, #7 coil spring, vinyl coated wire.
3. Fabric ties - Vinyl coated wire of approved gauge and design.

7.4.6 All fixed component parts:

7.4.6.1 post tops, bands, connectors, and rail ends will be galvanized on all surfaces. Only the visible surfaces will be vinyl coated. All threaded parts will be coated in the field with a PVC based compound after installation. The color will match the fabric.

7.4.7 INSTALLATION

- 7.4.7.1 Line posts shall be placed in concrete footings, depth as specified on the plans or frost depth, depending on the soils condition. The spacing of the line posts shall not be greater than 8'-0".
- 7.4.7.2 Terminal (corner, end and pull) posts shall be set 3'-0" below finished grade.
- 7.4.7.3 Line and terminal posts shall be set in cylindrical concrete foundations. The concrete shall have a minimum 3000 psi 28 day strength.
- 7.4.7.4 The fabric shall be place on the inside of the fence. It shall be fastened to the line
- 7.4.7.5 posts at intervals not greater than 24". The fabric shall be securely clipped to the top rail and bottom reinforcing wire at intervals not greater than 18".
- 7.4.7.6 The bottom of the fabric shall be approximately 1" above the finished surface.

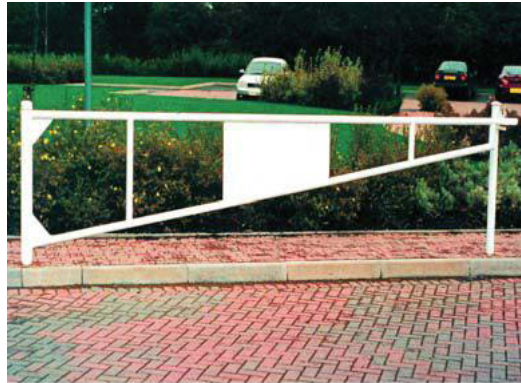
7.5 GATES

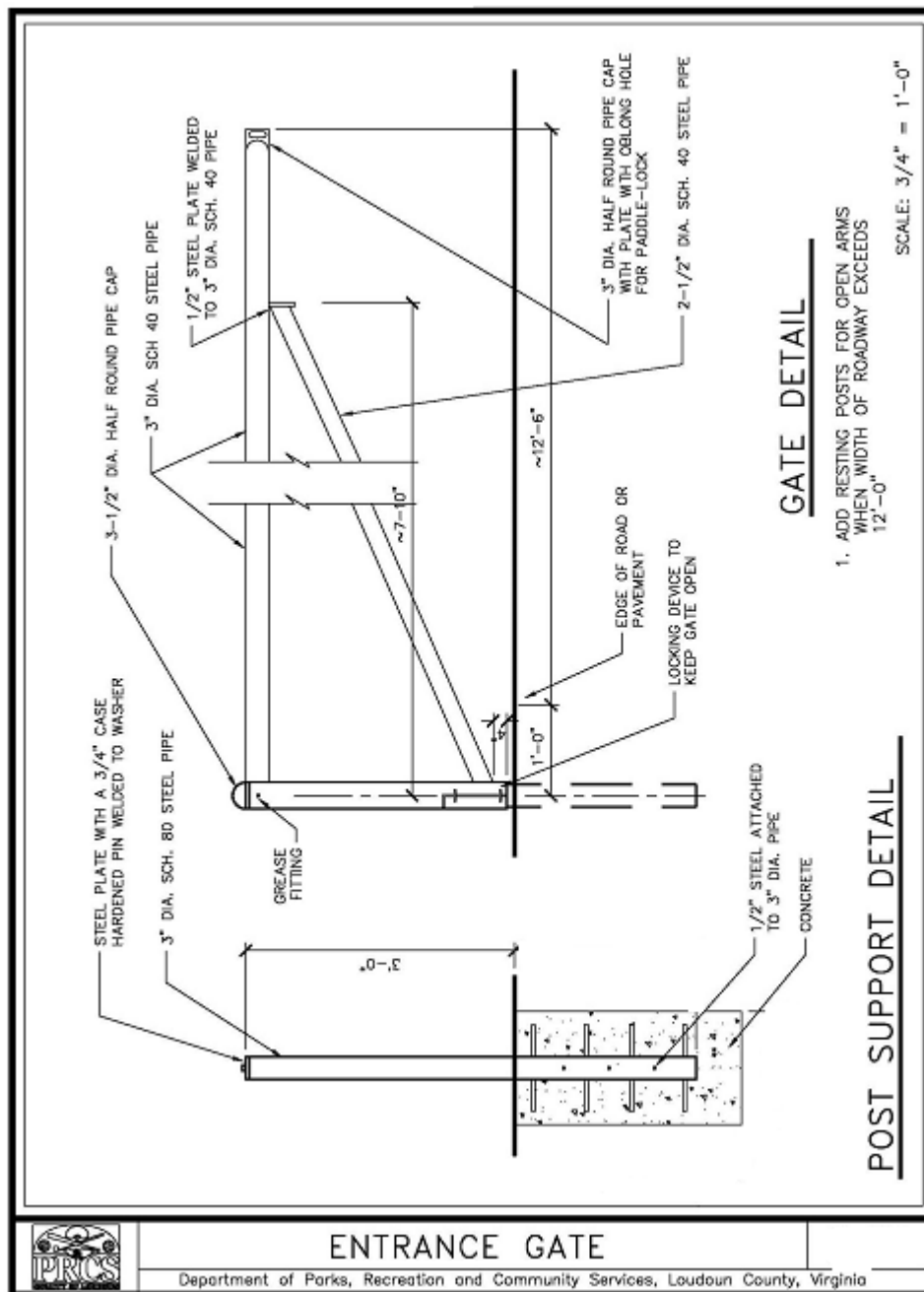
1. Gate frames shall be minimum 3' in height, 1 5/8" OD, vinyl coated pipe. 10'-13' long, 2" OD, vinyl coated pipe.
2. Internal bracing -Requirement shall per manufacturer's specification or the engineered drawings.
3. Miscellaneous fittings shall be those which are necessary to make a complete installation.

7.5.1 DEFINITION

GATE— A moving barrier such as a swinging, sliding, raising, lowering, or the like, barrier, that is a stand-alone passage barrier or is that portion of a wall or fence system that controls entrance and/or egress by persons or vehicles and completes the perimeter of a defined area.

1. swinging gate is of mild steel tubular construction throughout and is based upon a rigid triangular form, complete with strengthening struts and a central plate to accommodate a sign. The gate swings on a tubular sleeve, mounted on brass bushes for ease of movement.





7.5.2 MATERIALS

The gate shall be galvanized steel construction

7.5.3 INSTALLATION

Installation of the Swing Arm Gate involves excavation for the posts, setting and aligning the gate components, placement of concrete. Gate installation shall be in accordance with detailed drawings and instructions provided by the manufacturer and/or the owner.

7.5.4 SHOP DRAWINGS

1. When required Shop drawings shall be provided to PRCS, for approval, prior to fabrication and construction.
2. Gate posts shall be set in concrete, to a depth as specified on the plans.
3. All corner and gate posts shall be braced by a horizontal pipe securely attached to corner and first line posts with malleable iron or aluminum sand cast fittings, leveled edge bands and truss braced with 3/8" rod and take-up.

7.6 Split Rail Fence

7.6.1 GENERAL

All work under this section is subject to the provisions of Chapter 1, General References for All Sections.

7.6.2 SCOPE

- 7.6.2.1 The work includes, but is not limited to, the provision of all material, services, labor, and equipment necessary to construct split rail fences Excavation, compaction, backfill, fine grading and stabilization.
- 7.6.2.2 Wooden fence shall be "split-rail" or "rustic" style and It shall be minimum 3'-6" in height from the finished floor to top of rail



Four rail splitrail fence



Three rail splitrail fence

7.6.3 MATERIALS

1. The lumber used for split rail fence shall be Cedar or Pressure Treated Southern Yellow Pine #2 or better . The lumber shall be a standard manufactured item and shall be resistant to insect and rot and shall be free of toxic preservatives.
2. Split Rail post utilizes a half round post with about a six inch face and generally has a fairly smooth and finished look. The rail posts shall have rectangular holes to receive the rails. The posts shall be approximately End posts shall be one (1) size larger than line post (approx. 6" diameter), minimum 6'-6" in length.
3. Line (or intermediate) post shall be approximately 5" diameter, minimum 6'-6" in length.
4. Rails shall be approximately 4" diameter split rail, approximately 11'-0" in length (unless otherwise indicated on plan). Rails shall have narrowed

ends approximately 3" in diameter and 6" in length. Post rail spacing starts 6 inches from the top and then holes are spaced every 15 inches.

7.6.4 INSTALLATION

Line posts shall be spaced in the line of the fence as shown in the plan.

Posts shall be set in hand augured hole to frost depth minimum 2'-6" or half the post height, whichever is more. The post holes shall be sized as indicated on the plans

7.7 Three Board Fence

7.7.1 GENERAL

All work under this section is subject to the provisions of Chapter 1, General References for All Sections.

7.7.2 SCOPE

1. The work includes, but is not limited to, the provision of all material, services,
2. labor, and equipment necessary to construct Three (3) board fence. To include Excavation, compaction, backfill, fine grading and stabilization.
3. Rail shall be 1" x 6" x 16' rough-sawn oak boards.
4. Finish shall be Cabot 'Deep Forest Green' Solid Color Decking Stain with #1806 Neutral Stain Base, Behr 'Forest' Solid Color House & Fence Stain with #30 Tint Base, or equivalent.

7.7.3 TREATMENT

Preservative: All rails and posts shall be treated with preservative conforming to AWPAP5 Standards.

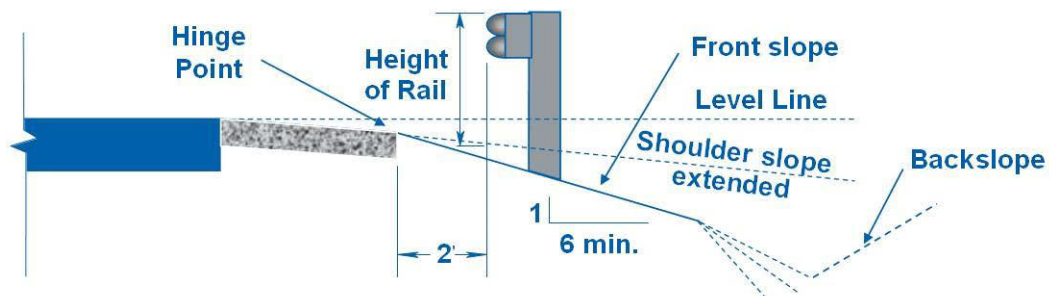
7.8 WOOD GUARDRAIL

7.8.1 GENERAL

The guardrail shall be constructed per provided drawings and or specifications and per details

7.8.2 SCOPE

This work includes furnishing and erecting guardrail and appurtenances according to the Specifications. Conform to the lines, grades, and locations shown on the Plans or as directed. All work shall conform to current VDOT Specification.

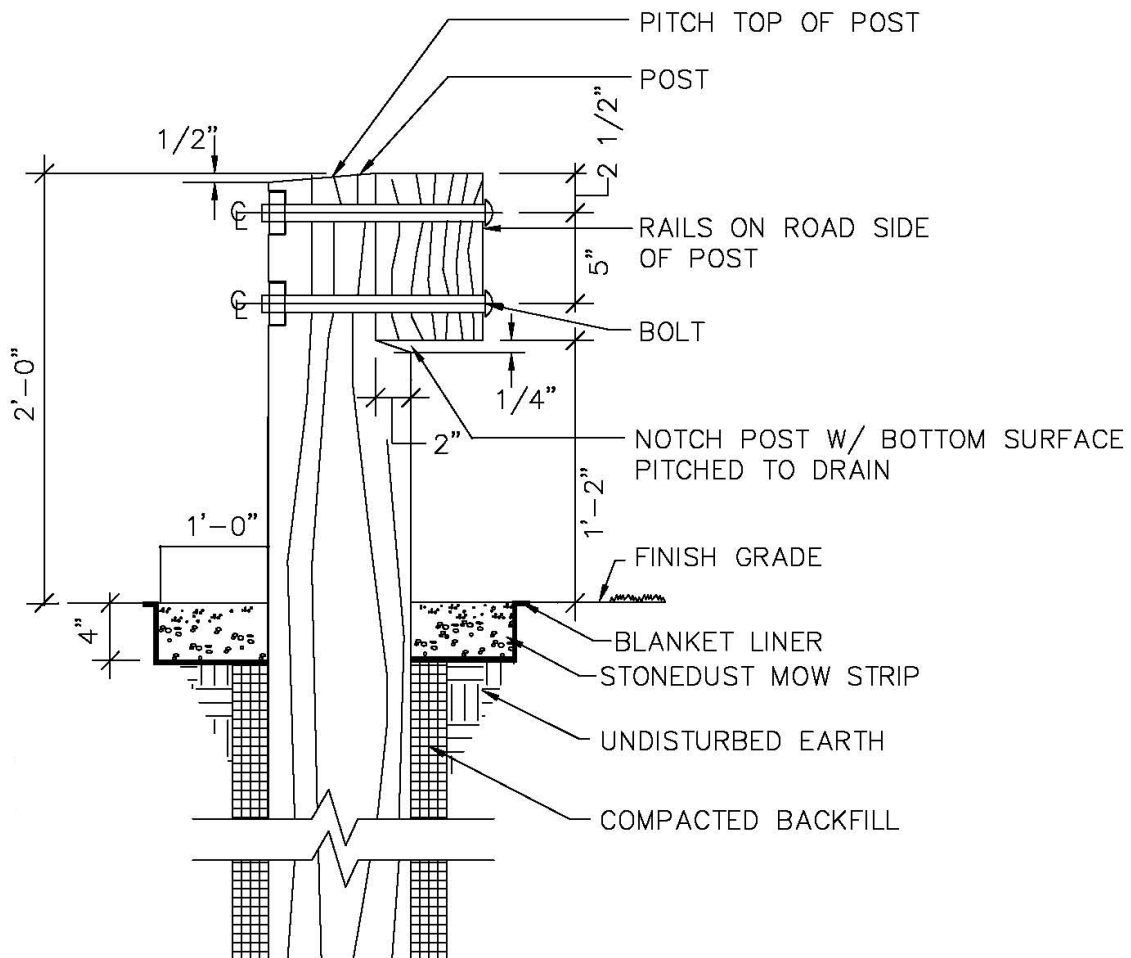


Hinge point : the point where the roadside cross section changes from one cross-slope to another, such as from the shoulder cross-slope to the front slope.

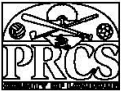
7.8.3 MATERIALS

1. Structural lumber shall be exterior grade, smooth cut, pressure treated Southern Yellow Pine (SYP) #2 or better, and approved for ground contact.
The lumber sizes shall be per approved plans and specifications.
2. All Preservative treated lumber shall bear the quality mark of an inspection agency that maintains continuing supervision, testing, and inspection over the quality of the preservative treated wood.
 - 2.2 The quality mark shall be on a stamp or label affixed to the lumber and shall include the following information:
 - 2.2.1 Identification of treating manufacturer.

- 2.2.2 Type of preservative used.
 - 2.2.3 Minimum preservative retention (pcf)
 - 2.2.4 End use for which the product is treated.
 - 2.2.5 AWP standard to which the product was treated.
 - 2.2.6 Identity of the accredited inspection agency.
3. All hardware shall be hot dipped galvanized or stainless steel where specified.
The bolts shall be hot dipped galvanized or stainless steel 5/8" inch with nuts and washers on both faces of the supporting lumber.

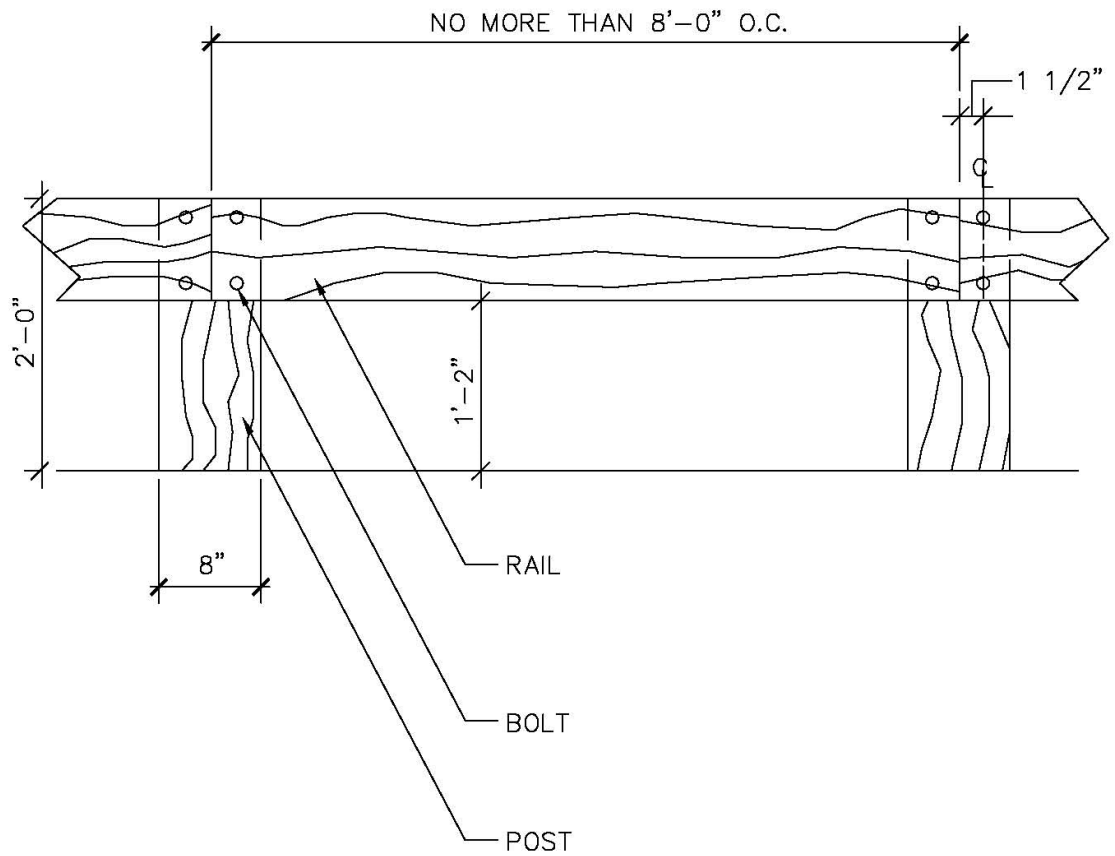


NOTE: DO NOT USE IN VDOT R.O.W.



WOOD GUARDRAIL — SECTION

Department of Parks, Recreation and Community Services, Loudoun County, Virginia



WOOD GUARDRAIL – ELEVATION

Department of Parks, Recreation and Community Services, Loudoun County, Virginia

7.9 WOOD PARKING BOLLARD

7.9.1 GENERAL

All work under this section is subject to the provisions of Chapter and General References.

7.9.2 SCOPE

The Contractor shall provide all labor, materials, services, and equipment necessary to construct the wood parking bollards and all related items as shown on the drawings and specified herein.

7.9.3 MATERIALS

1. Structural lumber shall be exterior grade, smooth cut, pressure treated Southern Yellow Pine (SYP) #2 or better, and approved for ground contact. The lumber sizes shall be per approved plans and specifications.
2. All Preservative treated lumber shall bear the quality mark of an inspection agency that maintains continuing supervision, testing, and inspection over the quality of the preservative treated wood.
 - 2.1 The quality mark shall be on a stamp or label affixed to the lumber and shall include the following information:
 1. Identification of treating manufacturer.
 2. Type of preservative used.
 3. Minimum preservative retention (pcf)
 4. End use for which the product is treated.
 5. AWPA standard to which the product was treated.
 6. Identity of the accredited inspection agency.
3. All hardware shall be hot dipped galvanized or stainless steel where specified.
4. Bolt ends shall be flushed with the nut or capped off so there are no protruding sharp edges present.
5. Asphalt concrete shoulder shall extend to minimum of twelve inches behind all posts.
6. All material excavated during the construction of the bollards and mowing strip shall be removed from the site at the expense of the Contractor.
- 7 Concrete for footings shall be CAST IN PLACE CONCRETE, with 3500 psi minimum 28 day strength.

7.9.4 EXECUTION

1. Parking bollards shall be constructed in according to drawings and specifications.
 3. 2. Concrete for footings shall be installed in accordance with CAST IN PLACE CONCRETE, Exposed edges of each post shall be rounded as shown on the drawings.
 4. Bolt ends shall be peened after posts have been assembled.
 5. Asphalt concrete shoulder shall extend a minimum of six (6) inches behind all posts.

7.10 REMOVABLE LOCKING BOLLARD

7.10.1 GENERAL

The guardrail shall be constructed per provided drawings and or specifications and per details

7.10.2 SCOPE

The work consists of furnishing all labor, materials and equipment necessary to construct the removable steel locking bollards and all related items as shown on the drawings and specified herein.

7.10.3 MATERIALS

1. Rectangular Steel Tubing shall conform to ASTM 333, , This specification covers wall seamless and welded carbon and alloy steel pipe intended for use at low temperatures. The pipe shall be made by the seamless or welding process with the addition of no filler metal in the welding operation.
2. Steel Hasp- Shall conform to ASTM A283 and be galvanized.
3. All Bolts, Nuts and Other Hardware shall comply with – ASTM A563 and ASTM A307
4. Concrete for Footings - Shall be LATEST EDITION ACI 347, CLASS D.
5. Table 3.1 in ACI 347-04 includes the following irregularity limits:

Table 3.1—Permitted abrupt or gradual irregularities in formed surfaces as measured within a 5 ft (1.5 m) length with a straightedge

Class of surface			
A	B	C	D
1/8 in. (3 mm)	1/4 in. (6 mm)	1/2 in. (13 mm)	1 in. (25 mm)

6. Class D is a minimum-quality requirement for surfaces where roughness is not objectionable, usually applied where surfaces will be permanently concealed."
7. Paint Primer - Shall be two (2) coats of zinc chromate paint.
8. Surface Paint - Shall be two (2) coats of Forest Green alkyd enamel paint. Other Colors may be approved by PRCS.
9. Reflective tape shall be silver, or white. Tapes shall be approved by PRCS .

10.METHOD OF CONSTRUCTION

11. Removable locking bollard shall be constructed and placed in accordance with the plans.
12. Concrete for footings shall be poured in accordance with the requirements outlined in CAST IN PLACE CONCRETE, Section.
13. Top of bollard shall have a cap continuously welded on all four (4) sides.
14. Reflective tape shall be applied and detailed as indicated by PRCS manual or project Manager.

15. All removable locking bollards shall have a minimum of six (6) inches pavement around all posts.
16. All welded surfaces shall be grounded smooth. All welds shall conform to AWS D1.1/D1.1M
17. All painted surfaces shall be free of imperfections. However, in the event of minor paint chips, the contractor shall touch up the paint with two (2) coats of primer and two (2) coats of paint prior to acceptance.

7.11 Steel Bollards

7.11.1 GENERAL

All work under this section is subject to the provisions of Chapter and General References.

7.11.2 SCOPE

This section is dealing with steel bollards used as barriers to vehicle collisions.

A bollards ability to stop a vehicle is a function of several variables such as the diameter of the pipe, the thickness of the pipe wall, the height above the ground, the depth into the ground, the area of the base, the structural properties of the steel, and whether the pipe is filled with concrete.

7.11.3 Material

The bollard integrity is related to two materials, the concrete fill and the steel used for the pipe.

7.11.3.1 Steel:

1. structural steel used for the pipe shall be minimum 6" diameter complying to ASTM A-36 and having a minimum strength of 60 ksi to 80 ksi.
2. The pipe shall be minimum 6' in length, with a minimum outside diameter (O.D.) 6" and a wall thickness 1/2".
3. The portion of the pipe above grade shall be treated with corrosion resistant paint or a rubber shrink sleeve that is slipped over the pipe and heated to shrink tightly around the pipe.

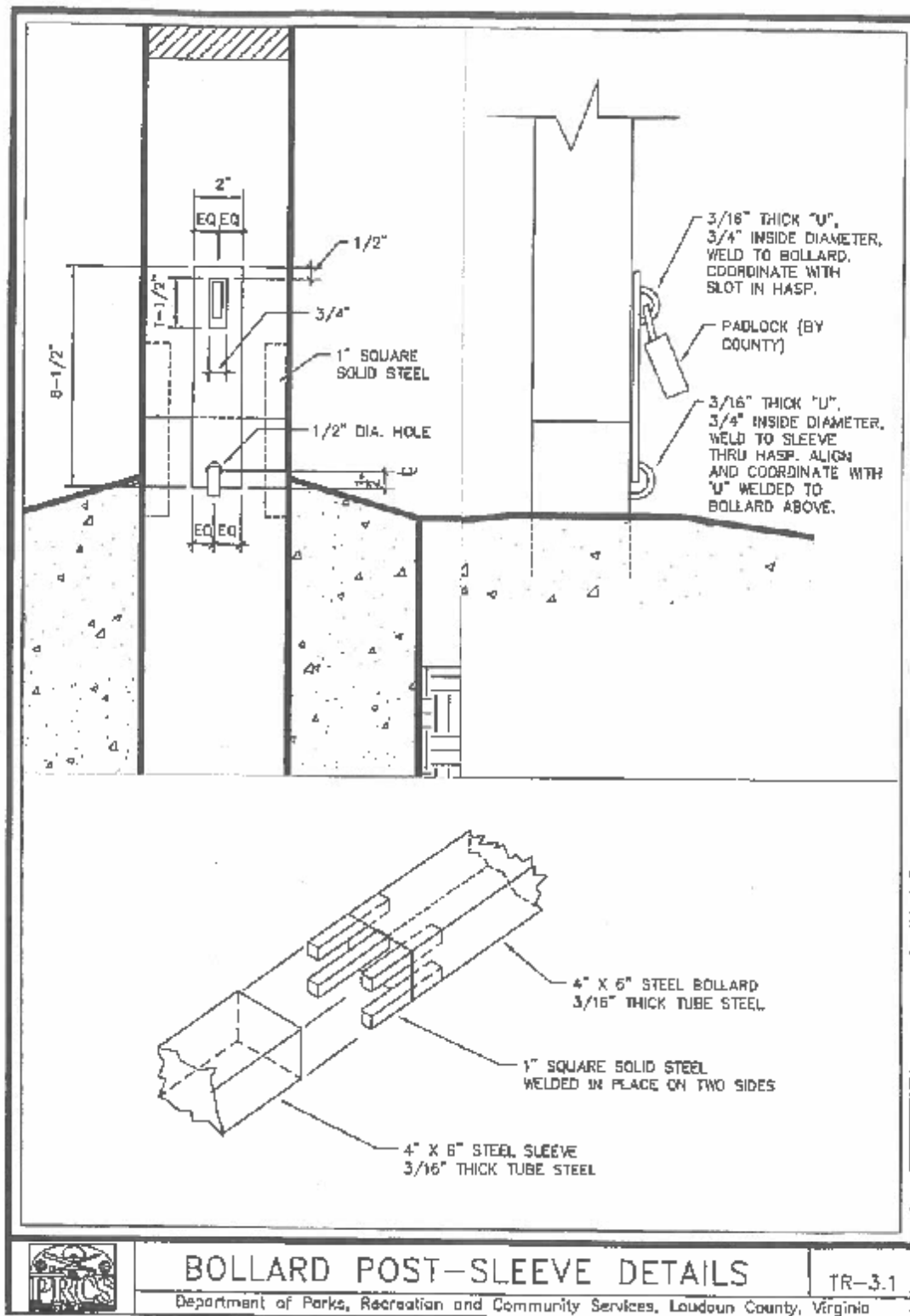
7.11.3.2 Concrete:

1. The concrete shall meet the requirement of ACI 318 and the applicable ASTM specifications.
2. The concrete shall have a minimum 28 days strength of 3500 psi with minimum slump of 4" maximum.
3. Cement shall be Type I, ASTM C-150.
4. Coarse and fine aggregate shall comply with ACI 318 and ASTM C-94 specifications. The aggregate size shall not be larger than 1"

7.11.3.3 Soil:

1. The minimum soils bearing capacity shall be 1500 psf for all seismic zones. all lateral load capacity shall comply with IBC "soils and foundation" Lateral Bearing Pressure.

Typical Steel bollard



BOLLARD POST-SLEEVE DETAILS

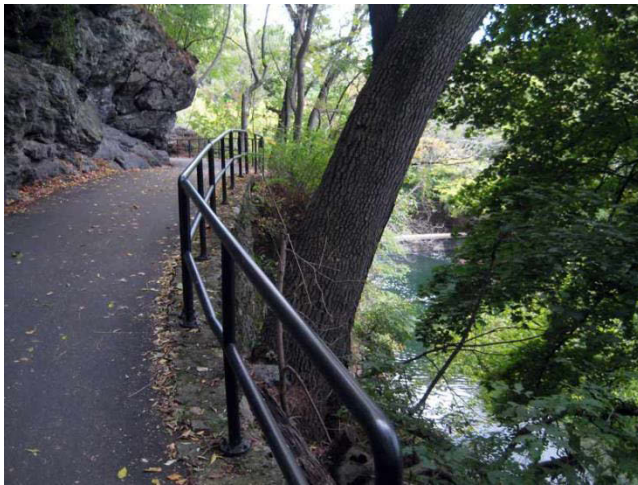
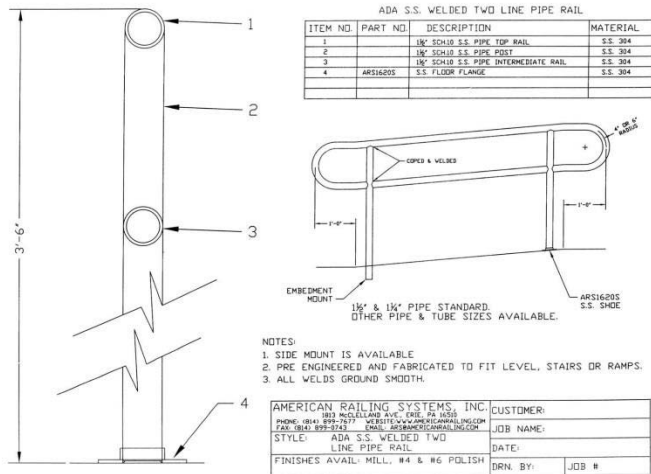
Department of Parks, Recreation and Community Services, Loudoun County, Virginia

TR-3.1

7.12 Handrail requirements:

7.12.1 Handrails shall comply with the requirement of the following:

1. Handrail Height shall be per current applicable IBC.
2. Hand rail with circular cross section shall have an OD per current applicable IBC.
3. The gripping surface shall be smooth and continuous without interruption.
4. Handrail shall return horizontally at least 12" beyond the last post as shown below.



5. The pipe shall be O.D. 1.5" schedule 40 with minimum wall thickness 0.145" minimum.
6. Center to center spacing of the posts 5'-6" maximum. the deflection is the governing factor.
7. You may build per detail shown on ist figure or second without the extension. Let's go with two rows of rails.
8. The length is 150' approximately .

9. the supporting pipes may be 1.5" diameter schedule 40 pipes. A36 minimum.
10. Footings 8" diameter, 2'-6" below finished grade. Hand augured.
11. Concrete 3500 psi 28 day strength.
12. Place a plate at the end of the post in ground to hold straight.

7.13 Flag Poles

7.13.1 GENERAL

All work under this section is subject to the provisions of Chapter and General References.

7.13.2 Scope:

Provide flagpoles capable of withstanding the effects of applied loads.

7.13.3 Applicable Codes:

1. Current adopted ASCE 7
2. Current ANSI/NAAMM FP 1001, "Guide Specifications for Design Loads of Metal Flagpoles."

7.13.4 SUBMITTALS:

1. Submit SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
2. Shop Drawings: Flagpole, including base and finial ball, showing construction and installation.
3. Manufacturer's Literature and Data: Flagpole

7.13.5 MATERIALS

1. Aluminum, Extruded: ASTM B241, alloy 6063 - T6.
2. Aluminum, Plate and Sheet: ASTM B209, alloy 1100.
3. Stainless Steel: ASTM A167, Class 302 or 304.

7.13.6 Installation

1. Fabricate flagpole shall be constructed of seamless extruded aluminum tube and shall be of uniform conical taper approximately 1 in 70 (one inch in every 6 feet). Taper shall not exceed 50 percent of outside diameter of pole.
2. When flagpoles are shipped in more than one section, provide self-aligning sleeves for field joint.
3. The base shall be Aluminum plate or stainless steel.
4. Finial Ball shall be spun aluminum sphere, with seams of ball welded flush and watertight. The finial shall be mounted on threaded rod in the field.
5. The Diameter of ball shall be approximately same as pole butt diameter.

7.13.7 Foundation Tube:

1. Galvanized corrugated-steel foundation tube, 0.0635-inch- minimum wall thickness with 3/16-inch steel bottom plate and support plate; 3/4-inch-diameter, steel ground spike; and steel centering wedges all welded together and galvanized after assembly.

2. Baseplate: Cast-metal shoe base of same metal and finish as flagpole, and furnished with anchor bolts for mounting.
3. Fittings: Manufacturer's standard fittings to suit the size and type of flagpole indicated, including finial and halyard system with swivel snaps for attaching flag.

7.13.8 FINISH

7.13.8.1 FINISH EXPOSED SURFACES OF FLAGPOLES.

7.12.8.1.1 Base and cleats:

1. Finish the base and cleats to match flagpole.

7.12.8.1.2 Stainless Steel (base):

1. Finish the base as recommended by flagpole manufacturer.

7.13.9 Installation:

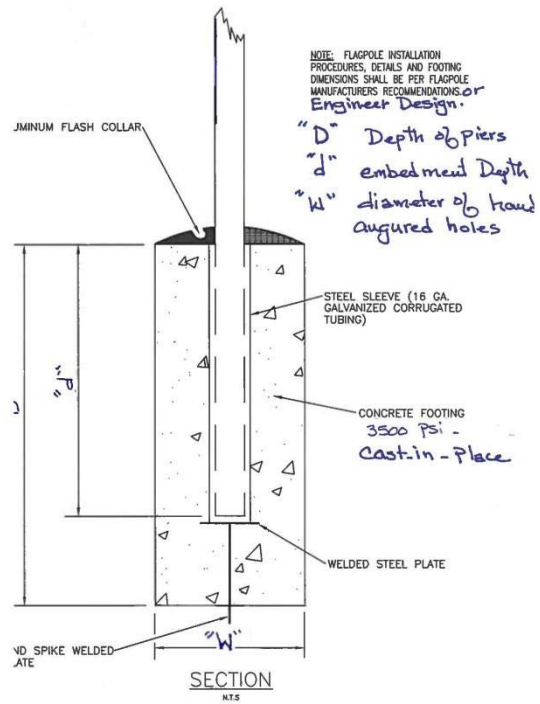
1. Set in Set flagpoles in hand augured piers to the diameter and depth specified and fill with concrete.
2. Plumb flagpole and install hardwood wedges to secure flagpole in place.

7.13.10 Baseplate Installation:

1. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb.
2. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with non-shrink, nonmetallic grout.
3. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

7.13.11 LIGHTNING ROD

1. Weld lightning ground rod of 3/4-inch diameter galvanized steel to base plate at bottom of sleeve or tube, and to steel support plate at grade.



Flag pole detail

8.0 CAST-IN-PLACE CONCRETE

8.1 GENERAL

This specification covers the furnishing of all material, equipment, accessories, tools, services, transportation, labor, and supervision required for the supply and installation of cast in place concrete.

8.2 Concrete

8.2.1 Unless otherwise indicated, concrete shall be normal weight (145 to 150 pcf) ready-mixed concrete, conforming to ASTM C94.

8.2.2 SCOPE

8.2.2.1 This Section specifies cast-in place concrete, including drainage fill under slabs-on- grade, formwork, reinforcement, concrete materials, design mix, placement procedures, and finishes for the following:

1. Footings for all structures.
2. Concrete for foundations and structures
3. Concrete for Slabs on grade
4. Concrete form work
5. Reinforcement
6. Embedded Items, including Anchor Bolts
7. Control, expansion and contraction joint devices associated with concrete work

8.2.3 SUBMITTALS

1. Provide Product Data For each type of product as shown on the plans or specifications.
2. Design Mix for each concrete mixture.
3. Shop Drawings for steel reinforcement.
4. Material test reports and certificates by a certified third party testing agency (where required).

8.2.4 Certification

The concrete manufacturer shall certify that the concrete delivered conforms to the specification for Ready-Mixed Concrete ASTM C94, and furnish the certification as specified in ASTM C94.

8.2.5 CODES AND STANDARDS

The following codes and standards of the latest revision shall be considered as part of this specification:

American Concrete Institute, ACI 318, Building Code Requirements for Reinforced Concrete

ACI 301, Specifications for Structural Concrete for Buildings

ACI 304, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete

ACI 305, Recommended Practice for Hot Weather Concreting

ACI 306, Recommended Practice for Cold Weather Concreting

ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures

ACI 347, Recommended Practice for Concrete Formwork

American Society for Testing and Materials (ASTM), as noted.

American Welding Society D12.1, Recommended Practices for Welding Reinforcing Steel, Metal Inserts, and Connections in Reinforced Concrete Construction.

Concrete Reinforcing Steel Institute (CRSI), as noted.

8.2.6 MATERIALS

8.2.6.1 Cement

Unless otherwise noted, all cement shall be Portland Cement conforming to ASTM C150, Type II. As specified in ACI 318.

8.2.6.2 Water

Water used in mixing shall be clean and free from deleterious amounts of acids, alkalis, organic matter, or other impurities likely to be injurious to concrete as specified in ACI 318.

8.2.6.3 Admixtures

1. Chemical Admixtures shall conform to "Chemical Admixtures for Concrete" and shall not be used unless approved in writing by the Engineer. Where approved, the admixture shall maintain or improve the strength and/or durability of concrete.
2. Admixtures shall be used in strict accordance with the manufacturer's recommendations and per ASTM C494/C494M-04.
3. Air Entraining Admixtures shall conform to "Specifications for Air-Entraining Admixtures for Concrete" (ASTM C 260).

8.2.6.4 Aggregate

1. Fine aggregate shall conform to "Concrete Aggregates" (ASTM C33).
2. Coarse aggregate shall conform to "Concrete Aggregates" the nominal size of coarse aggregate shall not be larger than specified requirements in ACI 318.
3. No carbonate rocks such as limestone, calcite, dolomite, magnesite, siderite, etc. shall be used.

8.2.6.5 Steel Reinforcement,

8.2.6.5.1 Steel reinforcement shall be deformed reinforcement. Deformed reinforcement bars shall conform to ASTM A615 "Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement" or ASTM A 706 "Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement. The deformed bars shall be Grade 60 minimum unless noted otherwise.

1. Bars shall be tagged with mark number and size before shipment.

2. Welding of reinforcement shall conform to "Structural Welding Code-Reinforcing Steel," ANSI/AWS D1.4 of the American Welding Society.
3. Type and location of the welding shall be specified in the project specifications.

8.2.7 Detailing and Fabrication

1. Reinforcing steel shall be detailed and fabricated in accordance with ACI 315.
2. The fabricating contractor shall prepare complete placing drawings and bending schedules.
3. All drawings, thus produced, shall be submitted to the Engineer for approval. No fabrication of reinforcing steel shall be done until drawings have been approved.

8.2.7.1 Splicing

8.2.7.1.1 Bar splices shall be made in accordance with ACI 318 unless noted otherwise on the design drawings. Any deviation will require approval of the Owner.

8.2.7.2 Installation

1. Before being placed, reinforcing shall be free from loose flaky rust, oil, grease, mud, or other coating, including ice that would reduce or destroy the bond.
2. Reinforcement shall be accurately placed and properly secured in position by precast concrete squares, metal chairs or spacers.
3. The use of heat to bend or straighten reinforcing may be permitted only if the operation is approved by the Engineer.
4. Tolerances, spacing, splices, and concrete protection to conform with the latest applicable ACI 318 Building Code.

8.2.7.3 Ties

1. Reinforcement bars shall be accurately placed and securely tied at all intersections and splices with 18 gauge black annealed wire, and shall be securely held in position.
2. Wire tie ends shall point away from the form.
3. The number, type, and spacing of supports shall conform to ACI 315 Manual.

Exception:

The temperature reinforcement, shall be tied to main steel.

8.2.7.4 Accessories

8.2.7.4.1 Accessories shall conform to CRSI Manual of Standard Practice of Reinforced Concrete Construction. Include all devices necessary for proper placing, spacing, supporting, and fastening steel reinforcement in place. Accessories shall be

galvanized after fabrication if underside of concrete will be exposed.

8.2.7.4.2 Concrete Squares (Precast Reinforcing Chairs)

Squares shall be approximately two inches square and of a thickness adequate to provide the cover for the reinforcing steel as called for on the plans. The squares shall be made using a mixture of one part Portland Cement to three parts sand (fine aggregate) and the tie wires shall be cast integrally with each square.

8.3 Welded wire fabric

Deformed wires shall have a minimum strength of 60,000 psi and shall not be spaced in any direction more than 16" o.c. and shall comply with ASTM A 497 "Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete".

8.4 QUALITY ASSURANCE

8.4.1 All concrete shall meet the durability and quality requirements specified in ACI 318.

1. The 28 day compressive strength (f'_c), of the concrete shall be not less than 2500 psi or as specified on the drawings.
2. Samples for strength tests of each class of concrete placed each day shall be taken not less than once for each 150 cu.yd of concrete nor less than once for each 5000 sq.ft. of surface area for slabs or walls.

Exception :

For total quantity of a given class of concrete less than 50 cu. yd., strength tests are not required.

3. Method of proportioning shall be in accordance with ACI 211.1, "Recommended Practice for Selecting Proportions for Normal and Heavy Weight Concrete."
4. The determination of the water-cement ratio to attain the required strength shall be in accordance with ACI 301, Method 2 (For combinations of materials previously evaluated or to be established by trial mixes), and with ACI 211.1. In addition, the maximum water-cement ratio (by weight) shall be 0.45 and the minimum cement content shall be 5-1/2 sacks per cubic yard.
5. The concrete mix design shall be submitted to the Engineer for approval prior to beginning of any concrete work.
6. Maximum aggregate size shall meet the requirements of ACI 318.
7. Unless otherwise noted or approved, all concrete shall be air entrained. Air entrainment shall be accomplished through the use of an approved admixture.

8.4.2 Air Content

8.4.2.1 The air content shall be as follows:

- 1 percent for 3/8 inch maximum aggregate size.
- 2 1/2 percent for 1/2 inch maximum aggregate size.
- 3 percent for 3/4 inch maximum aggregate size.

- 4 percent for 1 inch maximum aggregate size.
- 5 1/2 percent for 1-1/2 inch maximum aggregate size.
- 6 1/2 percent for 2 inch maximum aggregate size.

8.4.3 Slump

8.4.3.1 Concrete slump shall comply with ACI 318.

Types of Construction:	Slump in Inches	
	<u>Maximum</u>	<u>Minimum</u>
Reinforced foundation walls, footings, & small mat foundations	4	2
Reinforced slabs, beams & walls	4	2
Equipment foundations	5	3
Sidewalks, driveways & slabs on ground	4	2

8.4.4 Mixing

1. Mixing, transporting and placing concrete shall conform to applicable portions of ACI 211, ACI 212 and ACI 304 and as specified herein.
2. All concrete shall be mixed until there is a uniform distribution of materials. The concrete shall be discharged completely from the mixer before mixer is recharged.
3. Ready mixed concrete shall be mixed and delivered in accordance to ASTM C 94 (Standard Specifications for Ready Mixed Concrete) or ASTM C 685.
4. Job-mixed concrete shall be in accordance with the following:
 - 4.1 Mixing shall be done in a batch mixer of approved type.
 - 4.2 Mixer shall be rotated at a speed recommended by the manufacturer.
 - 4.3 Mixing shall be continued for at least 1-1/2 minutes after all materials are in the drum.
 - 4.4 Material handling, batching, and mixing shall conform to ASTM C 94 (Standard Specifications for Ready Mixed Concrete).
5. Keep detailed record to indicate:
 - 5.1 Number of batches produced.
 - 5.2 Proportion of the material used.
 - 5.3 Approximate location of final deposit in structure.
 - 5.4 Time and date of mixing and placing.
 - 5.5 The mixer and mixing time shall be in accordance with ACI 304.
6. Hot weather concreting shall comply with ACI 305, and cold weather concreting with ACI 306.
7. No additional water shall be added to batched concrete.
8. Concrete shall be mixed only in such quantities as are required for immediate use.

9. The maximum allowable time between charging of the material in the mixing drum and final placing for mean ambient temperatures below 90°F shall be ninety (90) minutes or 300 drum revolutions, whichever comes first.

- 9.1 Concrete not placed within the time limits, or if an initial set has developed, shall not be used. Tempering concrete by adding water or by other means will not be permitted.

10. Concrete to be delivered when the mean ambient temperature exceeds 90°F shall be mixed and delivered in accordance with the requirements of ACI 305 "Recommended Practice for Hot-Weather Concreting".
11. The concrete ticket shall be collected at the site upon delivery and checked for the proper mix, strength, additives and time the cement was introduced to the batch.
12. The owner's Project Manager shall inspect concrete surfaces immediately upon removal of forms.

8.5 Placing Concrete

- 8.5.1 Conveying and placing of concrete shall be in accordance with ACI 304. Concrete shall be deposited as quickly as practical in its final position to avoid segregation due to handling or flowing.

- 1 Concrete shall remain plastic and flow easily.
 - 2 Contaminated concrete or partially hardened concrete shall not be deposited in the structure.
 - 3 Concrete shall be thoroughly consolidated during mix, and shall be worked around the reinforcement and embedded fixtures.
 - 4 Concrete shall not be placed prior to a recorded pre-placement inspection and authorization to proceed by the Owner's Representative.
 - 5 The slump may be increased up to 6 inches if concrete pumping is to be used. The proposed mix design for pumped concrete shall be approved in advance by the Engineer or the owner.
 - 6 Each day's pour shall be properly scheduled to assure that concrete surfaces can be finished correctly and the use of cold joints can be minimized.
 - 7 All concrete shall be mechanically vibrated, except for slabs on grade that are six inches or less in thickness.

- 7.1 Duration of vibration shall be limited to the time necessary to produce satisfactory consolidation without causing segregation.

- 7.2 Vibrators shall be applied vertically and at uniformly spaced points.

- 7.3 The vibrator shall not be inserted into lower courses that have begun to set.

- 7.4 Vibrators shall not be used to transport concrete inside forms.

- 8 The free fall of concrete from the end of the spout or chute, or from a transporting vehicle, shall not exceed 7 feet for thin

walls (10 inches or less in thickness) nor more than 5 feet for other types of construction.

- 9 A tremie or flexible metal spout shall be used when the distance through which concrete must be dropped vertically exceeds the maximum specified above. The Flexible metal spouts shall be composed of conical sections not more than three feet long.
- 10 Chutes, troughs, or pipes used as aids in placing concrete shall be arranged and used so that the ingredients of the concrete will not be separated. Chutes and troughs shall be of metal.
- 11 Open troughs and chutes shall extend, if necessary, down inside the form or through holes left in the forms; or the ends of such chutes shall terminate in vertical downspouts. All chutes, troughs, and pipes shall be kept clean and free from coatings or hardened mortar by a thorough flushing with water before and after each placement. Water used for flushing shall be discharged outside of the forms.
- 12 The concrete shall be deposited, as nearly as possible, in its final position and shall not be caused to flow laterally in the form for any considerable distance.
- 13 Each pour shall be completed in a continuous operation with no interruptions in excess of forty-five minutes. Each layer shall be placed and compacted before the preceding layer has taken initial set.

8.6 Curing

8.6.1 All finished concrete shall be cured by a curing method compatible with the final floor finish for a minimum of 7 days at a temperature above 50° F and in a moist condition in accordance with ACI 301.

One or more of the following methods may be used, if approved by the Engineer:

- 1 Water curing by ponding or continuous wetting of sand or burlap.
- 2 Form curing by leaving on the forms and wetting for seven days.
- 3 An approved sprayed-on curing compound applied in accordance with the manufacturer's instruction.
- 4 Steel troweled floor slabs, not covered with other materials, shall receive a coat of "Cenco Seal 301" surface hardener applied after all other equipment and work in the building has been installed and/or completed and the floor has been thoroughly cleaned of all dust, dirt, masks, and foreign matter. Floor surfaces designated to receive tile or other treatment shall not be treated with sealers or hardeners.

8.6.2 Cold Weather requirement

Equipment shall be provided for heating concrete and protecting concrete during freezing or near freezing weather.

All concrete materials and all reinforcement, forms, materials, and ground shall be free from frost.

8.7 Concrete Admixtures:

8.7.1 Admixtures are those ingredients in concrete other than portland cement, water, and aggregates that are added to the mixture immediately before or during mixing.

Admixtures can be classified by function as follows and they shall be applied as required by current approved edition of ACI 318:

Concrete Admixtures By Classification

Type of admixture	Desired effect
ACCELERATORS (ASTM C94 and AASHTO M194, TYPE C)	ACCELERATE SETTING AND EARLY STRENGTH DEVELOPMENT
AIR DETRAINERS	DECREASE AIR CONTENT
Air-entraining admixtures (ASTM C 260 and AASHTO M 154)	Improve durability in freeze-thaw, DE-ICER, SULFATE, AND ALKALI-REACTIVE ENVIRONMENTS Improve workability
Alkali-aggregate reactivity inhibitors	Reduce alkali-aggregate reactivity expansion
Antiwashout admixtures	Cohesive concrete for underwater placements
Bonding admixtures	Increase bond strength
Coloring admixtures (ASTM C 979)	Colored concrete
Corrosion inhibitors	Reduce steel corrosion activity in a chloride-laden environment
Dampproofing admixtures	Retard moisture penetration into dry concrete
Foaming agents	Produce lightweight, foamed concrete with low density
Fungicides, germicides, and insecticides	Inhibit or control bacterial and fungal growth
Gas formers	Cause expansion before setting
Grouting admixtures	Adjust grout properties for specific applicator
Hydration control admixtures	Suspend and reactivate cement hydration with stabilizer and activator
Permeability reducers	Decrease permeability
Pumping aids	Improve pumpability
Retarders (ASTM C 494 and AASHTO M 194, Type B)	Retard setting time
Shrinkage reducers	Reduce drying shrinkage
Superplasticizers*	Increase flowability of concrete Reduce water-cement ratio
Superplasticizer* and retarder (ASTM C 1017, Type 2)	Increase flowability with retarded set Reduce water-cement ratio
Water reducer (ASTM C 494 and AASHTO M 194, Type 2)	Reduce Water content at least 5%

8.8 Form Work

8.8.1 Forms shall be constructed of wood, steel, or other approved material.

Material shall be chosen based on strength and concrete finish requirements.

8.8.2 Design

8.8.2.1 Formwork shall be designed for loads and lateral pressures and wind loads as specified by the building code.

8.8.2.2 Formwork design and construction are the responsibility of the Contractor.

8.8.3 Form Treatment

8.8.3.1 Board Forms: Keep wet prior to placing concrete.

8.8.3.2 Plywood Forms: For surfaces to be painted use silicone-type bondbreaker, applied in accordance with manufacturer's directions; Coat other surfaces with approved stainless form oil, using minimum quantity required for satisfactory removal.

8.8.3.3 Metal Forms: Approved-type release compound, applied in accordance with manufacturer's directions.

8.8.4 Formwork Installation

- 1 Forms shall be constructed to the shape, line, and grade required and shall be maintained sufficiently rigid to prevent deformation under load, including placing and compacting of concrete.
- 2 Forms shall not be placed such that they can damage the previously placed concrete.
- 3 Set forms and screeds for floor and decks to provide uniform slopes to drains and positive drainage for exterior slabs and steps.
- 4 Forms shall be tight enough to prevent leakage of mortar.
- 5 Forms shall be properly braced or tied together to maintain position and shape.
- 6 Formwork shall be secured to prevent sagging, yielding, bulging, depressions, waves, or other defects in the finished work.
- 7 Forms shall be smooth and free from warp.
- 8 Temporary openings shall be provided at base of column and wall forms for cleaning and inspection.
- 9 All debris including mud shall be removed before placing concrete.
- 10 Lumber once used shall be carefully cleaned and oiled before reuse.

8.8.5 Earth Sides

8.8.5.1 Earth sides may be utilized if clean cut and stable at time of concrete placing. Earth must be undisturbed or compacted to 95% density in accordance with ASTM D 1557, and free from surface water.

8.8.6 Form Removal

8.8.6.1 Form removal shall not impair safety and serviceability of the structure.

The concrete shall have sufficient strength prior to removal of the forms.

- 1 Side forms of walls and beams can be removed after 3 days.
- 2 Load-supporting forms and shoring shall not be removed until after 7 days or two-thirds of designed 28 day compressive strength is obtained or the 7-day test cylinders have been tested and results indicate an average strength adequate to support the load imposed on the concrete.

- 3 All forms shall be completely removed after setting of concrete together with all temporary supports, etc., employed for construction purposes.
- 4 Forms shall be readily removable without hammering or prying against the concrete. Do not count the days having temperatures below 40°F for form removal unless thermal protection for the concrete has been provided.

8.9 Embedded Items

8.9.1 Anchor Bolts and Sleeves

- 8.9.1.1 Unless noted otherwise, anchor bolts shall conform to ASTM A36 Steel as shown on the drawing.
- 8.9.1.2 Sleeves, if required shall be of high impact plastic or schedule 40 steel pipe with sleeve bottom closures of mild steel.
- 8.9.1.3 Furnish each bolt with one heavy hex nut and washer unless otherwise noted on the drawing.

8.10 Embedded Metals

- 8.10.1 Curb angles, frames, beams, ducts, etc., shall be fabricated of materials, and in accordance with Specification "Structural and Miscellaneous Steel".

8.11 Waterstops

- 8.11.1 Unless otherwise noted on the drawings, waterstops shall be Synko-Flex preformed plastic adhesive waterstop or approved equal.

8.12 Subsurface Covering (Vapor Barrier)

- 8.12.1 Polyethylene sheeting 6 mil (0.006") thick natural clear conforming to commercial standard CS238 or ASTM D2103.

8.13 Felt Joints

- 8.13.1 15 lb asphalt felt shall conform to ASTM D 250.

8.14 Fiber Board

- 8.14.1 Tempered hard board shall conform to commercial standard CS251.

8.15 Concrete Installation

8.15.1 Preparation

- 1 In no case shall concrete be placed on muddy, spongy, or frozen subgrade.
- 2 All wood scraps and debris shall be removed from the areas in which concrete is to be placed.
- 3 All areas where concrete is to be placed shall be thoroughly cleaned to ensure proper placement and bonding.
- 4 Forms and subgrade shall be wetted and all standing water removed prior to placing concrete.
- 5 All transporting and handling equipment shall be thoroughly cleaned.

8.16 Chamfering

- 8.16.1 Exposed corners of concrete shall have 3/4" chamfers unless shown otherwise.

8.17 Slabs on Grade

8.17.1 Bars used as dowels in joints shall be 1/2" diameter plain round bars 2' long and spaced on 24" centers, unless otherwise indicated on detailed drawings or specifications.

8.17.2 Embedded Items

- 1 No pours are to be made until all embedded items, anchor bolts, electrical conduits, steel frames, pipe supports, etc., are properly positioned and secured and required inspections are performed and approved.
- 2 The contractor shall be responsible to coordinate with other trades to obtain necessary data and information.
- 3 All sleeves, inserts, anchor bolts, waterstops, and other embedded items shall be positioned accurately and supported against displacement.

8.17.3 Anchor Bolts

- 1 Unless otherwise noted on the drawings, all anchor bolts shall be constructed per ASTM A-36 steel.
- 2 Anchor bolts shall be complete with flat plate bolt washer, nut and, if required, anchor bolt sleeve. Anchor bolt threads shall be N.C. Class 1 fit. Welding shall be in accordance with AWS recommended practice.
- 3 Anchor bolts shall be set true to the lines and grades shown on the drawings and shall be set plumb and be securely braced to prevent displacement during placing of concrete.
- 4 Threads shall be protected by coating with oil or grease and encasing them in burlap or paper before placing concrete.
- 5 Bolts shall be rechecked for correct location and elevations after the concrete is placed.
- 6 Should any bolt exceed acceptable tolerances such corrections as are necessary shall be made at no additional cost.
- 7 Tolerance limits in setting of anchors
- 8 and anchor bolts shall be as follows:
- 9 Location, sleeved: 3/16 inch
- 10 Location, unsleeved: 1/8 inch
- 11 Projection: plus 1/4 inch, minus 0 inch

8.18 Bonding

- 1 The existing surfaces shall be thoroughly cleaned of all foreign material and laitance
- 2 Before depositing new concrete on old concrete or against concrete which has set.
- 3 Existing surfaces shall be coated with a bonding agent in accordance with specification "Bonding and Grouting".
- 4 On previously placed concrete prepare the concrete surface by cleaning with steel brush and apply bonding agent in accordance with manufacturer's instructions.

- 5 In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout or Epoxy resin.

8.19 Joints

8.19.1 Construction and control joints

Construction and control joints shall be placed as indicated on drawings (when shown).

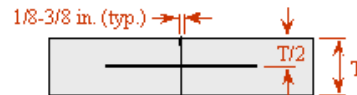
- 1 Use of construction and control joints, when not shown on the drawings, shall be in accordance with ACI 318, and subject to approval of the Engineer.
- 2 Waterstops shall be installed as shown on the drawings, forming a continuous diaphragm in each joint. Support for waterstops shall be provided and waterstop material shall be protected from damage. Field joints in waterstops shall be fabricated in accordance with manufacturer's instructions.
- 3 Saw cutting of contraction joints shall be done as soon as concrete hardens sufficiently (normally 4-12 hours) so as not to be torn or damaged by the blade. Sawing shall not be done while concrete temperature is falling. Construction and control joints shall be filled with an approved sealant, and pre-molded joint filler, and/or backer rod as shown on the drawings.
- 4 Joints not specified on the design drawings shall be in accordance with ACI 301,
- 5 All reinforcing shall be continued across construction joints. Keys shall be provided only if required by the design drawings.
- 6 When called for on the design drawings, the concrete surface at construction joints shall be roughened uniformly to approximately 1/4 inch, and laitance, loosened aggregate or damaged surface concrete shall be removed.
- 7 Paving or slab construction joints, when not specified on the design drawings, shall be located at column centerlines and at intermediate intervals so that each panel shall be not more than 400 square feet in the area, unless slab is reinforced, in which case the area shall not be more than 600 square feet. Maximum spacing of construction joints in unreinforced slabs shall not exceed twice the slab thickness in inches (i.e., 6 inch slab: 12 feet) nor 1-1/2 times the width for narrow slabs such as sidewalks.
- 8 Concrete shall be placed in checker board patterns or in alternate paving lanes utilizing construction and contraction joints to provide panels of the size shown on the drawing (when shown).

8.19.2 Isolation joints

Isolation joints separate the pavement and slab from objects or structures, and allow independent movement of the pavement, object or structure without any connection that could cause damage. Isolation joints are used where a pavement abuts certain manholes, drainage fixtures, sidewalks and buildings, and intersects other pavements.



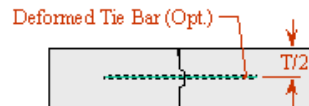
Doweled Butt - Transverse (Type B-1)
(Smooth Round Bar)



Tied Butt - Longitudinal (Type B-2)
(Deformed Tiebar)



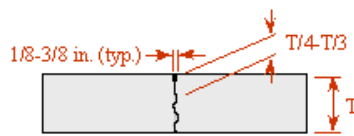
Keyed - Transverse (Type C-1)
(Keyway Optional)



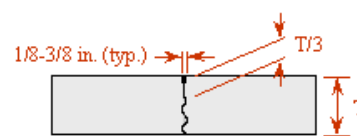
Keyed - Longitudinal (Type C-2)
(Deformed Tie Bar Optional)

Note: T = Thickness of Concrete Slab

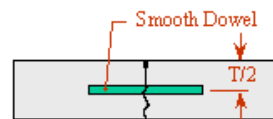
Typical Construction Joints



Undoweled - Transverse (Type A-1)



Untied - Longitudinal (Type A-3)



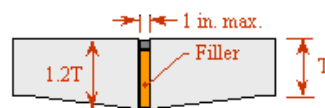
Doweled - Transverse (Type A-2)



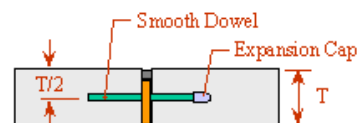
Tied - Longitudinal (Type A-4)

Note: T = Thickness of Concrete Slab

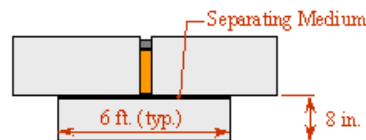
Typical Contraction Joints



Thickened Edge - Transverse (Type D-1)



Doweled - Transverse (Type D-2)



Sleeper Slab - Transverse (Type D-3)



Undoweled - Longitudinal (Type D-4)

Note: T = Thickness of Concrete Slab

Typical Isolation Joints

8.20 Finishing Concrete

8.20.1 Form ties shall be broken back 1 inch from the surface of the concrete. The remaining holes shall be filled by seal patching using a 1-to-2 mix of cement-sand mortar.

8.20.2 All voids and honeycomb in formed concrete shall be filled with a 1-to-2 cement-sand mortar mix. Form ridges and other projections shall be removed immediately, after forms are removed. Exposed form concrete shall be rubbed with a carborundum brick and a thin cement grout shall be applied as necessary to produce a true, even, finished surface. Grout shall extend at least 3" below finished backfill grade on grade walls.

8.20.2 Concrete surfaces left low for grouting shall be roughened to expose aggregate, and all loose particles and laitance shall be removed. Anchor bolt threads shall be wire brushed, and greased, after concrete has set. Nuts and washers shall be placed on the bolts.

8.21 Finish for Floors

1. Interior building slabs receiving vinyl covering, shall be screeded, floated and steel troweled. Unless otherwise noted slabs shall be screeded, floated and steel troweled.
2. Special care shall be exercised on floors that have drains or trenches. Floors shall be sloped uniformly to provide even fall for drainage.
3. Screeding, Floating, Troweling, Brooming & Nonslip Finishing Surfaces shall be screeded to the elevations shown on the drawings
4. Floating shall start as soon as the screeded surface has stiffened sufficiently. Floating shall be performed as necessary to produce a smooth, even, textured finish. Floating shall be performed by hand using magnesium tools.
5. The slab surface shall be tested for accuracy with a straight edge after the first floating finish is completed. Any depressions shall be filled and high areas shall be cut down and reworked. Straight edge testing and refloating shall continue until there are no deviations of more than 1/8 inch under a ten foot straight edge.
6. Slabs and other surfaces, unless noted otherwise, shall be broomed after final floating to provide a nonskid surface. A soft bristled push broom shall be used, with a swirling motion.
7. Slabs shall be troweled where noted on drawings or as specified otherwise. Steel troweling shall begin after straight edge testing is finished and while concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint. Steel troweling shall produce a smooth troweled finish per ACI Standard 301 "Trowel Finish". Time lapse and number of trowelings to produce a hard surface will vary depending on weather conditions.

8.22 Cold Weather Concreting

1. Thorough preparation for protection against cold weather damage to concrete shall be made well in advance. Cold weather concreting shall be performed in accordance with ACI 306 or as recommended by the designer.
2. Concrete shall be protected from freezing for at least the first 48 hours after the first frost, or when the mean 24-hour temperature at the job site falls below 40°F.

3. The placing temperature of the concrete shall be maintained above 50°F when the mean 24-hour temperature falls below 40°F.
4. The temperature of fresh-placed concrete shall be between 50 and 60°F.

8.23 Hot Weather Concreting

1. Thorough preparation for protection against hot weather damage to concrete shall be made well in advance. Hot weather concreting shall be performed in accordance with ACI 305 or as recommended by the designer.
2. The maximum concrete temperature, at time of placement, shall be limited in accordance with ACI 305.
3. One or more of the ingredients may have to be cooled to keep the temperature of the concrete from being excessive at time of placement.
4. The replacement of part of the mixing water with an equal weight of crushed ice is recommended for effective cooling per ACI 305.
5. In-place concrete shall be protected and cured so as to minimize drying and absorption of heat.

8.24 Pumped Concrete

1. The use of pumped concrete shall be approved in each case by the Engineer.
2. The proposed mix design for each class of concrete to be pumped, including all necessary background data of test results, shall be submitted to the Engineer for approval.
3. All slump and cylinder test samples shall be taken from the end of the discharge line.
4. Cutting and patching on any portion of the work after it has been completed shall be done only with the approval of the Owner's Representative.
5. Forms, equipment, protective coverings, and rubbish resulting therefrom shall be removed from the premises upon completion of the work.

8.25 TESTING AND INSPECTION

8.25.1 Inspection

All forms, reinforcement, and anchor bolts shall be inspected and approved by the Owner's Representative before concrete is placed. If work is found unsatisfactory, the work shall not proceed until all defects have been remedied. Repaired work shall be approved by the Owner's Representative. Such approval will in no way relieve the contractor of his obligation to produce finished concrete as required by the drawings and specifications.

8.25.2 Testing

8.25.2.1 Testing and acceptance of tests of concrete shall be done in accordance with ASTM C31, C39, C94, C143, C172, and C173, D75 and C136.

8.25.2.1.1 A testing laboratory engaged by the Owner will be responsible for:

1. Supplying 6 inch by 12 inch test cylinder molds to the jobsite and taking of cylinder samples.
2. Testing for air, slump, temperature, compressive strength and aggregate gradation.
3. Preparing test reports.

8.25.2.1.2 The Contractor shall supply concrete for all tests.

1. Concrete shall be sampled, cured, tested and accepted for compressive strength in accordance with ASTM C172, C31, C39, and C94. Compressive test cylinders shall be prepared in sets of three cylinders for each test.
2. Specimens for each set shall be obtained from the same batch of concrete after about one half of the batch has been placed in the forms.
3. The minimum rate of sampling shall be as follows:
 - 3.1 Structures and Foundations one set per 100 cubic yards of concrete.
 - 3.1.1 At least one set shall be obtained for each structure or foundation, except when placing a number of items, each smaller than 15 cubic yards, one set per 15 cubic yards shall suffice.
 - 3.2 Floors and Slabs at Grade
 - 3.2.1 One set per 50 cubic yards of concrete.
4. Test cylinder sets shall be dated, numbered consecutively, and identified as to location.
5. All cylinders shall be immediately stored in an insulated container under wet sand or burlap for about 24 hours after preparation. All vibration or impact shall be avoided during this period.
6. After initial storage, the cylinders (still in their molds) shall be packed in sealed polyethylene bags, wet sand or other resilient material for shipment to the testing laboratory.
7. Concrete slump tests shall be made in accordance with ASTM C 143 and shall be taken as necessary to assure well-placed concrete.
8. In-Place Tests: Where questions exist as to the quality of the
9. concrete placed, Designer and or owner may require tests per ASTM C42 or order a load test on structures as outlined in ACI 318, Building Code Requirements for Reinforced Concrete.
10. Contractor shall give PRCS 48 hours of notice before any pour requiring testing.

8.26 SUBMITTALS

8.26.1 Two (2) copies of the following (unless noted otherwise) shall be submitted to the Engineer and one (1) copy to the Owner's Representative for review and approval:

1. Design of concrete mixes in accordance with the specification and ACI 301.
2. Reinforcing steel and embedded items shop drawings, bar lists and bending and erection drawings.
3. Two (2) sets of these documents shall accompany the first load of reinforcing delivered to the job site.

4. One (1) reproducible of the final reinforcing steel and embedded items shop drawings shall be forwarded to the Engineer when they are issued to the shop.
5. Test Reports and material certifications as noted in the specification, and/or on the drawings.

8.27 DEFECTIVE CONCRETE

8.27.1 Defective Concrete:

Great care is required throughout the entire construction process to ensure that the hardened concrete actually has the desired properties.

8.27.1.1 A blemish on the surface of a concrete slab can likely be one of the following:

8.27.1.1.1 Blisters,

Blisters are surface bumps that may range in size from 1/4" to 4" in diameter with a depth of about 1/8".



(Photo courtesy of National Ready Mixed Concrete Association.)

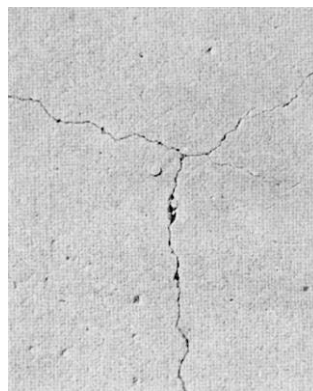
8.27.1.1.1.1 Cause of blisters can be contributed to:

1. Concrete with a high slump,
2. Excessively high air content
3. Excess fines.
4. Not an appropriate cement content was used
5. The subgrade before placing concrete on it during cold
6. Weather was not warmed up.
7. The concrete for the slab was directly poured on polyethylene film or other vapor barriers.
8. The concrete was improperly vibrated to release entrapped air.
9. Concrete was overworked this causes the aggregate to settle and bleed water and excess fines to rise.
10. The surface was sealed too early Use a wood bull float on non-air-entrained concrete to avoid early sealing. Use Magnesium or aluminum tools should be used on air-entrained concrete.
11. Use of improper finishing techniques and improper timing during and between finishing operations.
12. Rapid evaporation over the slab by using a fog spray or slab cover.
13. Air contents over 3% to 4% was used for interior slabs

8.27.1.1.2 Cracking



Plastic shrinkage



Drying Shrinkage

8.27.1.1.2.1 Cause of blisters can be contributed to:

1. Cracks that occur before hardening usually are the result of settlement within the concrete mass, or shrinkage of the surface (plastic-shrinkage cracks) caused by rapid loss of water while the concrete is still plastic.
2. Settlement cracks may develop over embedded items, such as reinforcing steel, or adjacent to forms or hardened concrete as the concrete settles or subsides. Settlement cracking results from insufficient consolidation (vibration), high slumps (overly wet concrete), or a lack of adequate cover over embedded items.
3. Plastic-shrinkage cracks are relatively short cracks that may occur before final finishing on days when wind, a low humidity, and a high temperature occur. Surface moisture evaporates faster than it can be replaced by rising bleed water, causing the surface to shrink more than the interior concrete. As the interior concrete restrains shrinkage of the surface concrete, stresses develop that exceed the concrete's tensile strength, resulting in surface cracks. (Under certain combinations

of conditions, warping or curling can result from these stresses, too. See Curling.)

Plastic-shrinkage cracks are of varying lengths, spaced from a few inches up to 10 ft apart, and often penetrate to mid-depth of a slab.

4. Cracks that occur after hardening usually are the result of drying shrinkage, thermal contraction, or subgrade settlement. While drying, hardened concrete will shrink about 1/16 in. in 10 ft of length. To accommodate this shrinkage and control the location of cracks, joints are placed at regular intervals.

8.27.1.1.2.2 Cracking in concrete can be reduced significantly or eliminated by the following practices:

1. Use proper subgrade preparation, including uniform support and proper subbase material at adequate moisture content.
2. Minimize the mix water content by maximizing the size and amount of coarse aggregate and use low-shrinkage aggregate. Use the lowest amount of mix water required for workability; do not permit overly wet consistencies.
3. Avoid calcium chloride admixtures.
4. Prevent rapid loss of surface moisture while the concrete is still plastic through use of spray-applied finishing aids or plastic sheets to avoid plastic-shrinkage cracks.
5. Provide contraction joints at reasonable intervals, per ACI requirements.
6. Provide isolation joints to prevent restraint from adjoining elements of a structure.
7. Prevent extreme changes in temperature.
8. Properly place, consolidate, finish, and cure the concrete.
9. Avoid using excessive amounts of cementitious materials.
10. Consider using a shrinkage-reducing admixture to reduce drying shrinkage, which may reduce shrinkage cracking.
11. Consider using synthetic fibers to help control plastic shrinkage cracks.

8.27.1.1.3 crazing,

8.27.1.1.3.1 Crazing, a network pattern of fine cracks that do not penetrate much below the surface, is caused by minor surface shrinkage



Crazing Crack

8.27.1.1.3.2 Crazing cracks are very fine and barely visible except when the concrete is drying after the surface has been wet. The cracks encompass small concrete areas less than 2 in.in dimension, forming a chicken-wire pattern. The term “map cracking” is often used to refer to cracks that are similar to Crazing cracks may be unsightly and can collect dirt, however, these cracks are not considered structurally serious.

8.27.1.1.3.3 To prevent crazing:

1. Curing procedures should begin early, within minutes after final finishing when weather conditions warrant.
2. The concrete should be protected against rapid changes in temperature and moisture wherever feasible.

8.27.1.1.4 Curling

Curling is the distortion (rising up) of a slab’s corners and edges due to differences in moisture content or temperature between The top and bottom of a slab. The top dries out or cools and shrinks more than the wetter or warmer bottom. If the curled section of a slab is loaded beyond the flexural strength of the concrete, cracks may develop to relieve the stress.

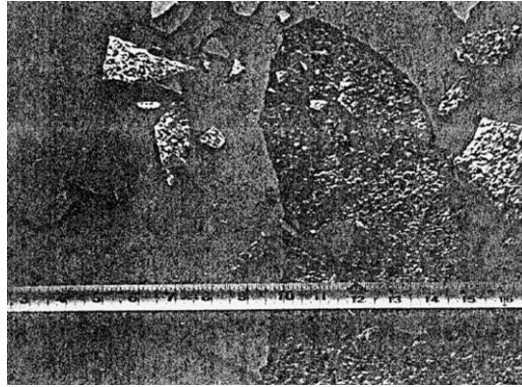
8.27.1.1.4.1 Curling can be reduced by:

1. Using a low-shrinkage concrete mix.
2. Using proper control-joint spacing.
3. Creating uniform moisture content and temperature of the slab from top to bottom.
4. Using large amounts of reinforcing steel 2 in. down from the surface.
5. Using thickened slab edges.

6. Using vacuum dewatering, shrinkage-compensating concrete, or post-tensioning.

8.27.1.1.5. Delamination

- 8.27.1.1.5.1 Delaminations are similar to blisters in that delaminated areas of surface mortar result from bleed water and bleed air being trapped below the prematurely closed mortar surface.



Delamination as the result of sealing the surface before bleeding has occurred.

- 8.27.1.1.5.2 The primary cause is finishing the surface before bleeding has occurred. Delaminations are also more likely to occur when factors that extend the bleeding time of concrete (e.g. cold substrate) are combined with factors that accelerate surface setting

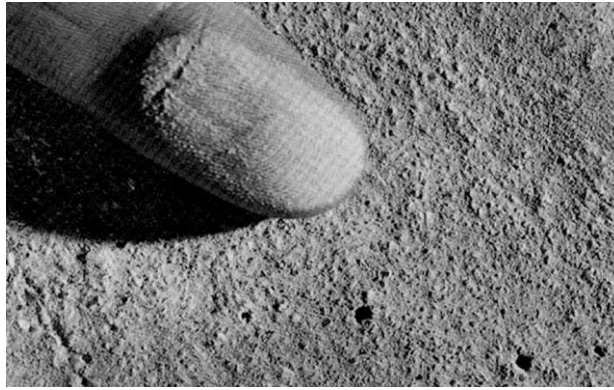
8.27.1.1.6 Discoloration,

1. Surface discoloration of concrete flatwork can appear as color changes in large areas of concrete, spotted or mottled light or dark blotches on the surface.
2. Factors found to influence discoloration are calcium chloride admixtures, cement alkalies, hard-troweled surfaces, inadequate or inappropriate curing, a wet substrate, variation of the water-cement ratio at the surface, and changes in the concrete mix. Discoloration from these causes appears soon after placing the concrete.
3. Discoloration at later ages may be the result of atmospheric or organic staining—simply stated, the concrete is dirty. This type of discoloration is usually removed by power washing with pressurized water and, possibly, chemical cleaners.

8.27.1.1.7. Dusting

- 8.27.1.1.7.1 The development of a fine, powdery material that easily rubs off the surface of hardened concrete—can occur either indoors or outdoors, but is more likely to be a problem when it occurs indoors.

Dusting is the result of a thin, weak layer, called laitance, composed of water, cement, and fine particles.



Dusting is evident by the fine powder that can be easily rubbed off the surface

Floating and troweling concrete with bleed water on it mixes the excess water back into the surface, further weakening the concrete's strength and wear resistance and giving rise to dusting.

8.27.1.1.7.2 Dusting may also be caused by

1. Water applied during finishing
2. Exposure to rainfall during finishing
3. Spreading dry cement over the surface to accelerate finishing
4. A low cement content
5. Too wet a mix
6. Lack of proper curing (especially allowing rapid drying of the surface)
7. Carbonation during winter concreting (caused by unvented heaters)
8. Freezing of the surface
9. Dirty aggregate.

8.27.1.1.8 Efflorescence,

Efflorescence can be considered a type of discoloration. It is a deposit, usually white in color, that occasionally develops on the surface of concrete, often just after a structure is completed. Efflorescence is usually harmless. In some cases, excessive efflorescence deposits can occur within the surface pores of the material, causing expansion that may damage the surface.

8.27.1.1.8.1 Efflorescence is caused by a combination of circumstances:

1. Soluble salts in the material, moisture to dissolve these salts, and evaporation or hydrostatic pressure that moves the solution toward the surface.
2. Efflorescence is particularly affected by temperature, humidity, and wind.

3. Usually efflorescence is more common in the winter when a slower rate of evaporation allows migration of salts to the surface.

8.27.1.1.9 Low spots,

8.27.1.1.9.1 Low spots can affect slab drainage or serviceability if the slab need to be level.

8.27.1.1.9.2 Low spots are often caused during placement and finishing, by improperly set forms and screeds use of overly wet or variably wet concrete, and poor placement and finishing techniques.

8.27.1.1.9.3 Low spots can be avoided by:

Using a low-slump, low-water-content concrete mix

1. Providing adequate light
2. Frequently checking grades and levels, and filling the low areas
3. Using a vibrating screed for strikeoff
4. Using a “highway” straightedge in lieu of a bullfloat to smooth and straighten the surface.

8.27.1.1.10 Popouts

8.27.1.1.10.1 A popout is a conical fragment that breaks out of the surface of the concrete leaving a hole that may vary in size from 1/4 in. to 2 in. but up to as much as 1 ft in diameter

Usually a fractured aggregate particle, still adhering to the point of the popout cone is found at the bottom of the hole.

Most popouts appear within the first year after placement.



A popout is a small fragment of concrete surface that has broken away due to internal pressure, leaving a shallow, typically conical, depression.

8.27.1.1.10.2 To minimize or to eliminate popouts the following steps may be taken:

1. Use concrete with the lowest water content and slump possible for the application.
2. Use a durable crushed-stone or aggregate in concrete.
3. During hot, dry, and windy weather, cover the surface with plastic sheets after screeding and bullfloating to reduce evaporation before final finishing.
4. Do not finish concrete with bleed water on the surface.
5. Avoid hard-steel troweling where not needed, such as most exterior slabs.
6. Avoid use of vapor barriers. If required, cover the vapor barrier with 4 in. of compactible granular fill
7. Use wet-curing methods such as continuous sprinkling with water, fogging, ponding, or covering with wet burlap soon after final finishing. Wet-cure for a minimum of 7 days.
 - 7.1 Avoid plastic film, curing paper, and especially curing compounds.
 - 7.2 Impervious floor coverings or membranes should be avoided as they can aggravate popout development.
8. Flush curing water from the surface before final drying.
9. Use two-course construction with clean, sound rock in the topping, and the aggregates in the base of the slab, to limit the aggregate's exposure to excess moisture.
10. Slope the slab surface to drain water properly.
11. Use air-entrained concrete.
12. Reduce concrete temperature to 50°F to 70°F.

8.27.1.1.10.3 Surfaces with popouts can be repaired by following methods:

1. Create a small patch by drilling out the spalled particle and filling the void with a dry-pack mortar or other appropriate patch material. If the popouts in a surface are too numerous to patch individually, a thin-bonded concrete overlay may be used to restore serviceability.

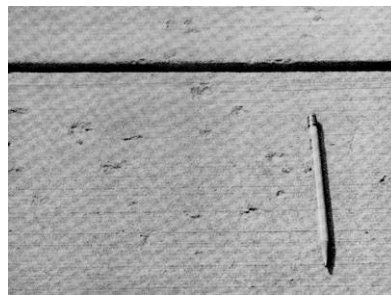
8.27.1.1.11 Scaling

Scaling is the general loss of surface mortar exposed to freezing and thawing. The aggregate is usually clearly exposed and often stands out from the concrete.

Scaling is caused by hydraulic pressure from water freezing within the concrete.

When pressure exceeds the tensile strength of concrete, scaling can result if entrained-air voids are not present to act as internal pressure relief valves.

The deicer solution in water-soaked concrete during freezing causes an additional buildup of internal pressure.



Mortar flaking over coarse aggregate

8.27.1.1.12 Spalling

8.27.1.1.12.1 Spalling is a deeper surface defect than scaling, often appearing as circular or oval depressions on surfaces or as elongated cavities along joints. Spalls may be 1 in. or more in depth and 6 in. or more in diameter, although smaller spalls also occur.

8.27.1.1.12.2 Spalls are caused by:

1. Contraction or expansion within the concrete
2. Bond failure in two-course construction
3. Impact loads
4. Fire or weathering.
5. Improperly constructed joints
6. Corroded reinforcing steel.

8.27.1.1.12.2 Spalls can be avoided by:

1. Properly designing the concrete element—including joints—for the environment and anticipated service
2. Using proper concrete mixes and concreting practices
3. Taking special precautions against steel corrosion caused by deicers
 - 3.1 Provide adequate cover per ACI 318, for the steel If steel reinforcement is used.
 - 3.2 The use of epoxy-coated reinforcing

8.27.1.1.12.3 Spalled areas of concrete can be repaired when no more than the top 1/3 of the pavement is damaged and the underlying pavement is sound. The economics of partial-depth repair versus complete replacement should be considered, as it may be more cost effective (and more uniform-looking) to replace the entire area.

1. Patch limits should be extended about 4 in. beyond the edges of the unsound areas.
2. Spalled or delaminated concrete shall be removed by saw cutting and chipping. If jackhammers are used, they should be small—no greater than 30-lb—to prevent concrete damage beyond the repair area.
3. The area shall be kept in rectangular or square cuts and provide vertical edges at the boundaries to contain the patch.
4. The exposed concrete's surface shall be lightly sandblasted to clean so a good bond can be obtained with the repair material.
5. Patching materials can be portland-cement-based, rapid strength

9.0 Retaining Walls

9.1 General

The objectives of this section is to obtain uniformity of construction within the department, and establish standard procedures. The following is a general requirement for retaining walls of all heights and types.

9.2 Scope of Work

1. Retaining walls shall be designed to withstand lateral earth and water pressures, the effects of surcharge loads (e.g. building or vehicular loads), the self-weight of the wall and in special cases, earthquake loads.
2. Retaining walls shall be designed for a service life based on consideration of the potential long-term effects of material deterioration.
3. Contractor shall provide all labor, materials, equipment, and services necessary to construct walls and all related items as shown on the approved plans and as specified herein.

Note:

Permanent retaining walls should be designed for a minimum service life of 50 years. Temporary retaining walls should be designed for a minimum service life of 5 years. Retaining walls are generally classified as gravity, semi-gravity (or conventional), non-gravity cantilevered, and anchored.

Within the wall types above, many of the retaining wall systems available are proprietary. **Care must be exercised to use an approved material.**

9.3 Design Consideration for retaining walls

For any specific retaining wall, an acceptable design will depend upon several factors, including:

1. Wall height
2. Slope of soil behind and in front of the wall
3. Backfill soil property
4. Subsurface soil properties (foundation)
5. Groundwater and surface water conditions
6. Type and properties of reinforcing elements depending on the type of the wall chosen
7. Check for required permits, such as site plan, or site plan amendment depending on the height, slope in the front of the wall, and the area being disturbed and zoning approval.
8. Contact the Building and Land Development for all required permit. See note below.

Exemption:

1. Building permit requirements apply when the wall is supporting soils other than Class I and II soils group, liquids, or supporting surcharge other than ordinary unbalanced fill.
2. Retaining walls between 2'-0" and 4'-0" in height are not required to be designed by a Professional Engineer registered in the Commonwealth of Virginia.

Exception:

2.1 When there is a surcharge load or the wall is supporting soils other than Class I and II soils group, liquids, or supporting surcharge other than ordinary unbalanced fill.

2.2 Walls greater than 4'-0" (regardless of the type) are required to be designed by a Professional Engineer Registered in the Commonwealth of Virginia.

Note:

Walls more than 30" above the finished grade are required to have a guardrail in accordance with IBC and requirements set forth in this Manual.

3. In addition, the requirements set forth in IBC "SAFEGUARDS DURING CONSTRUCTION" shall apply.
 - 3.1** Guardrails, and their supports must be designed to withstand the required applied loads per the latest IBC (International Building Code) and ASCE-07.
 - 3.2** Guardrail height shall be a minimum of 42 inches above the leading edge of the tread or walking surface. The height shall be per latest edition of IBC.
 - 3.3** Open guards shall have balusters or ornamental patterns such that a 4 inch diameter sphere cannot pass through any opening.

9.3.1 Soil classifications

TABLE R405.1
PROPERTIES OF SOILS CLASSIFIED ACCORDING TO THE UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL GROUP	UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL	SOIL DESCRIPTION	DRAINAGE CHARACTERISTICS ^a	FROST HEAVE POTENTIAL	VOLUME CHANGE POTENTIAL EXPANSION ^b
Group I	GW	Well-graded gravels, gravel sand mixtures, little or no fines	Good	Low	Low
	GP	Poorly graded gravels or gravel sand mixtures, little or no fines	Good	Low	Low
	SW	Well-graded sands, gravelly sands, little or no fines	Good	Low	Low
	SP	Poorly graded sands or gravelly sands, little or no fines	Good	Low	Low
	GM	Silty gravels, gravel-sand-silt mixtures	Good	Medium	Low
	SM	Silty sand, sand-silt mixtures	Good	Medium	Low
Group II	GC	Clayey gravels, gravel-sand-clay mixtures	Medium	Medium	Low
	SC	Clayey sands, sand-clay mixture	Medium	Medium	Low
	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Medium	High	Low
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium	Medium	Medium to Low
Group III	CH	Inorganic clays of high plasticity, fat clays	Poor	Medium	High
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Poor	High	High
Group IV	OL	Organic silts and organic silty clays of low plasticity	Poor	Medium	Medium
	OH	Organic clays of medium to high plasticity, organic silts	Unsatisfactory	Medium	High
	Pt	Peat and other highly organic soils	Unsatisfactory	Medium	High

For SI: 1 inch = 25.4 mm.

a. The percolation rate for good drainage is over 4 inches per hour, medium drainage is 2 inches to 4 inches per hour, and poor is less than 2 inches per hour.

b. Soils with a low potential expansion typically have a plasticity index (PI) of 0 to 15, soils with a medium potential expansion have a PI of 10 to 35 and soils with a high potential expansion have a PI greater than 20.

Table is copied from IRC 2009 (International Residential Code) for Information only. Refer to current edition of IRC for updated information.

9.3.2 General Structural and Geotechnical Design Requirements

9.3.2.1 The following are general design requirements for retaining walls that shall be shown on the drawings and shall be included in the contract documents.

1. Minimum safety factors for overturning, sliding and stability of temporary construction slopes. (Typical minimum values are overturning 2.0, sliding 1.5, and temporary construction slopes 1.2).
2. Allowable foundation bearing pressure, minimum wall footing embedment depth and maximum tolerable total and differential settlements
3. Magnitude, location and direction of all external loads due to traffic, and other surcharge loads.
4. Limits and requirements for drainage features beneath, behind, or through the retaining structure.
5. Backfill requirements behind the retaining structure
6. Special facing panel and module finishes or colors.
7. The Contractor shall be responsible for field verifying original ground elevations.

9.4 Submittals:

The plans shall be prepared to include but not be limited to the following items:

9.4.1 A plan and elevation sheet or sheets for each wall containing the following:

1. An elevation view of the wall showing grades at the top of the wall, every 50 feet along the wall and at all horizontal and vertical break points.
2. Elevations at the top of leveling pads and footings,
3. The distance along the face of the wall to all steps in the footings, and leveling pads
4. The designation as to the type of panel or module, the length, size and number of tiebacks, nails, mesh or strips and all the distances along the face of the wall to where changes in length of the reinforcing elements occur and the location of the original and final ground line should be shown.
5. Any general or special notes, standard or special drawings, or other unique provisions required for construction of the wall.
6. All horizontal and vertical curve data affecting wall construction.
7. Cross sections showing limits of construction and in fill sections, limits and extent of select granular backfill material placed above original ground.
8. Limits and extent of reinforced soil volume.

9.4.2 Details

1. Detailed design computations which clearly demonstrate compliance with design requirements provided in this manual.
2. All structural details including reinforcing bar bending details. Bar bending details shall be in accordance with CRSI standards.
3. All details for foundations and leveling pads, including details for steps in the footings or leveling pads
4. All modules and facing elements shall be detailed. The details shall show all dimensions necessary to construct the elements, all reinforcing steel in the element, and the location of reinforcement element attachment devices embedded in the facing.
5. All details for construction of the wall around drainage facilities, other adjacent footings and piles shall be clearly shown.
6. All details for drainage behind wall or reinforced soil

9.4.3 Limits

1. Each design submittal shall include a detailed list of quantities for each wall unit. The quantities shall include but not be limited to: concrete cast in-place, pre-cast concrete, select backfill material, backfill material, reinforcing steel, geo-membrane/geogrid reinforcement, modular blocks, structural steel, pre-stressing steel, etc... If known, all materials sources shall be identified so acceptance and verification sampling and testing can be conducted.
2. The plans shall be signed, stamped and dated by a qualified registered Professional Engineer licensed in the State of Tennessee.

9.4.4 Submittals and Approval

1. When required; The plans shall be signed, stamped and dated by a Professional Engineer licensed in the Commonwealth of Virginia.
2. Four sets of design drawings and detail design computations shall be submitted. Also, an electronic copy of the design drawings and detail design computations shall be submitted to PRCS.

9.4.5 Materials Approval

1. Prior to delivery of any material used in the retaining wall construction, the sources must be accepted in conformance with the material specifications associated with the wall type being constructed.

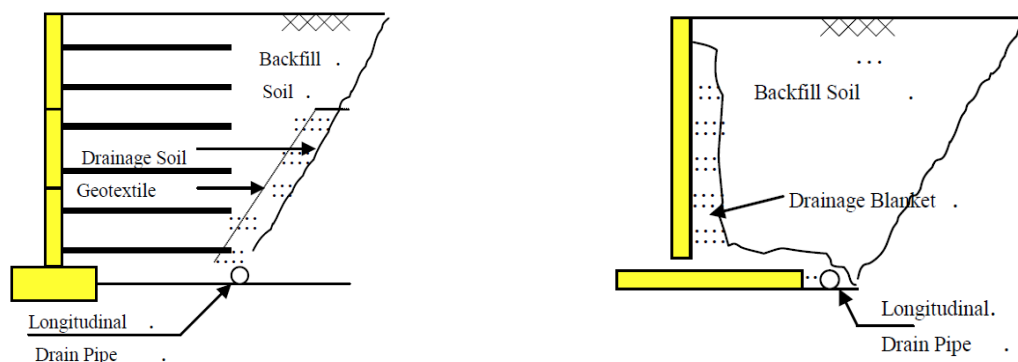
9.5 Geotechnical Investigation

1. The engineering properties and behavior of backfill, retained soil, and foundation material must be evaluated through a geotechnical subsurface investigation, and through a laboratory testing.
2. Three (3) sets of Sealed signed and dated reports by a professional engineer registered in the Commonwealth of Virginia, when required, shall be submitted to PRCS and the appropriate review agencies prior to wall design.

9.6 Wall Drainage Systems

9.6.1 Drainage System for Fill Walls:

- 9.6.1.1 Drainage measures to prevent surface water from infiltrating into the wall backfill shall be included in the design of a wall system.
- 9.6.1.2 The backfill surface shall be graded away from the wall at the end of each day of construction to prevent water from ponding behind the wall and saturating the soil.



Drainage System; Fill Walls

9.6.2 Drainage System for Cut Walls:

- 9.6.1 Drainage systems shall be required to control surface-water infiltration and ground-water seepage.

9.7 Guideline for Segmental Retaining Wall units (SRW):

9.7.1 General

It is the Project manager's responsibility to achieve coordination between construction and design professionals to ensure all required design, engineering analysis, and inspection is provided. The project Manager shall ensure that the engineering design professionals' scope of work, roles and responsibilities are clearly defined so that there is no ambiguity regarding responsibility for investigation, analysis and design, and that all required testing is performed.

9.7.2 Definitions

Concrete Segmental Retaining Wall (SRW) Units: Dry-stacked masonry units used as the retaining wall fascia.

Reinforced Backfill: Soil that is used as fill behind the SRW unit, and within the reinforced soil mass (if applicable).

Drainage Aggregate: Material used (if applicable) within, between, and directly behind the concrete retaining wall units.

Geotextile Filter: Material used for separation and filtration of dissimilar soil types.

Foundation Soil: Soil mass supporting the leveling pad and reinforced soil zone of the retaining wall system.

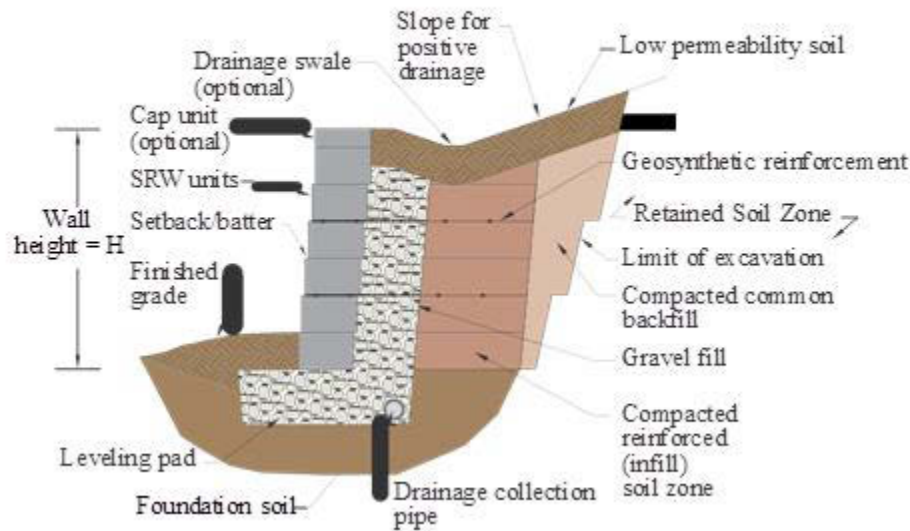
Geosynthetic Reinforcement: Polymeric material designed specifically to reinforce the soil mass.

Pre-fabricated Drainage Composite: three-dimensional geosynthetic drainage medium encapsulated in a geotextile filter, used to transport water.

Impervious Materials: Clay soil or low permeability geosynthetic used to prevent water percolation into the drainage zone behind the wall.

Global Stability: The general mass movement of a soil reinforced segmental retaining wall structure and adjacent soil mass.

Project Geotechnical Engineer: A registered engineer who provides site observations, recommendations for foundation support, and verifies soil shear strength parameters.



Reinforced Segmental Retaining Wall system Components

9.7.3 REFERENCES

9.7.3.1 American Society for Testing and Materials (ASTM)

- 1 ASTM C1372 Standard Specification for Segmental Retaining Wall Units.
- 2 ASTM C1262 Evaluating the Freeze thaw Durability of Manufactured CMU's and Related concrete Units
- 3 ASTM D698 Moisture Density Relationship for Soils, Standard Method
- 4 ASTM D422 Gradation of Soils
- 5 ASTM C140 Sample and Testing concrete Masonry Units
- 6 ASTM D4595 - Tensile Properties of Geotextiles by the Wide-Width Strip Method
- 7 ASTM D5262 - Test Method for Evaluating the Unconfined Creep Behavior of Geogrids
- 8 ASTM D6638 Grid Connection Strength (SRW-U1)
- 9 ASTM D6916 SRW Block Shear Strength (SRW-U2)
- 10 GRI-GG4 - Grid Long Term Allowable Design Strength (LTADS)
- 11 ASTM D6706 - Grid Pullout of Soil

9.7.3.2 NCMA Design Manual For Segmental Retaining Walls,

1. NCMA SRWU-2 Determination of Shear Strength Between Segmental Concrete Units

9.7.3.3 IBC (International Building Code) applicable edition referenced by USBC.

9.7.3.4 ACI (American Concrete Institute) as referenced.

9.7.3.5 NDS (National Design Standard)

9.7.4 General Requirements

As a minimum, the subsurface exploration and testing programs shall define the following, where applicable:

- 1. Soil strata:**
Depth, thickness, and variability -Identification and classification -Relevant engineering properties (i.e., natural moisture content, Atterberg limits, shear strength, compressibility, stiffness, permeability, expansion or collapse potential, and frost susceptibility) - Relevant soil chemistry, including pH, resistivity, chloride, sulfate, and sulfide content
- 2. Rock strata:**
Depth to rock -Identification and classification -Quality (i.e., soundness, hardness, jointing and presence of joint filling, resistance to weathering, if exposed, and solution)-
- 3. Compressive strength (i.e., uniaxial compression, point load index) -**
Expansion potential
- 4. Ground water elevation, including seasonal variations, chemical composition, and pH (important for anchored, non-gravity cantilevered, modular, and MSE walls) where corrosion potential is an important consideration**
- 5. Ground surface topography**
Exploration logs shall include soil and rock strata descriptions, penetration resistance for soils (i.e., SPT), and sample recovery and RQD for rock strata. The drilling equipment and method, use of drilling mud, type of SPT hammer (i.e., safety, donut, hydraulic) or cone penetrometer (i.e., mechanical or electrical), and any unusual subsurface conditions such as artesian pressures, boulders or other obstructions, or voids shall also be noted on the exploration logs.

Table 1—Suggested Roles for a Segmental Retaining Wall Project

Owner/Developer or Owner's Representative:
Ensure that design professionals are contracted to provide all required engineering evaluation, layout, design, testing and inspection.
Construction Observation and Testing Agencies:
Earthwork inspection preferably performed by the geotechnical engineering consultant.
Inspect SRW foundation area, including area below planned geosynthetic-reinforced soil fill, to verify that bearing, soil, and groundwater conditions meet design assumptions.
Inspect native soils in retained zone for consistency with reported soil types and properties.
Monitor fill placement and laboratory- and field-testing to ensure specified soil types used for fill and specified compaction achieved.
Inspect overall wall material installation—preferably contracted directly with SRW engineer or site civil engineer.
Observe placement of SRW units and geosynthetic reinforcement installation.
Review material submittals for conformance with specifications.
Additional review of soil properties and earthwork testing, provided by the geotechnical engineer, for conformance with wall material specifications.
Geotechnical Engineer:
Subsurface investigation, including any required soil borings and laboratory soils testing.
Define pertinent subsurface conditions including soils, rock and groundwater conditions in the area of SRWs.
Determine properties and strengths of retained soil/rock behind and foundation material underneath the SRWs as well proposed soil for use as reinforced fill.
Evaluate foundation capacity below SRW, including bearing capacity and settlement estimates and recommendations for any required foundation improvements.
Global stability analysis throughout site including above and below SRWs.
Supervise and coordinate slope stability evaluation and corrections around the SRW with the SRW engineer.
Evaluate seismic potential and recommended design accelerations, if applicable.
Construction inspection and testing of on-site and fill soils (generally on a time and materials basis, separate from the soils exploration report contract).
Landscape Architect/Architect:
May act as specifier of retaining walls, rather than site civil engineer, primarily for walls near building structures (architectural walls) or for landscaping features.
Specify retaining walls appropriate to project conditions, if not civil engineer's responsibility.
For walls near building structures or for landscaping, retaining wall layout and alignment on site plan, if not site civil engineer's responsibility.
Coordinate SRW layout with site civil engineer's site and grading plans.
Structural Engineer:
Structural design of appurtenant structures to SRW such as guide rails, traffic barriers and structural slabs at top or bottom of wall.

Table 1—Suggested Roles for a Segmental Retaining Wall Project (continued)

SRW Engineer:
Design SRW for structural stability including external stability (sliding and overturning), internal stability, and facial stability.
Determine maximum unreinforced height of SRW.
Design geosynthetic reinforcement layout, when required.
Determine minimum embedment of wall (except in the case of scour depth or erosion control issues, which should be determined by site civil).
Specify SRW unit, geosynthetic reinforcement, drainage material within wall structure and reinforced soil properties.
Determine which structures can or cannot be placed within the reinforced soil zone and wall face, and detail the SRWs to accommodate acceptable structures.
Under the direction of geotechnical engineer, assist in coordination of slope stability evaluation around and through the SRW and the geosynthetic reinforcement design in reinforced SRWs to address slope stability in vicinity of SRW, as required.
If contracted to and notified, observe construction of the overall SRW installation and review SRW material submittals (generally on a time and materials basis, separate from the wall design contract). See <i>Construction Observation and Testing Suggested Roles Overview</i> below.
When required by state law that the SRW engineer be a licensed professional structural engineer (S.E.), structural engineer also takes on SRW engineer role. In this case, the general project structural engineer often may be a different firm than the SRW structural engineer, depending on the project structural engineer's familiarity with SRWs and interest in designing SRWs.
Site/Civil Engineer:
Specify retaining walls appropriate to project conditions.
Act as SRW Engineer (see above) when wall design performed in-house.
Prepare site plan and grading plan, including slopes and SRW heights and alignments.
Address any space limitations and easement issues relevant to SRW layout.
Design surface grading for drainage and design for erosion control around SRWs.
Design storm water collection structures and detention/retention ponds.
Utility design and layout around SRWs.
Pavement section design and grading above SRWs.
Layout of traffic control structures, such as pedestrian fall protection, curbs, wheel stops, guide rails and traffic barriers behind walls.
Hydrologic evaluations including water flows, scour depths, flood areas and high water level predictions around SRW.
Ensure SRW engineer contracted for involvement in pre-construction meetings and construction inspection services coordination.
Observe construction of the overall SRW installation and review SRW material submittals, if SRW engineer not contracted specifically for these services.
Owner (after installation):
Maintenance and cleaning.
Ensure landscaping and other site work does not damage or impair the SRW installation.

9.7.5 FIELD QUALITY CONTROL

1. Installer is responsible for quality control of installation of system components.
2. Installer shall correct work that does not meet these specifications or the requirements shown on the Drawings at the installer's expense.
3. An independent testing agency, shall be contracted to perform compaction testing of the reinforced backfill placed and compacted in the reinforced backfill zone.
4. Testing Frequency
 - 4.1 One test for every 2 feet (vertical) of fill placed and compacted, for every 50 lineal feet of retaining wall.

4.2 Vary compaction test locations to cover the entire area of the reinforced soil zone, including

9.7.6 Delivery, Storage, and Handling

- 1** Contractor shall check the materials upon delivery to assure proper material has been received.
- 2** Contractor shall prevent excessive mud, cementitious material, and like construction debris from coming in contact with the materials.
- 3** Contractor shall protect the materials from damage. Damaged material shall not be incorporated in the project (ASTM C1372).

9.7.7 MATERIALS

9.7.7.1 Physical Requirements of blocks

- 1.** Compressive strength and Absorption: Concrete retaining wall units shall be tested in accordance with ASTM C140, Sections 6, 8 and 9. Concrete retaining wall units shall meet requirements of ASTM C1372, except the compressive strength requirements shall be increased to a minimum of 3,500 psi and the maximum water absorption shall be limited to 7 percent, and unit height dimensions shall not vary more than $\pm 1/16$ inch from that specified in the ASTM reference, not including textured face. Test shall be performed within the past 6 months to be considered current and valid.
- 2.** Freeze-Thaw Durability: Shall be tested in accordance with ASTM C1262 when required. Test shall be performed within the past 12 months to be considered current and valid.

9.7.7.2 Geosynthetic Reinforcement shall be manufactured with high-tenacity polyester or HDPE (High Density Polyethylene) a grid or textile structure. The geosynthetic reinforcement must meet the long-term design strength, soil interaction, and connection capacity requirements as required by the design of the retaining wall.

- 1.** Long-term Design Strength: As determined in accordance with Method A of the NCMA Design Manual for Segmental Retaining Walls.
 - 1.1.** Ultimate Tensile Strength: The ultimate tensile strength of the geosynthetic reinforcement shall be determined in accordance with ASTM D4595 or ASTM D6637.
 - 1.2** Creep: Creep testing of the geosynthetic shall be performed in accordance with ASTM D5262. The creep reduction factor shall be determined in accordance with FHWA-NHI-00-043.
 - 1.3.** Installation Damage: The installation damage reduction factor shall be determined in accordance with ASTM D5818 and FHWA-NHI-00-043.
 - 1.4.** Durability: The durability reduction factor shall be determined in accordance with FHWA-NHI-00-044.
- 2.** Soil Interaction: The soil interaction properties include the coefficient of direct sliding and coefficient of interaction as determined through direct shear and pullout testing, respectively.
 - 2.1.** Pullout: Shall be determined in accordance with ASTM D6706.
 - 2.2.** Direct Sliding: Shall be tested in accordance with ASTM D5321.
- 3.** Connection Capacity: As determined in accordance with ASTM D6638.

9.7.8 Leveling Pad Base

1. Aggregate Base: Crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D422:

<u>Sieve Size</u>	<u>Percent Passing</u>
No. 200	3 to 10

- 1.1. Base Thickness: 6 inches (minimum compacted thickness).
- 1.2. Base Width: must extend 6 inches from the toe and heel of the block.
- 1.3. Material behind and within the blocks may be the same material.

2. Concrete Base: Non-reinforced lean concrete base.

- 2.1 Base Thickness: At least 2 inches

9.7.9. Infill Soil

1. The infill soil used must meet or exceed the designed friction angle and description noted on the design cross sections, and must be free of debris and consist of one of the following inorganic USCS soil types:

- 1.1 GP, GW, SW, SP meeting the following gradation as determined in accordance with ASTM D422.

<u>Sieve Size</u>	<u>Percent Passing</u>
4 inch	100 – 75
No. 4	100 – 20
No. 40	0 - 60
No. 200	0 - 35

- 9.7.9.1 Drainage Aggregate: Clean crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:

<u>Sieve Size</u>	<u>Percent Passing</u>
1 inch	100
3/4 inch	75 to 100
No. 4	0 to 60
No. 40	0 to 50
No. 200	0 to 5

- 9.7.9.2 Reinforced Backfill: Suitable reinforced backfill soils shall be free of organics and debris and consisting of either GP, GW, ML, SP, SW, or SM type, classified in accordance with ASTM D2487 and the USCS classification system. Soils classified as SC and CL are considered suitable soils for segmental retaining walls with a total height of less than 10 feet.

1. The Plasticity Index (PI) of the reinforced backfill soils shall not be greater than 20 as measured in accordance with ASTM D4318.
2. Unsuitable soils are organic soils and those soils classified as CH, OH, MH, OL, or PT.
3. The pH of the reinforced backfill shall be between 3 and 10 and be tested in accordance with ASTM G51.

9.7.9.3 Drainage Pipe: Perforated or slotted PVC or corrugated HDPE pipe manufactured in accordance with D3034 and/or ASTM F405. The pipe may be covered with a geotextile filter to prevent fines migration into the pipe.

1. Pre-fabricated Drainage Composite: The pre-fabricated drainage composite shall be Miradrain 5000, manufactured by Mirafi, or equal.
2. Geotextile Filter: The geotextile filter shall be in accordance with AASHTO M288 guidelines.
3. Impervious Material: Clay soil and/or low permeability geosynthetic shall have a coefficient of permeability of less than 10^{-7} cm/s as tested in accordance with ASTM D5084 or ASTM D4491, as applicable.
4. Construction Adhesive: Exterior grade adhesive as recommended by the retaining wall unit manufacturer.

9.7.10 PREPARATION

1. Ensure surrounding structures are protected from the effects of wall excavation.
2. Excavation support, if required, is the responsibility of the Contractor, including the stability of the excavation and its influence on adjacent properties and structures.

9.7.11 FOUNDATION PREPARATION

1. Excavate foundation soil as required for footing or base dimension shown on the Drawings, or as directed by the Project geotechnical engineer.
2. The Project geotechnical engineer will examine foundation soil to ensure that the actual foundation soil strength meets or exceeds that indicated on the Drawings. Remove soil not meeting the required strength. Oversize resulting space sufficiently from the front of the block to the back of the reinforcement, and backfill with suitable compacted backfill soils.
3. The Project geotechnical engineer will determine if the foundation soils will require special treatment or correction to control total and differential settlement.
4. Fill over-excavated areas with suitable compacted backfill, as recommended by the Project geotechnical engineer.

9.7.11.1 BASE COURSE PREPARATION

9.7.11.1.1. Place base materials to the depths and widths shown on the Drawings, on undisturbed soils.

1. Extend the leveling pad laterally at least 6 inches in front and behind the lowermost concrete retaining wall unit.
2. Provide aggregate base compacted to 6 inches thick (minimum).
3. The Contractor may at their option, provide a concrete leveling pad as specified in lieu of the aggregate base.
4. Where a reinforced footing is required by local codes, place footing below frost depth.

9.7.7.11.1.2 Compact aggregate base material to provide a level, hard surface on which to place the first course of units.

9.7.7.11.1.3 Prepare base materials to ensure complete contact with retaining wall units.

9.7.12 ERECTION

9.7.12.1.General:

Erect units in accordance with manufacturer's instructions and recommendations, and as specified herein.

1. Place first course of concrete wall units on the prepared base material. Check units for level and alignment. Maintain the same elevation at the top of each unit within each section of the base course.
2. Ensure that foundation units are in full contact with natural or compacted soil base.
3. Place concrete wall units side-by-side for full length of wall alignment. Alignment may be accomplished by using a string line measuring from the back of the block.
4. Place 12 inches (minimum) of drainage aggregate directly behind the concrete wall units. Fill voids in and between retaining wall units with drainage aggregate. Provide a drainage zone behind the wall units to within 12 inches of the final grade. Cap the backfill and drainage aggregate zone with 6 inches of impervious material. Design Engineers can waive the drainage aggregate requirement if they independently evaluate the reinforced backfill and find it to have sufficient drainage properties. If waived, the Design Engineer shall design and require a suitable filter fabric between the SRW units and the reinforced backfill zone per AASHTO M288 Design Guidelines.
5. Install drainage pipe at the lowest elevation possible, to maintain gravity flow of water to outside of the reinforced zone. Slope the main collection drainage pipe; located just behind the concrete retaining wall units, 2 percent (minimum) to provide gravity flow to the day-lighted areas. Daylight the main collection drainage pipes to an appropriate location away from the wall system. The daylight drainage pipe should be placed at the lowest point and at 50-foot (maximum) intervals along the wall.
6. Remove excess fill from top of units and install next course. Ensure drainage aggregate and backfill are compacted before installation of next course.
7. Check each course for level and alignment. Adjust units as necessary to maintain level and alignment prior to proceeding with each additional course. Install alignment devices (pins) if required.
8. Install each succeeding course. Backfill as each course is completed. Pull the units forward until the locating surface of the unit contacts the locating surface/device of the units in the preceding course. Interlock wall segments that meet at corners by overlapping successive courses. Attach concrete retaining wall units at exterior corners with adhesive specified.
9. Install geosynthetic reinforcement in accordance with geosynthetic manufacturer's recommendations and the shop drawings.
 - 9.1 Orient geosynthetic reinforcement with the highest strength axis perpendicular to the wall face.
 - 9.2 Prior to geosynthetic reinforcement placement, place the backfill and compact to the elevation of the top of the wall units at the elevation of the geosynthetic reinforcement.
 - 9.3 Place geosynthetic reinforcement at the elevations and to the lengths shown on the Drawings.
 - 9.4 Lay geosynthetic reinforcement horizontally on top of the concrete retaining wall units and the compacted backfill soils. Place the geosynthetic reinforcement within one inch of the face of the concrete retaining wall

units. Place the next course of concrete retaining wall units on top of the geosynthetic reinforcement.

- 9.5. The geosynthetic reinforcement shall be in tension and free from wrinkles prior to placement of the backfill soils. Pull geosynthetic reinforcement hand-taut and secure in place with staples, stakes, or by hand tensioning until the geosynthetic reinforcement is covered by 6 inches of loose fill.
- 9.6. The geosynthetic reinforcements shall be continuous throughout their embedment lengths. Splices in the geosynthetic reinforcement strength direction are not allowed.
- 9.7. Do not operate tracked construction equipment directly on the geosynthetic reinforcement. At least 6 inches of compacted backfill soil is required prior to operation of tracked vehicles over the geosynthetic reinforcement. Keep turning of tracked construction equipment to a minimum.
- 9.8. Rubber-tired equipment may pass over the geosynthetic reinforcement at speeds of less than 5 miles per hour. Turning of rubber-tired equipment is not allowed on the geosynthetic reinforcement.

9.7.13 BACKFILL PLACEMENT

- 1 Place reinforced backfill, spread and compact in a manner that will minimize slack in the reinforcement.
- 2 Place fill within the reinforced zone and compact in lifts not exceeding 6 to 8 inches (loose thickness).
 - 2.1 Only lightweight hand-operated compaction equipment is allowed within 4 feet of the back of the retaining wall units. If the specified compaction cannot be achieved within 4 feet of the back of the retaining wall units, replace the reinforced soil in this zone with drainage aggregate material.
3. Compaction testing shall be done in accordance with ASTM D1556 or ASTM D2922. Refer to Article 3.10 for compaction testing.
4. Minimum Compaction Requirements for Fill Placed in the Reinforced Zone is as followed:
 - 4.1 The minimum compaction requirement will be determined by the project geotechnical engineer. At no time shall the soil compaction requirements be less than 95 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)] for the entire wall height
 - 4.2 Utility Trench Backfill: Compact utility trench backfill in or below the reinforced soil zone to 98 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)], or as recommended by the Project geotechnical engineer. If the height from the utility to finish grade is higher than 30 feet, increase compaction to 100 percent of the standard Proctor density [modified Proctor density].
Utilities must be properly designed (by others) to withstand all forces from the retaining wall units, reinforced soil mass, and surcharge loads, if any.
 - 4.3 Moisture Content: Within 3 percentage points of the optimum moisture content for all wall heights.

5. At the end of each day's operation, the wall installer shall slope the last level of compacted backfill away from the interior (concealed) face of the wall to direct surface water runoff away from the wall face.
 - 5.1 The General Contractor is responsible for ensuring that the finished site drainage is directed away from the retaining wall system.
 - 5.2 In addition, the General Contractor is responsible for ensuring that surface water runoff from adjacent construction areas is not allowed to enter the retaining wall area of the construction site.

9.7 14 CAP UNIT INSTALLATION

- 9.7.14.1 Apply adhesive to the top surface of the unit below and place the cap unit into desired position.
- 9.7.14.2. Cut cap units as necessary to obtain the proper fit.
- 9.7.14.3. Backfill and compact to top of cap unit.

9.7.15 SITE CONSTRUCTION TOLERANCES

9.7.15.1 Site Construction Tolerances

1. Vertical Alignment: Plus or minus 1-1/2 inches over any 10-foot distance, with a maximum differential of 3 inches over the length of the wall.
2. Horizontal Location Control From Grading Plan
 - 2.1. Straight Lines: Plus or minus 1-1/2 inches over any 10-foot distance.
 - 2.2. Corner and Radius Locations: Plus or minus 12 inches
 - 2.3. Curves and Serpentine Radii: Plus or minus 2 feet.
3. Immediate Post Construction Wall Batter: Within 2 degrees of the design batter of the concrete retaining wall units.
4. Bulging: Plus or minus 1-1/4 inches over any 10-foot distance.

9.7.16 ADJUSTING AND CLEANING

- 9.7.16.1. Replace damaged units with new units as the work progresses.
- 9.7.16.2. Remove debris caused by wall construction and broom clean adjacent paved areas.the area compacted by the hand-operated compaction equipment.

9.7.17. Maintenance

- 9.7.17.1. Table below demonstrate the required maintenance for Segmental retaining Walls

Table 2—Example SRW Maintenance Schedule (ref. 4)

Task:	Frequency
Check overall appearance of the structure for any signs of damage or poor performance.	Periodically
Examine drainage outlets to ensure proper function.	Biannually
Check to ensure roof drains, downspouts and other water sources are directed away from the wall. Check that water collection structures are operating properly. Clean and repair as necessary.	Spring and fall
Check for locations and sources of water.	Annually (spring)
Check to ensure grade slopes away from wall or that drainage swales are working properly.	Annually (spring)
Examine drainage outlets for presence of vermin. Remove nests and clean as necessary. Install vermin caps or screens as necessary.	Annually
If a coating has been applied, examine the condition of the coating.	Annually
Examine the condition of cap units and the effectiveness of cap unit adhesive.	Annually
If large trees and/or shrubs are present, examine the impact of root structures on the wall.	Annually
Check for the presence of dirt, efflorescence and graffiti. Clean as necessary.	Annually
Check vertical and horizontal alignment of wall surfaces.	Every 2 to 5 years

NCMA TEK 15-3A

9.8 Guidelines for Concrete Retaining Walls:

9.8.1 Scope of Work:

1. This item shall govern reinforced Portland cement concrete precast or cast-in-place retaining walls constructed in conformity with the lines, grades and details indicated on the Drawings or as directed by the Engineer or designated representative.
2. When indicated on the drawings or directed by the Engineer or designated representative, this item shall also govern any requirements for pumping, bailing, drainage and/or protection of workers in trenches in compliance with Standard Specification Item No. 509S, "Excavation Safety Systems".

9.8.2 Submittals

9.8.2.1. The submittal requirements of this specification item may include:

9.8.2.1.1. Type of concrete

9.8.2.1.2. Reinforcing steel type, size, area, lengths

9.8.2.1.3. Joint sealants and fillers type, manufacturer, fact sheets and application recommendations.

9.8.2.1.4. Curing compound: manufacturer, type compound material, batch number or symbol and appropriate fact sheets

9.8.2.1.5. Filter fabric manufacturer, fact sheets and test results.

9.8.2.1.6. Select Backfill source, gradation and test results.

9.8.2.1.7. Type and manufacturer of waterstops

9.8.3 Materials

9.8.3.1 Concrete

Cast-in-place Portland cement concrete shall conform to the requirements of a Class C Concrete, but shall have a minimum 28 day compressive strength of 3500 psi air entrained (6%) minimum where applicable and as specified.

9.8.3.2. Reinforcing Steel; Reinforcing steel shall be grade 60 minimum and as specified on the drawings.

9.8.3.3. Joint Sealants and Fillers

Preformed Bituminous Fiber Material shall meet the requirements of ASTM D 1751. Joint sealant shall be a non-sag low-modulus silicone.

9.8.3.4. Membrane Curing Compound

9.8.3.5. Filter Fabric

9.8.3.6. Select Backfill

9.8.3.7. Waterstops; Waterstops, if shown on the Drawings

9.8.3.8. Drainage pipes

9.8.4 References:

ACI 318 "Building Code requirements for Structural Concrete"

ACI 347 "Guide to Formwork for Concrete"

ACI 306.1 "Standard Specification for Cold Weather Concreting"

ACI 305.1 "Standard Specification for hot Weather Concreting"

ASTM A 82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

ASTM A 185 – Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

ASTM A 496 – Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.

ASTM A 497 – Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.

ASTM A 775 – Standard Specification for Epoxy-Coated Reinforcing Steel Bars. Erection;

ASTM C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field

ASTM C 33 – Standard Specification for Concrete Aggregates

ASTM C 39 – Standard Test Method for Compressive Strength of Cylindrical

ASTM C 94 – Standard Specifications for Ready-Mixed Concrete

ASTM C 143 – Standard Test Method for Slump of Hydraulic Cement Concrete

ASTM C 150 – Standard Specification for Portland Cement

ASTM C 172 – Standard Practice for Sampling Ready-Mixed Concrete.

ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete.

AWS D1.4 – Structural Welding Code – Reinforcing Steel

CRSI – Manual of Standard Practice

CRSI – Placing Reinforcing Bars

CRSI – Reinforcement Anchorages and Splices

PCA- Portland Cement Association – Design and Control of Concrete Mixtures

9.8.5 Costruction:

- 9.8.5.1.** Cast-in-place Portland cement concrete retaining walls shall be constructed in one continuous vertical pour from the top of the footing to the top of the wall. The height of the retaining wall will be determined by established grades or as directed by the Engineer or designated representative.
- 9.8.5.2.** Reinforcement for the wall shall be as indicated on the Drawings. The Contractor shall provide dowel bars of the proper size, shape and spacing, as indicated on the drawings.
- 9.8.5.3.** Devices to release the hydrostatic head shall be installed as indicated on the drawings.
- 9.8.5.4.** All exposed corners and edges shall be filleted with triangular chamfer strips measuring 3/4 inch on each side. Exposed horizontal surfaces shall be level and flat, and exposed vertical surfaces shall be plumb and flat, unless indicated otherwise on the Drawings.

9.8.6. Vertical Control Joints

- 9.8.6.1.** Unless indicated otherwise on the Drawings, vertical control joints shall be constructed in the retaining wall stem (the vertical portion of the wall) to create planes of weakness to control cracking. Horizontal wall reinforcement shall extend through the vertical control joints. These joints shall be constructed at abrupt
- 9.8.6.2.** Changes in wall height and at a spacing not to exceed 20 feet in wall sections of uniform. The joints shall be formed by placing triangular chamfer strips to create grooves in both faces of the wall to a depth of at least ten percent of the wall thickness. Control joints shall be sealed, on the backfilled side of the retaining wall, with a non-sag low-modulus silicone sealant, or, alternatively, the joint may be covered with a waterproofing material consisting of an 18-inch wide strip of self-adhering polyethylene having a rubberized asphalt mastic, as approved by the Engineer or designated representative.

9.8.7. Vertical Expansion Joints

- 9.8.7.1.** Vertical expansion joints shall conform to the applicable section of Standard Specification Item 410S, "Concrete Structures". These joints shall be constructed at a spacing not to exceed 60 feet, unless indicated otherwise on the Drawings. They shall extend the full height and width of the wall, including the wall footing, and shall consist of sleeved dowels and 1/2-inch thick preformed bituminous fiber material. The edges and corners of the joints shall be formed by triangular chamfer strips measuring 3/4 inch on each side. The concrete on the two sides of an expansion joint shall be placed in two separate pours unless approved otherwise by the Engineer or designated representative.

9.8.8 Construction Joints

9.8.8.1 Construction joints shall conform to the applicable section of Standard Specification Item 410S, "Concrete Structures". Wall reinforcement shall extend through the construction joint unless indicated otherwise on the Drawings,

9.8.9 Waterstops

9.8.9.1. Waterstops shall be provided in construction and expansion joints in retaining walls where water-tightness is essential to the function of the structure, as in detention, retention, or water quality ponds or flood walls.

9.8.10. Measurement

9.8.10.1. Accepted cast in place or precast Portland cement concrete work as prescribed by this item will be measured by the cubic yard for reinforced concrete retaining wall, complete in place. All concrete quantities will be based on the dimensions indicated on the drawings.

9.9 Guidelines for Concrete Masonry Retaining Walls:

9.9.1 All Masonry structures, walls, shall comply with the MSJC (ACI 530) code requirements and specification, which governs masonry construction requirements and quality assurance provisions.

9.9.2 References:

1. Hollow or solid concrete masonry units used in gravity retaining walls should meet the requirements of:
2. ASTM C 90 and preferably have an oven-dry density of 125 lb/ft³ (2002 kg/m³) or more. Cores of hollow units are typically filled to increase the weight of the wall. Bond is important to ensure sufficient shear resistance to withstand the pressure exerted by the retained earth.
3. ASTM C 270 for type M or S mortars.

1. Timber Retaining walls:

9.10.1 Timber Retaining Walls Materials

9.10.1.1 Materials Approval

Prior to delivery of any material used in the construction of the retaining wall, the sources must be accepted in conformance with the material specifications associated with the wall type being constructed.

9.10.1.2. Structural lumber shall be exterior grade, smooth cut, pressure treated Southern Yellow Pine (SYP) #2 or better, and approved for ground contact. The lumber sizes shall be per approved plans and specifications.

9.10.1.3. shall be graded in accordance with the grading rules, applicable to the specified species per latest applicable NDS and conform to the basic principles of ASTM Standards D 245.

9.10.1.4. All Preservative treated lumber shall bear the quality mark of an inspection agency that maintains continuing supervision, testing, and inspection over the quality of the preservative treated wood.

9.10.1.5. The quality mark shall be on a stamp or label affixed to the lumber and shall include the following information:

1. Identification of treating manufacturer.
2. Type of preservative used.
3. Minimum preservative retention (pcf)
4. End use for which the product is treated.
5. AWWPA standard to which the product was treated.
6. Identity of the accredited inspection agency.

9.10.1.6. All hardware shall be hot dipped galvanized or stainless steel where specified. The bolts shall be hot dipped galvanized or stainless steel 1/2" inch with nuts and washers on both faces of the supporting lumber.

9.10.1.7. Treated lumber, timber, piles, poles, or posts shall be free from heat checks, water bursts, excessive checking, results of chafing or from any other damage or defects that would impair their usefulness or durability for the purpose intended. Holes bored for tests shall be filled with tight fitting treated plugs.

9.10.1.8. Treated timber and lumber shall be impregnated with the specified type and quantity of preservative. All material shall be sound wood, free from decay, and shall be adequately seasoned and dried before impregnation with preservative.

9.10.1.8.1. The moisture content before treatment shall not exceed 19 percent.

9.10.1.8.2. Lumber shall be subject to inspection at the treating plant prior to treating.

9.10.1.8.3. Nails and other hardware shall be galvanized and shall conform to Section

9.10.1.8.4. Structural Lumber shall be 6" x 8", exterior grade, smooth cut pressure treated

9.10.1.8.5. Douglas Fir or Southern Yellow Pine and shall conform to NDS and conform to the basic principles of ASTM Standards D 245.

9.10.1.9. Steel bolts

9.10.1.9.1. shall conform to the requirements of ASTM Specification A 307, and shall be galvanized or zinc-coated. The zinc coating shall conform to the requirements of ASTM Specification A 153.

9.10.1.9.2. Washers

9.10.1.9.2.1. Shall be steel plate as specified on the drawings. Washers shall have a minimum thickness equal to 1/2 the diameter of the bolt and have a diameter equal to four times the thickness of the bolt. Holes in washers shall be not more than one-eighth (1/8) inch greater in diameter than the bolt.

9.10.2 HANDLING AND STORING MATERIALS

All timber and lumber stored at the site of the work shall be neatly stacked on supports at least six inches above the ground surface and protected from the weather by suitable covering. Treated timber shall be close-stacked. The ground underneath and in the vicinity of all stacks shall be cleared of weeds and rubbish. The use of cant hooks, peavies, or other pointed tools, except end hooks will not be permitted in the handling of structural timber or lumber. Treated timber shall be handled with rope slings or other methods that will prevent the breaking or bruising of outer fibers, or penetration of the surface in any manner

9.10.3. Guidelines for Timber Walls:

1. Check for the required permits (zoning, site plan amendment and building permit)
2. Based on the height of the wall, and any surcharge, sealed and signed drawings are required.
3. Prior to construction review the existing site and soil conditions.
4. In general the subgrade for the retaining wall shall be placed on dense sand and gravel.
5. Soft and compressible clay are not acceptable soils
6. Remove questionable soils to a depth of 4'-0" minimum and replace with properly compacted granular soils.

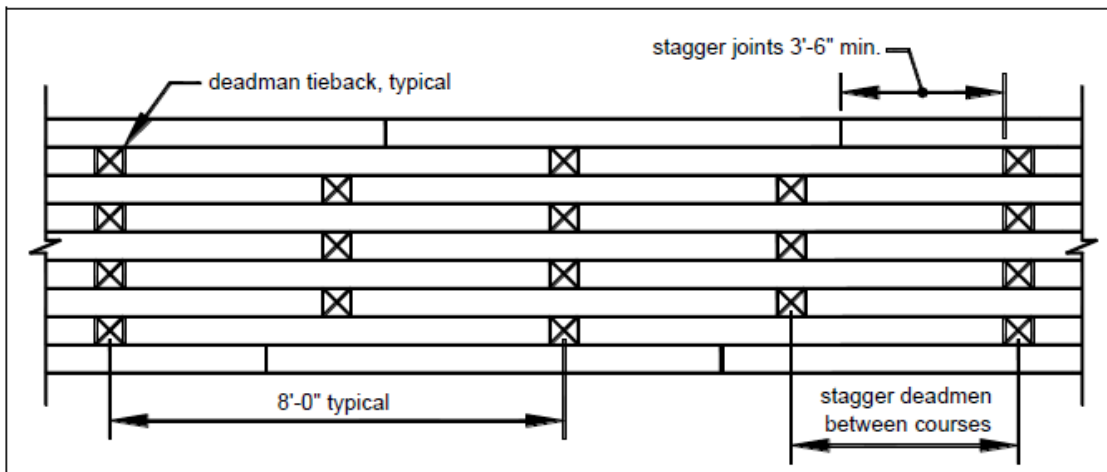


FIGURE 1: TYPICAL ELEVATION

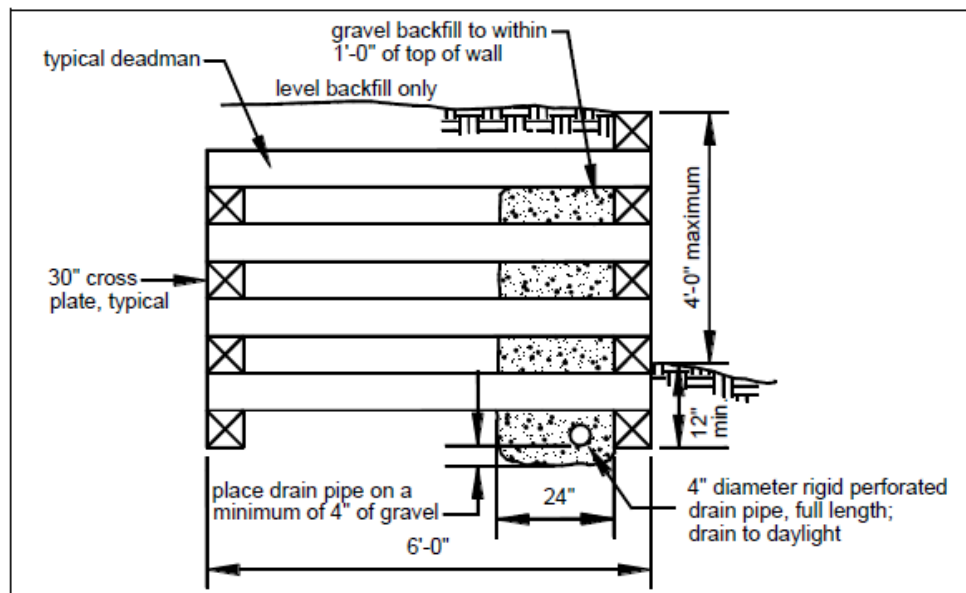


FIGURE 2: TYPICAL SECTION

9.10.3.1. Leveling Pad

1. Call Miss Utility to locate all underground utilities. Keep a copy of the final Miss Utility "ok" by all utility companies for the record.
2. Excavate a trench for the leveling pad to the width required.
3. The trench shall be deep enough to accommodate 6" of aggregate or 4" of concrete plus the number of buried timbers below grade. The embedment shall be 6" minimum or 1/10 of total wall height, whichever is greater.
4. The pad shall be extended 6" minimum laterally on each side of the timbers.
5. Remove all loose soil and compact with a mechanical plate compactor.
6. For aggregate leveling pad place aggregates in 4" lifts.
7. Use screed boards for leveling pad construction.
8. Level the screed board along the length of the.
9. Place additional soil up to approximately ½" of the top of the board.
10. Place the first row of the timber.

9.10.3.1.1 Concrete Leveling pad:

1. Place the concrete between the boards and screed off the excess concrete.
2. Place the first course of timbers in place, and install the anchors.
3. Level the timbers.
4. Let the concrete cure for 24 hours minimum before placing the next row.

9.10.3.1.2. Placement of the timber

1. Place the first course of timbers in the center of the leveling pad. As specified above.
2. The first row shall be in complete contact with the pad.
3. Do not use the timbers that are bowed or warped.
4. The lip on the back of the timber shall become embedded in the leveling pad.
5. Anchor the timbers into the underlying soil with minimum 36" long anchors or re-bars.
6. The reinforcement bars shall be place at each end of each timber with minimum 2'-0" embedment into the underlying soil.
7. Clean debris from the timber and install the next row.
8. Stagger the timbers so the joints will not line up.
9. Reinforcement bars shall be placed in all holes and staggered.
10. After the first course of timbers placed backfill and compact the dirt in front and behind the wall until the entire first course is buried.

9.10.3.1.3 Fabrication

1. Timber and lumber shall be accurately cut and assembled to a close fit and shall have even bearing over the entire contact surfaces.
2. No cut joints will be accepted which are due to misalignment of adjacent posts. Cut joints will be allowed only to accommodate curves in alignment or as staked in the field. No open or shimmed joints will be accepted.
3. Deep hammer marks in wood surfaces shall be considered evidence of poor workmanship and sufficient cause for rejection of the work.
4. Stain less steel or hot dipped galvanized washers shall be used in contact with all bolt heads and nuts that are in contact with wood.
5. Bolts in contact with ground shall be galvanized or stainless steel.
6. All nuts shall be checked or burred effectively with a pointed tool after being finally tightened.
7. Cuts on treated timber shall be carefully trimmed and coated with not less than three brush coats of the same preservative used in the original treatment.
8. All holes bored in treated timber and lumber shall be swabbed with minimum three coats of the same preservative used in the original treatment. After field treatment any unfilled holes shall be plugged with tightly fitting wooden plugs treated with the same preservative used in the original treatment.

9.10.3.1.4. Wall Drainage Systems

Appropriate drainage system to prevent surface water from infiltrating into the wall backfill should be included in the design of a wall system.

During construction, the backfill surface should be graded away from the wall at the end of each day of construction to prevent water from ponding behind the wall and saturating the soil.
Filter fabric shall be installed

9.11 Rubble Wall

9.11.1 This section describes the classes commonly known as coursed, random, and random range work and consists of roughly squared and dressed stone laid either in cement mortar or without mortar, as the contract requires and as specified in the plans.



Joints: Drystack



Joints: $\frac{1}{2}$ " Deep Raked

9.11.2 REFERENCE STANDARDS

1. American Concrete Institute (ACI):
 - 1.1 ACI 530/530.1-02/530R/530.1R-02 Building Code Requirements and Commentary for Masonry Structures and Specification for Masonry Structures and Related Commentaries.
2. ASTM International (ASTM):
 - 2.1 ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2.2 ASTM C144 Standard Specification for Aggregate for Masonry Mortar.
 - 2.3 ASTM C150 Standard Specification for Portland Cement.
 - 2.4 ASTM C778 Standard Specification for Standard Sand.
 - 2.5 ASTM C847 Standard Specification for Metal Lath.
 - 2.6 ASTM C979 Standard Specification for Pigments for Integrally Colored Concrete.
 - 2.7 ASTM D226 Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
3. ICC Evaluation Services, Inc. (ICC-ES):
 - 3.1 AC51 Acceptance Criteria for Precast Stone Veneer.
4. Uniform Building Code (UBC):
 - 4.1 UBC for Precast Stone Veneer (ICBO; AC51).
 - 4.2. UBC Standard No. 14-1 Kraft Waterproof Building Paper.
5. US Green Building Council (USGBC):
 - 5.1. Leadership in Energy and Environmental Design (LEED)

9.11.3 SUBMITTALS

Note: Samples are full-size actual products intended to illustrate the products to be incorporated into the project. Sample submittals are shall be provided by the contractor/installer to PRCS for such characteristics such as colors, textures and other appearance issues.

9.11.3.1 Samples:

9.11.3.1.1 Submit samples as follows:

1. Submit two samples each of stone.
2. Submit one sample of each accessory.

9.11.3.2 Product Data:

9.11.3.2.1 Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.

1. Material safety data sheets (MSDS).
2. Submit product data sheet prior to mixing or preparation of mortar.

9.11.3.3. INFORMATION SUBMITTALS

9.11.3.3.1 Test Reports:

Certified test reports showing compliance with specified performance characteristics and physical properties.

9.11.3.3.2 Certificates:

Product certificates signed by manufacturer certifying materials comply with specified criteria, performance characteristics and physical requirements.

9.11.3.3.3. Manufacturer's Instructions: Manufacturer's installation and mixing instructions.

9.11.3.3.4. Letter of Verification:

Manufacturer's Qualifications.

9.11.3.3.5. Letter of Verification:

Installer's Qualifications.

9.11.3.4. CLOSEOUT SUBMITTALS

9.11.3.4.1. Warranty:

Submit warranty documents specified.

9.11.3.4.2. Operation and Maintenance Data:

Submit Operation and Maintenance data for installed products.

9.11.3.4.2.1. Include: Manufacturer's instructions covering maintenance requirements.

9.11.4. QUALITY ASSURANCE

9.11.4.1. Qualifications:

1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving application method.

9.11.5 Materials

9.11.5.1 General

Furnish portland cement and water as specified, unless the engineer allows an alternate, use either type I, IL, IS, or IP cement.

9.11.5.1.1 Portland Cement

9.11.5.1.1.1 Use cement conforming to ASTM specifications as follows:

1. Type I portland cement; ASTM C150.
2. Type II portland cement; ASTM C150.
3. Type III portland cement; ASTM C150, for high early strength.
4. Type IP portland-pozzolan cement; ASTM C595, except maximum loss on ignition is 2.0 percent.
5. Type IS portland blast-furnace slag cement; ASTM C595.
6. Type IL portland-limestone cement; ASTM C595, except maximum nominal limestone content is 10 percent with no individual test result exceeding 12.0 percent.

9.11.5.1.1.2. Store cement of different types, brands, and sources separately. Keep batches of concrete made from different types, brands, and sources from becoming intermixed in the work, unless the engineer approves otherwise.

9.11.5.1.1.3. Furnish masonry cement conforming to ASTM C91, type S.

9.11.5.1.1.4. Furnish hydrated lime conforming to ASTM C207.

9.11.5.2. Stone:

9.11.5.2.1 Stone used for rubble masonry shall be of engineer-approved quality, sound, durable, and free from segregations, seams, cracks, and other structural defects impairing its resistance to the weather. Ensure it is free from rounded, worn, or weathered surfaces. Stones with flat faces as nearly parallel as it is practical shall be selected.

9.11.5.2.1.1. Size Requirements

Use 6-inch or thicker stones at least 1 1/2 times wider than they are thick. Ensure that individual stones, except headers, are at least 1 1/2 times longer than they are wide. Vary the thickness throughout the wall using thicker stones on the bottom.

9.11.5.2.1.2 Shaping the Stone

1. Roughly square the stones on joints, beds, and faces. At angles and ends of walls, use selected stone roughly squared and pitched to line. If specified, finish the corners or angles in exterior surfaces with a chisel draft.
2. Before laying the stone in the wall, shape and dress it so that it will not loosen after it is placed. No dressing or hammering which will loosen the stone will be permitted after it is placed.

9.11.5.2.1.3 Laying the Stone

1. Decrease the stone thickness from the bottom to the top of wall.

2. Ensure that the headers in the heart of the wall are the same size as shown in the face and extend at least 12 in into the core or backing.
3. Ensure that headers in walls 2 ft or less in thickness extend entirely through the wall. The headers shall occupy at least 20 percent of the face of the wall.
4. Lay the masonry to line and in roughly leveled courses. Ensure that the bottom of the foundation is large, selected stones.
5. Lay the courses with leaning beds parallel to the natural bed of the material.
6. Regularly diminish the thicknesses of the courses, if varied, from the bottom to the top of the wall. Keep a surplus supply of stones at the site to select from.
7. When mortar masonry is specified:
 - 7.1 Clean each stone and saturate it with water before setting it. Clean and moisten the bed that will receive it.
 - 7.2 Bed the stones in freshly made mortar with full joints. Carefully settle the stones in place before the mortar sets.
 - 7.3 Do not permit spalls in the beds. Ensure that the joints and beds have an average thickness of not more than 1 in.
 - 7.4 Ensure that the vertical joints in each course break with the adjoining courses at least 6 in.
 - 7.5 Do not place vertical joints directly above or below a header joint.
 - 7.6 If a stone is moved or if the joint is broken after the mortar has set, take the stone up and thoroughly clean the mortar from the bed and joints.
 - 7.7 Reset the stone in fresh mortar.
 - 7.8 Do not lay the masonry in freezing weather or when the stone contains frost, except by permission and subject to required conditions.
 - 7.9 Whenever possible, properly point the face joints before the mortar sets. If joints cannot be pointed, rake them out to a depth of 1 in before the mortar sets.
 - 7.10 Do not smear the stone face surfaces with the mortar forced out of the joints or the mortar used in pointing.
 - 7.11 Thoroughly wet the joints pointed after the stone is laid with clean water and fill with mortar.
 - 7.12. Drive the mortar into the joints and finish with an approved pointing tool.

7.13. Keep the wall wet while pointing. In hot or dry weather, protect the pointed masonry from the sun and keep it wet for at least three days after the pointing is finished.

NOTE: Do not perform pointing in freezing weather or when the stone contains frost. After the pointing is completed and the mortar is set, thoroughly clean the walls and leave them in a neat condition.

9.11.5.3 Aggregate:

Aggregate shall be delivered, stored and handled so as to avoid mixing of different sizes, segregation in particular size, breakage, contamination with deleterious matter and retention of water.

9.11.5.3.1. Coarse Aggregate

Those aggregates predominantly retained on the No. 4 sieve. Coarse aggregate shall consist of well-shaped clean, hard, dense, durable rock fragments and shall not contain substances which may impair the quality of the concrete, or may attack reinforcing steel, or reduce bond.

9.11.5.3.1.1. Grading

Coarse aggregate shall be graded as specified below

US Standard Sieve	Nominal 1-1/2"	Nominal 3/4"
2"	100	
1 1/2"	95-100	100
3/4"	35-70	90-100
3/8"	10-30	20-55
No. 1	0-5	0-10

9.11.5.3.2. Fine Aggregate

Shall be natural sand or manufactured sand. It shall consist of clean, hard, dense and durable rock particles, free from injurious amounts of dust, silt, stone powder, pieces of thin stone, alkali, organic matter and other impurities. The silt, clay and dust fraction by weight shall not exceed 3 % for natural sand and 15 % for crushed sand.

9.11.5.3.2.1. Grading

Those aggregates that entirely pass the 3/8-inch sieve, almost entirely pass the No. 4 sieve and are predominantly retained on the No. 200 sieve. Fine aggregate shall be graded as specified below. Fine aggregates

US Standard Sieve Size	Percentage Passing by Weight
3/8"	100
4	95 to 100
8	80 to 100
16	50 to 85
30	25 to 60

50	10 to 30
100	2 to 10

9.11.5.4 Water

Water for the mixing and curing of concrete, mortar shall be potable and shall be clear and free from deleterious substances including salt, oil, alkali, or organic matter.

9.11.5.5. Mortar

1. Use mortar for laying the stone and pointing composed of 3 parts sand for mortar and one part of any one of the following materials, by volume: masonry cement, a mixture of 50 percent portland cement and 50 percent masonry cement, or a mixture of 50 percent portland cement and 50 percent hydrated lime.
2. Use a machine to mix the mortar unless the engineer allows otherwise. Prepare machine-mixed mortar in an engineer-approved mixer and mix not less than 1 1/2 minutes. If preparing hand-mixed mortar, mix the sand and cement thoroughly in a clean, tight mortar box until uniform in color, then add clean water in a quantity that forms a stiff paste. Do not use mortar mixed longer than 30 minutes or that develops its initial set.

9.11.6 Dry Rubble Masonry**9.11.6.1 Laying dry rubble:**

1. Take care that each stone takes a firm bearing no less than in three separate points upon the underlying course.
2. Ensure that face joints are no greater than 1 in wide.
3. Chink the open front and rear joints with spalls fitted to take firm bearing upon the top and bottom surfaces throughout the length of the stone.
4. Fill the interstices in the heart of the wall with spalls. When specified, thoroughly slush the open joint on the rear surfaces with mortar to prevent water from seeping through the joints.

9.11.6.2 Weep

Holes Provide adequate drainage for retaining walls with weep holes as shown on the Plans or required by the Engineer. When backfilling at weep holes, build chimneys and french drains extending through the parts of the fill to be drained.

9.11.6.3 Copings

Use copings, bridge seats, and back walls made from the materials shown on the Plans. If not otherwise specified, they shall be Class A concrete. Make concrete copings in sections at least 12 in thick and from 5 to 10 ft long, extending the full width of the wall.

9.11.7. Backfilling

1. The contractor may backfill structures that have attained the specified compressive strength.

- 2.** Backfill material shall be of the approved material free of organic, clay with high plasticity index.

10.0 CARPENTRY

10.0 ROUGH CARPENTRY WORK

10.1. GENERAL

10.1.1 All work under this section is subject to the provisions of Chapter 1, General References for All Sections.

10.2. SCOPE

10.2.1 Provide all labour, Materials, equipment, services, etc., necessary or required for the work of this section, as indicated on the drawings, specified and as required by the existing conditions for proper performance and completion, in accordance with the requirement of the contract documents.

The items of work shall consist generally of, but not limited to the following:

1. Performing all rough carpentry work including rough framing, grounds, blocking, nailing strips, furring and similar rough carpentry for the work of all trades.
2. Temporary enclosures for exterior openings.
3. Wood grounds and blocking.
4. All staging, blocking and shims.
5. New windows sub-frames.
6. Plywood sub-flooring and underlayment.
7. Blocking and backer panels for kitchen cabinets, closets shelves and handicapped grab bars.
8. Suspended ceiling system for all floors.
9. Installation of wood and metal framing for partitions and furring at masonry walls.
10. Engineered wood products, including panels and dimensional wood products.
11. Hardware, fasteners, building paper, and other accessories.

10.3. REFERENCE STANDARDS

Comply with the provisions of the latest versions of the publications listed below except as otherwise shown or specified.

10.3.1 American Hardwood Association (AHA):

1. AHA A135.1—Basic Hardboard.

10.3.2 American Society for Testing and Materials (ASTM) International

1. ASTM A123—Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A153—Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM D226—Specifications for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

4. ASTM D779—Standard Test Method for Water Resistance of Paper, Paperboard, and Other Sheet Materials by the Dry Indicator Method.
5. ASTM D828—Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus.
6. ASTM D1761—Standard Test Methods for Mechanical Fasteners in Wood.
7. ASTM D5456—Specification for Evaluation of Structural Composite Lumber Products.
8. ASTM E96—Test Methods for Water Vapor Transmission of Materials.
9. ASTM E331—Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
10. ASTM F1667—Specifications for Driven Fasteners: Nails, Spikes, and Staples.

10.3.3. APA, The Engineered Wood Products Association and Engineered Wood Systems, a Related Corporation (APA and APA-EWS)

1. APA Product Guide—Grades and Specifications.
2. APA Product Guide—Performance Rated Panels.
3. APA PS 1—Construction and Industrial Plywood (With Typical APA Trademarks).
4. APA PS 2—Performance Standard for Wood-Based Structural-Use Panels.
5. APA Design Construction Guides.
6. APA Technical Notes.
7. APA Research Reports.

10.3.4. U.S. Department of Commerce, National Institute of Standards and Technology (DOC)

1. DOC PS 1—Construction and Industrial Plywood.
2. DOC PS 2—Performance Standard for Wood-Based Structural-Use Panels.
3. DOC PS 20—American Softwood Lumber Standard.

10.3.5. International Building Code (IBC)

1. Legacy Evaluation Reports.

10.3.6. International Code Council, Evaluation Services (ICC-ES)

1. Evaluation Reports.

10.3.7. National Fire Protection Association (NFPA).

10.4 Definitions

Certified Sustainably Harvested Lumber:

Dimensional lumber derived from a Well Managed Forest as certified by one of the following Certification Organizations accredited by the Forest Stewardship Council:

1. Green Cross Certification Program:
Scientific Certification Systems
2. Smart Wood Certification Program:
Rainforest Alliance

3. Pacific Certified Ecological Forest Products:
Institute for Sustainable Forestry
4. Community Forestry Certification Program:
Rogue Institute for Ecology and Economy.

Salvaged Lumber:

Lumber from deconstruction or demolition of existing buildings or structures. Unless otherwise noted, salvaged lumber shall be delivered clean, de-nailed, and free of paint and finish materials, and other contamination. Provide documentation certifying products are from salvaged lumber sources.

Recovered Lumber:

Previously harvested lumber pulled from riverbeds or otherwise abandoned. Unless otherwise noted shall be delivered clean and free of contamination. Provide documentation certifying products are from recovered lumber sources.

10.5 SUBMITTALS:

10.5.1 Product Data

10.5.1.1. Lumber, General:

1. Manufacturer's product literature for fasteners, vapor barrier tape, and building paper.
2. Grade Stamps:
 - 2.1 Furnish lumber with grade-stamps of inspection agency to show compliance with grading rules, and identifying grading agency, grade, species, moisture content and mill number.
3. Provide lumber sizes as required by PS 20, (Product Standard) unless otherwise shown.
4. Provide dressed (surfaced) lumber, S4S (Surface four Sides).
5. Provide seasoned lumber with 19% moisture content.

10.5.1.2 Certifications:

As specified under Quality Assurance, written on official letterhead, signed by officer with legal authority to represent the organization or the manufacturer which offers the certification.

10.5.1.3. Evaluation Reports:

ICC-ES Report with applicable Legacy ICBO Evaluation Report and Legacy NES Report Number for each type of fastener.

10.5.1.4. Sample Warranty:

1. Meet or exceed provisions specified by this Section.
2. Submit samples of each connecting device (typical).

10.6 QUALITY ASSURANCE

1. Evidence of Grade:
Conform to IBC and DOC PS 20.
2. Rough Lumber:
Stamp each piece of lumber and plywood with grademark and trademark of Association having jurisdiction.
3. In Lieu of Grade Stamping Exposed to View Lumber:
Certify by manufacturer that products meet or exceed specified requirements.

10.7 Inspection:

10.7.1 Prior to work of this Section, carefully inspect the installed work of other trades and verify that such work is completed to the point where this installation may properly commence.

10.7.2 Discrepancies:

In the event of discrepancy, immediately notify the Project Manager. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.

10.7.3 Lumber may be rejected by the Project Manager, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus, or mold, as well as for improper cutting and fitting.

10.8 MATERIALS

10.8.1 General:

10.8.1.1. All sawn Lumber shall conform to the specifications and to the applicable current editions of the Standard Specifications of ASTM and IBC and all reference codes and standards.

10.8.1.1.1. All design values shall comply with the grading rules published by seven agencies:

1. National Lumber Grade Authority (NLGA).
2. Northeastern Lumber Manufacturers Association (NELMA).
3. Northern Softwood Lumber Bureau (NSLB).
4. Redwood Inspection Services (RIS).
5. Southern Pine Inspection Bureau (SPIB).
6. West Coast Lumber Inspection Bureau (WCLIB).
7. Western Wood Products Association (WWPA).

10.8.1.2. Plywood:

U.S. Product Standard PS1 (latest edition), grade stamped and edge branded to Standards of the APA - The Engineered Wood Association.

10.8.1.3. Lumber Grade Marking:

Each piece of lumber shall bear the official grade mark of the appropriate inspection bureau as listed in section 10.8.1.1.1.

10.8.1.4. Lumber Size and Patterns:

Sizing and surfacing shall be as required and approved for the particular location. Framing shall be sized and where exposed shall be surfaced.

10.8.1.5 Fir Plywood: U.S. Product Standard PS1 (latest edition), grade stamped and edge branded to DFPA Standards of the American Plywood Association.

10.8.1.6 Dimensional lumber 2 inches or less in thickness shall have an average moisture content of 19 percent or less. Air dried lumber is desired but, if necessary, lumber may be kiln dried, however, the drying process must be slow and regulated to cause only an amount of checking comparable with air-dried stock. Wood thicker than 2-1/2 inches shall be well seasoned stock, moisture content not to exceed 18 percent.

10.8.1.7. Sills and equipment curbs which rest on concrete or exposed earth shall be foundation grade Redwood or preservative pressure treated SYP (Southern Yellow Pine).

10.8.1.8. Exterior stair framing and decking, and wood exposed to the exterior, or otherwise shown, shall be Pressure Treated lumber.

10.8.1.9 Dimensional lumber shall be derived from either Certified Sustainable Harvested Lumber or Salvaged and/ or Recovered Lumber.

10.9. Structural use panels for Wall, floor and roof Sheathing:

10.9.1 Structural-use panels are wood-based panel products that have been rated for use in structural applications. Common applications for structural-use panels include roof sheathing, wall sheathing, subflooring, and single-layer flooring (combination subfloor-underlayment).

10.9.1.1 Structural-use panels are classified by span ratings. Panel span ratings identify the maximum recommended support spacing for specific end uses. Design capacities are based on the span ratings.

10.9.1.2. Structural-use panel shall comply to the provisions of PS1 and / or PS2.

1. Single Floor panels are rated for use as combination subfloor-underlayment and are usually manufactured with tongue and groove (T&G) edge profiles.
2. Single Floor panels are typically sanded or touch-sanded while Sheathing panels are usually unsanded.
3. Structural I Sheathing panels meet the requirements of the sheathing grade as well as additional requirements associated with use in panelized roof systems, diaphragms, and shear walls.
5. Each panel shall be identified for grade and glue type by trademark of approved testing and grading agency.
6. All structural sheathing shall conform to IBC for identification of approved testing and inspection agency indicating conformance with applicable standards for design and fabrication of wood structural panel components.

10.9.2 Span Ratings

Span ratings indicate the maximum recommended support spacing, in inches, for specific applications. The span rating system applies when the panel is applied with the reference axis across two or more supports. The reference axis is usually the primary axis of the panel.

1. Sheathing: Sheathing panels rated for use in roof or subfloor applications are identified with a dual span index — two numbers separated by a slash. The number preceding the slash is the maximum recommended support spacing for roof applications. The number following the slash is the maximum recommended support spacing for subfloor applications.

2. Recommendations for use of sheathing panels also include wall applications.
3. Certain of the roof sheathing spans are dependent upon panel edge support

4. Single Floor:

The Single Floor span rating is an index number that provides the maximum recommended support spacing with the primary axis across two or more supports.

10.9.3 Panel Construction:

10.9.3.1. Plywood:

Plywood is comprised of alternating layers of veneer (plies). Each layer consists of one or more plies. Structural-use plywood panels are assembled with waterproof adhesive applied between plies. The adhesive cures upon application of heat and pressure.

10.9.3.2 Oriented Strand Board:

10.9.3.2.1. Oriented strand board (OSB) is comprised of thin rectangular wood strands arranged in a minimum of three cross-aligned layers and bonded under heat and pressure with a waterproof and boil proof adhesive.

10.9.3.2.2. Oriented strand board is manufactured from hardwood species, softwood species, and mixed species. The hardwood species used are selectively harvested from forests that naturally regenerate. The softwood resource is derived from fast-maturing species from managed forests.

10.9.3.3. COM-PLY®: COM-PLY panels

10.9.3.3.1 COM-PLY is composite panel of wood veneer and other wood-based material. COM-PLY panels are typically manufactured with five layers. The outer layers and the center layer are wood veneer, and the two remaining core layers are comprised of wood fiber sandwiched between the veneer layers. COM-PLY panels are manufactured with waterproof adhesives.

10.9.4 Exposure Durability

The following exposure durability classifications are based on product composition and adhesive bond durability.

1. Exterior:

Exterior panels may be used in applications that are permanently exposed to the weather or to moisture.

2. Exposure 1:

Exposure 1 panels may be used in applications that are not permanently exposed to weather or moisture, but where resistance to moisture effects due to high humidity, water leakage, exposure during construction delays, or similar exposure conditions, is required.

3. Exposure 2:

Exposure 2 panels may be used for interior applications requiring resistance to effects of high humidity and water leakage.

10.9.5. DELIVERY, STORAGE, AND HANDLING

1. Conform to the manufacturer's instructions.
2. Deliver from manufacturing plant with manufacturer's identifying labels or markings intact for identifying each panel.
3. Off-load panels from truck and handle using a forklift or other means to prevent bending or twisting of panels.
4. Stack panels on pallets or minimum three stickers so that panels remain flat.
5. Cover and store off ground. Protect against direct exposure to sunlight, water, moisture vapor, mud, dirt, dust, and other residue that may affect panel performance.

10.10 HEAVY TIMBER CONSTRUCTION

10.10.1. This Section is a supplement to the engineering and design requirements for timber frame construction. A timber frame shall be regarded as a structural building frame system or a portion thereof that is composed of timber members.

10.10.2 Heavy timber construction is that type in which fire resistance is attained by placing limitations on the minimum size, thickness, or composition of all load-carrying wood members by avoiding concealed spaces under floors or roofs; by using approved fastenings, construction details, and adhesive; and by providing the required degree of fire resistance in exterior and interior walls.

10.10.3. References:

10.10.3.1 REFERENCE STANDARDS

Comply with the provisions of the latest versions of the publications listed below except as otherwise shown or specified.

1. American Institute of Timber Construction (AITC):
 - 1.1 AITC 108—Standard for Heavy Timber Construction.
2. American Society for Testing and Materials (ASTM) International:
 - 2.1 ASTM A36—Standard Specification for Carbon Structural Steel.
 - 2.2 ASTM A153—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 2.3 ASTM A307—Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

2.4 ASTM A572—High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.

2.5 ASTM D25—Standard Specification for Round Timber Piles.

2.6 ASTM D2555—Standard Test Methods for Establishing Clear Wood Strength Values.

2.7 ASTM D2899—Standard Practice for Establishing Allowable Stresses for Round Timber Piles.

2.8 ASTM D3200—Standard Specification and Test Method for Establishing Recommended Design Stresses for Round Timber Construction Poles.

3. American Welding Society (AWS):

3.1 AWS D1.1—Structural Welding Code

10.10.4 DEFINITIONS

Timbers: Lumber with least dimension 5 inches nominal or greater.

10.10.5 SUBMITTALS

10.10.5.1 Shop Drawings:

1. Dimensions, wood species and grades, component profiles, drilled holes, fasteners, connectors, erection details.
2. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.

10.10.5.2 Product Data:

10.10.5.2.1 Preservative-Treated Wood Products: Chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.

10.10.5.2.2 Timber Connectors: Proprietary connection devices and installation instructions.

10.10.5.3. Samples:

1. Wood Products:
Not less than 9 inches wide by 24 inches long, showing range of variation expected in appearance, including surface texture.
2. Penetrating Sealer:
Apply one coat to samples.

10.10.5.4. Certificate of Inspection:

Issued by lumber grading agency for exposed timber not marked with grade stamps.

10.10.5.5. LEED Submittals:

Provide information required to complete LEED Credit Template submittals to obtain LEED credits. Include the following:

1. EQ 4.1 - Low Emitting Materials - Adhesives and Sealants: Verify VOC content of interior adhesives.
2. EQ 4.4 - Composite Wood and Agrifiber Products: Verify that the composite or agrifiber products used do not contain any ureaformaldehyde.
3. MR 7.0 - Certified Wood: Submit LEED electronic Credit Template. Include list of certified wood and Chain of Custody certification numbers.

10.10.6 DELIVERY, STORAGE, AND HANDLING

10.10.6.1 Conform to the manufacturer's instructions.

1. Delivery:

Schedule heavy timber to avoid extended on-site storage and in time to expedite Work.

2. Storing:

Stack timbers above ground, under cover, and protected from weather, moisture, dampness, and damage. Maintain air circulation around each timber.

3. Handling:

Lift and handle to protect from staining, soiling, abrasion, and other damage.

10.11.4 Heavy Timber Framing:

10.11.4.1. COLUMNS

Wood columns may be sawn or glued laminated and shall be not less than 8 in., nominal, in any dimension when supporting floor loads and not less than 6 in., nominal, in width and not less than 8 in., nominal, in depth when supporting roof and ceiling loads only.

10.11.4.1.1. Columns shall be continuous or superimposed by means of reinforced concrete or metal caps with brackets, or shall be connected by properly designed steel or iron caps, with base plates, or by timber splice plates affixed to the columns by means of metal connectors housed within the contact faces, or by other approved methods.

10.11.4.2 FLOOR FRAMING

10.11.4.2.1. Beams and girders may be sawn or glued laminated and shall be not less than 6 in., nominal, in width and not less than 10 in., nominal in depth. Framed or glued laminated arches which spring from grade or the floor line and support floor loads shall not be less than 8 in., nominal, in any dimension.

Framed timber trusses supporting floor loads shall have members of not less than 8 in., nominal, in any dimension.

10.11.4.2.2 HEAVY TIMBER FLOORS

Floors shall be of sawn or glued laminated: (1) planks splined or tongue-and-groove, not less than 3 in., nominal, in thickness covered with 1 in., nominal, dimension tongue-and-groove flooring laid crosswise or diagonally to the plank or with other approved wearing surfaces, or (2) planks, not less than 4 in., nominal, in width set on edge close together and well spiked, and covered as for 3 in. thick plank. The planks shall be laid so that there is no continuous line of end joints except at points of support. Floors shall not extend closer than 1/2 in. to walls to provide an expansion joint, but the joint shall be covered at top or bottom to avoid flue action.

10.11.4.3. ROOF FRAMING

10.11.4.3.1 Framed or glued laminated arches for roof construction which spring from grade or the floor line and do not support floor loads shall have members not less than 6 in., nominal, in width and not less than 8 in., nominal, in depth for the lower half of the height and not less than 6 in., nominal, in depth for the upper half.

10.11.4.3.2. HEAVY TIMBER ROOF DECKS

Roof decks shall be of sawn or glued laminated:

1. Planks, splined or tongue-and-groove, not less than 2 in., nominal, in thickness 1-1/8 in. thick tongue-and-groove interior plywood (exterior glue), or
2. Planks, not less than 3 in., nominal, in width, set on edge close together and laid as required for floors. Other wood and/or wood-fiber based decking or other types of decking may be used if noncombustible.

10.11.4.4. WALLS

10.11.4.4.1 LOAD BEARING WALLS.

Load Bearing portions of exterior and interior walls shall be of approved noncombustible material and shall have a fire resistance rating of not less than two hours except that, where a horizontal separation of 3 ft or less is provided, load bearing portions of exterior walls shall have a fire resistance rating of not less than three hours.

10.11.4.4.2 NON-LOAD BEARING WALLS.

Non-load bearing portions of exterior walls shall be of approved noncombustible materials except as otherwise noted, and:

1. Where a horizontal separation of 3 ft or less is provided, non-load bearing exterior walls shall have a fire resistance rating of not less than three hours.
2. Where a horizontal separation of more than 3 ft but less than 20 ft is provided, non-load bearing exterior walls shall have a fire resistance rating of not less than two hours.
3. Where a horizontal separation of 20 to 30 ft is provided, non-load bearing exterior walls shall have a fire resistance rating of not less than one hour.
4. Where a horizontal separation of 30 ft or more is provided, no fire resistance rating is required.
5. Where a horizontal separation of 20 ft or more is provided, wood columns, arches, beams and roof decks conforming with heavy timber sizes may be used externally.

10.11.5 CONSTRUCTION DETAILS

10.11.5.1. Wall plate boxes of self-releasing type or approved hangers shall be provided where beams and girders enter masonry. An air space of 1 in. shall be provided at the top, end, and sides of the member unless approved durable or fire retardant treated wood is used.

10.11.5.2. Girders and beams shall be closely fitted around columns, and adjoining ends shall be cross tied to each other, or inter-tied by caps or ties, to transfer horizontal loads across the joint. Wood bolsters may be placed on top of columns which support roof loads only.

10.11.5.3. Where intermediate beams are used to support a floor, they shall be supported;

1. On the top of the girders, or
2. By ledgers or blocks securely fastened to the sides of the girders, or
3. By approved metal hangers into which the ends of the beam shall be closely fitted.

- 10.11.5.4.** Wood beams and girders supported by walls required to have a fire resistance rating of two hours or more shall have not less than 4 in. of solid masonry between their ends and the outside face of the wall and between adjacent beams.
- 10.11.5.5.** Columns, beams, girders, arches, trusses, and floors of materials other than wood shall have a fire resistance rating of not less than one hour.
- 10.11.5.6.** Floors and roof decks shall be without concealed spaces, except that building service equipment may be enclosed provided the spaces between the equipment and enclosures are fire stopped or protected by other acceptable means.
- 10.11.5.7.** Adequate roof anchorage shall be provided.

10.11.6. STANDARD DIMENSIONS FOR HEAVY TIMBER

- 10.11.6.1.** Excellent fire resistance is achieved with "heavy timber" construction. Minimum sawn lumber sizes have been long established. They are expressed in nominal dimensions and assume surfacing to "American Lumber Standard" net sizes.
- 10.11.6.2.** For "heavy timber" construction, the net width of glued laminated structural members shall be the standard glued laminated net width for the nominal sawn width specified, and the net depth of glued laminated structural members shall be equal to or greater than the net finished depth specified by the following table.

10.12. COMPOSITE LUMBER DECKING

10.12.1. REFERENCES

10.12.1.1. Latest ASTM International (ASTM) standards:

- 1.** C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- 2.** D143 - Standard Test Methods for Small Clear Specimens of Timber.
- 3.** D198 - Standard Test Methods of Static Tests of Lumber in Structural Sizes.
- 4.** D1037 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
- 5.** D1413 - Standard Test Method for Wood Preservatives by Laboratory Soil-Block Cultures.
- 6.** D1761 - Standard Test Methods for Mechanical Fasteners in Wood.
- 7.** D1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
- 8.** D2047 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
- 9.** D2394 - Standard Methods for Simulated Service Testing of Wood and Wood-Base Finish Flooring.
- 10.** D2395 - Standard Test Methods for Specific Gravity of Wood and Wood-Based Materials.
- 11.** D4761 - Standard Test Methods for Mechanical Properties of Lumber and Wood-Base Structural Material.

12.E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

13.F1679 Standard Test Method for Using a Variable Incidence Tribometer (VIT).

10.12.1.2. American Wood Preservers Association (AWPA) E1-06 - Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites.

10.12.1.3. International Code Council (ICC) Evaluation Services.

10.12.1.4. International Building Code (IBC)

10.12.2 SUBMITTALS

10.12.2.1. Submittals for Review:

1. Product Data:
Indicate sizes, profiles, surface finishes, and performance characteristics.
2. Samples:
Length of decking and fascia samples illustrating size, profile, color, and surface finish.
3. Regional Materials.
4. Recycled Content

10.12.2.2. Closeout Submittals:

1. Maintenance Data:
Manufacturer's instructions on care and cleaning of composite wood products.

10.12.2.3. DELIVERY, STORAGE AND HANDLING

1. Deliver, store, and handle composite wood in accordance with manufacturer's instructions.
2. Store composite wood level and flat, off ground or floor, with supports at each end and maximum 24 inches on center.
3. Do not stack composite wood over 12 feet high.
4. Cover composite wood with waterproof covering, vented to prevent moisture buildup.

10.12.3. WARRANTIES

Furnish manufacturer's 25 year warranty providing coverage against checking, splitting, splintering, rotting, structural damage from termites, and fungal decay of composite wood.

10.12.4. PRODUCTS

10.12.4.1. INSTALLATION

1. Install composite wood in accordance with manufacturer's instructions.
2. Cut, drill, and rout composite wood using carbide tipped blades.
3. Pre-drill fastener holes located closer than 1 inch from edges.
4. Cut ends square and true.
5. Do not use composite wood products as structural members.
6. Do not exceed maximum spans recommended by manufacturer.

7. Place boards [perpendicular] [diagonal] to supports.
8. Stagger end joints in adjacent rows at least one support.
9. Leave expansion spaces between abutting boards and between boards and adjacent construction:
 - 9.1. End gaps between boards: 1/8 inch at ambient temperatures of 60 degrees F and above and 3/16 inch at ambient temperatures below 60 degrees F.
 - 9.2. Side gaps between boards: 1/4 inch at ambient temperatures of 60 degrees F and above and 3/8 inch at ambient temperatures below 60 degrees F.
 - 9.3. Gaps between boards and adjacent construction: 1/4 inch at ambient temperatures of 60 degrees F and above and 1/2 inch at ambient temperatures below 60 degrees F.
10. Place boards to span three or more supports.
11. Fasten each board to each support with two fasteners.

10.12.5 CLEANING

- 10.12.5.1. Clean composite wood to remove stains:
Mold, mildew, berry and leaf stains: Clean surfaces with conventional deck wash containing detergent or sodium hypochlorite.
- 10.12.5.2. Rust and ground-in dirt:
Clean surfaces with cleaner containing oxalic or phosphoric acid.
- 10.12.5.3. Oil and grease:
Clean surfaces with detergent containing degreasing agent.

10.13. FASTENERS

- 10.13.1. Fastener Types, Sizes, Spacing, and Quantities: Provide fasteners and connectors including nails, spikes, screws, clips, bolts, and anchors required for installation of carpentry and millwork, conforming to IBC Table or as shown on Structural Drawings.
 - 10.13.1.1 Steel Drill Screws:
ASTM C1002, self-drilling, minimum 1-1/4-inch long, bugle head, corrosion-resistant polymer coating, conforming to ASTM B117.
 - 10.13.1.1. Screws at Steel Framing:
Type S, in lengths required to penetrate 3/8 inches beyond steel stud framing.
 - 10.13.1.1. Nails, Spikes, Staples and Other Driven Fasteners:
Conform to ASTM F1667 and IBC.
 - 10.13.1.1. Bolts and Lag Bolts:
Conform to ASTM A307. Provide steel plate washers.
 - 10.13.1.1. Metal Connectors:
 - 10.3.1.1.1. Simpson Strong-Tie Company or approved equivalent. Types indicated on drawings with minimum G-90 zinc coating.
 - 10.3.1.1.2. Conform to Structural Drawings, manufacturer's ICC ES Evaluation Reports, and manufacturer's instructions, including manufacturer's tables indicating design loads and recommended use for each fastener type.

10.13.2. ANCHORS

10.13.2.1. Definition:

Anchor-Steel component used to transmit loads from the attachment into the concrete. Anchors include, but are not limited to, bolts, welded studs, threaded rods, bars, undercut anchors, and expansion anchors.

Anchorage-The process of attaching a member or object to the concrete structure by means of an embedment, taking into consideration those factors (e.g., depth of embedment, edge distance, and spacing of anchors) which determine the load capacity of the anchorage system.

Anchor head-A nut, flat washer, plate, stud, or bolt head used to transmit loads from the tensile strength component to the concrete by bearing.

Attachment-The attachment is that structure external to the surfaces of the embedment which transmits loads to the embedment.

Embedment-The embedment is that steel component embedded in the concrete used to transmit applied loads to the concrete structure. The embedment may be fabricated of plates, shapes, bolts, reinforcing bars, shear connectors, expansion anchors, inserts, or any combination thereof.

Expansion anchor-Component that is installed in a hole drilled in hardened concrete and then is expanded in order to transfer loads into the concrete by direct bearing and/or friction.

Expansion mechanism-A mechanism used to transmit load from the tensile stress component to the concrete when used as part of an expansion anchor.

Grouted Embedments-An embedment located in a formed or drilled hole in hardened concrete utilizing a grout to provide load transfer from the embedment to the concrete.

Inserts--Commercially available, predesigned, and prefabricated embedments installed prior to concrete placement which are specifically designed for attachment of bolted connections.

Strength, design-Nominal strength multiplied by a strength reduction factor ϕ .

Strength, nominal-Strength of a connection calculated in accordance with the provisions and assumptions of the strength design method of this code before application of any strength reduction factors.

Tensile stress component-That part of the embedment attached to the anchor head or expansion mechanism used to transmit tensile loads to the concrete.

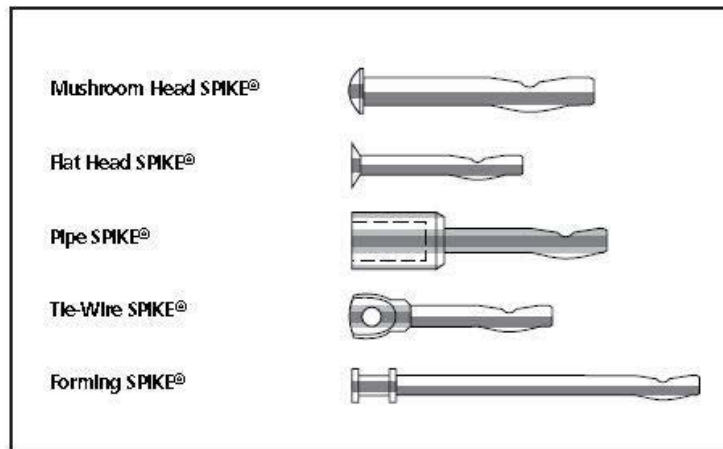
10.13.2.2. Concrete Anchors:

1. Drive Anchors: Powers Spike or Threaded Spike.

The Spike is a, one-piece, vibration resistant anchor for use in concrete block or stone.

Several head styles, including tamper proof versions, and anchor materials are available.

The Spike anchor is formed with an “s” shaped configuration at the working end of the anchor to create an expansion mechanism. Since the anchor is pre-formed, there is no secondary tightening operation required which greatly reduces the overall cost of an anchor installation.



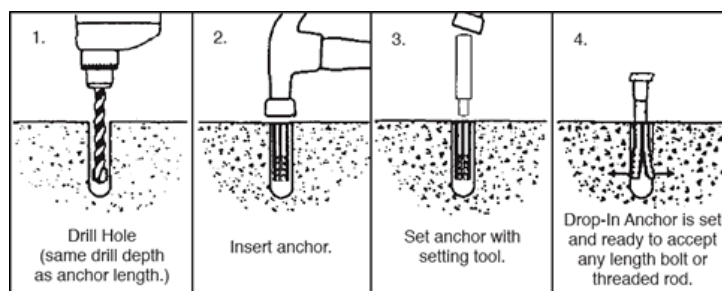
Types of Spike Anchor

2. Expansion Anchors: As specified by the Structural Notes.



Expansion bolt sample

3. Drop-In Anchors:
 - 3.1 Hilti, HDI-P Drop-In Anchor.
 - 3.2 Powers Fasteners, Steel Drop-In.
 - 3.3 ITW Ramset/Red Head, Multi-Set II Drop-In.



Installation Procedure for drop in anchors

3.4 Advantages of Drop In Anchors

3.4.1. Drop-In Anchors have a much smaller hole diameter requirement than lead anchors.

3.4.2. The DFS Drop-In Anchors have much greater pull-out strength than lead anchors and lag shields.

3.4.2. DFS Drop-In Anchors are preassembled. Ready for use right out of the box!

3.4.2.1 For flush & shallow embedment anchoring to poured concrete and brick.

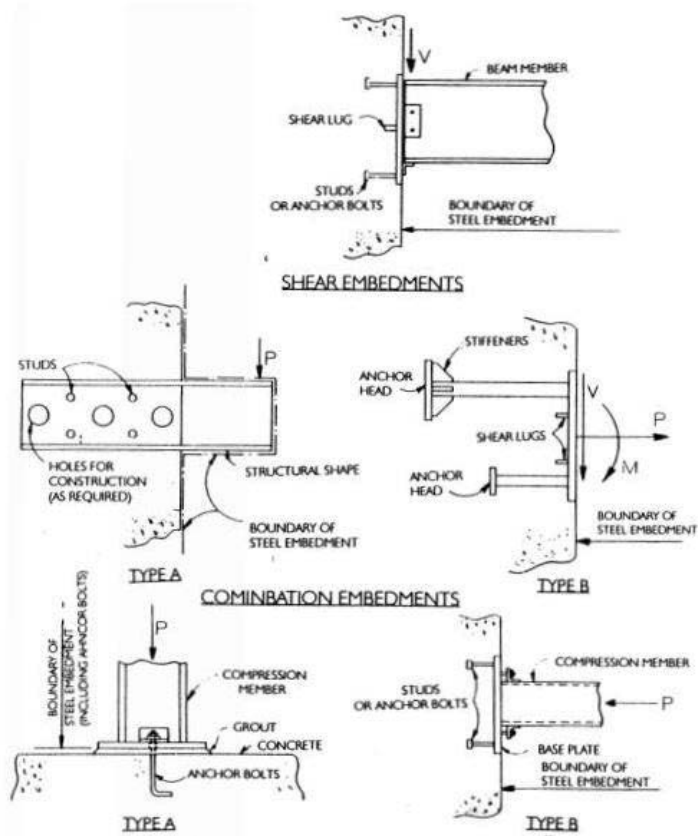
3.4.2.2. For use with any length threaded rod Carbon steel and setting plug.

3.4.2.3. Also available with Richmond thread for rebar reinforcement.

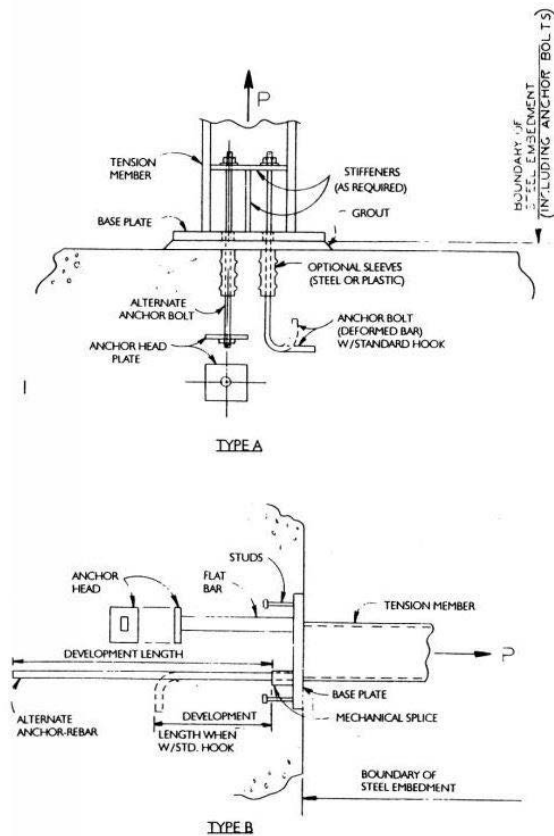
3.4.2.4. Zinc plated for Corrosion resistance

10.13.2.3. Adhesive Anchors:

Adhesive anchor systems are used to anchor threaded metal rod and rebar into concrete. In many applications, of these systems, the adhesive anchor is under a constant tensile load, requiring the use of adhesives with strength and creep behavior which is correct for the load and expected service life, the anchor installation details, and the environmental conditions.



Bearing Type Embedments



Tension Type embedment

10.13.3. Steel Anchors:

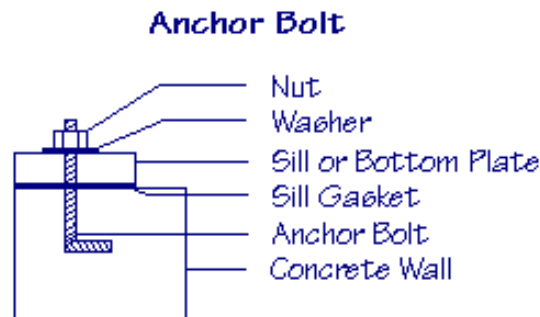
Shall be powder actuated fasteners or threaded bolts, nuts, and washers as indicated by the Structural Drawings and manufacturer's instructions.

10.13.4. Floor Plate and Sill Anchors:

10.13.4.1 Shall conform to current adopted IBC and to the Structural Drawings.

10.13.4.2 The anchor bolts shall be 5/8 galvanized steel bolts or approved anchors embedded minimum 7 inches into concrete or solid grouted hollow core masonry and spaced as indicated on the Structural Drawings.

1. Two bolts or anchor straps shall be provided at each plate. The bolts or straps shall be located not more than 12 inches and not less than 4 inches from each end.
2. Bolt and tighten plate to foundation with nut and washer.



10.13.4.1. Bar or Strap Anchors:

The bars and anchors shall Conform to the Structural Drawings.

10.14. Nailing:

10.14.1. Use only common wire nails or spikes of the dimension shown on the Nailing Schedule, except where otherwise specifically noted on the drawings. Sinker nails are not allowed

10.14.1. For conditions not covered in the Nailing Schedule, provide penetration into the piece receiving the point of not less than 1/2 the length of the nail or spike, provided, however, that 16d nails may be used to connect two pieces of 2-inch (nominal) thickness.

10.14.2. Nail without splitting wood.

10.14.3. Predrill as required.

10.14.4. Remove split members and replace with members complying with the specified requirements.

10.14.5 ROUGH HARDWARE

1. Framing Anchors, Beam, and Post Connectors: Designed to support imposed loads, conforming to the Structural Drawings.
2. Joist and Rafter Hangers: Conform to IBC, as tested according to ASTM D1761, for vertical load-bearing capacity, torsional moment capacity, and deflection characteristics and as specified by the Structural General Notes.

10.14.6. Construction Adhesives:

Solvent based, conforming to APA Specification AFG- 01, with maximum Volatile Organic Compounds (VOC) based on Rule No. 1168 Adhesive and sealant application.

10.14.7. Definition:

Adhesive - Any substance that is used to bond one surface to another surface by attachment. Adhesives include, Adhesive Bonding Primers, Adhesive Primers, Adhesive Primers for Plastics and any other Primer used with Adhesives.

Adhesive Bonding Primer - An Adhesive applied to a surface to improve the bond of subsequent Adhesives and sometimes to inhibit corrosion.

Adhesive Primer - A coating applied to a substrate, prior to the application of an Adhesive, to provide a bonding surface.

10.14.8. ROOF AND WALL UNDERLAYMENT

10.14.8.1 Exterior Wall Assemblies:

1. Weather/Vapor Barrier minimum of one layer of Tyveck or equivalent product.

10.14.8.2. Exterior Roof Assemblies:

1. Structural Insulated Panel Roof Decks, Roof Membrane.
2. Plywood Roof Decks: No. 30 Asphalt-Saturated Felt, ASTM D226, Type II.
3. Ice shield

10.14.9 FINISHES

10.14.9.1. Carbon Steel Fasteners, Anchors, Straps, and Rough Hardware shall comply with ASTM A123 or ASTM A153, hot-dip galvanized.

1. Exterior carbon steel in contact with concrete and masonry, G90. Stainless steel also is acceptable.
2. Interior steel, G40 in dry conditions, G60 where subject to wetting. Stainless steel also is acceptable.
3. Stainless Steel Fasteners and Anchors shall comply to ASTM A276 Type 304 or 316.

10.14.9.2 Electrolysis Protection:

1. Metals of dissimilar galvanic range shall not be in contact and shall be separated by application of suitable primers, paints, or tapes.

10.14.10. EXECUTION

10.14.10.1 Verify conditions ready to receive work of this Section before beginning. Notify the Architect in writing of conditions detrimental to the proper and timely completion of the work. Do not begin installation until all unsatisfactory conditions are resolved. Beginning work constitutes acceptance of site conditions and responsibility for defective installation caused by prior observable conditions.

10.14.11. General:

1. In addition to framing operations normal to the fabrication and erection indicated on the drawings, install wood blocking and backing required for the work of other trades (MEP).
2. Set horizontal and sloped members with the crown up.

3. Do not notch, cut, or bore members for pipes, ducts, or conduits, or for other reasons except as shown on the drawings or as specifically approved in advance by the Engineer of Record.
4. The contact surfaces of any member coming in contact with an exterior concrete or masonry wall regardless of height above ground shall be treated wood or shall be painted with two coats of an approved preservative.

10.14.12. INSTALLATION

1. Conform to APA Design/Construction Guides, IBC, and the Structural Drawings.
2. Conventional Light-Frame Construction shall conform to IBC.
3. Cants, Curbs, and Nailers shall be pressure treated; and dimensions as indicated or required.
4. Fire Blocking shall be constructed with nominal 2-inch-thick solid lumber at ceiling line.
5. Shall be provided at mid-height between studs, where partition height exceeds 8 feet. Do not exceed 10 feet on center vertical spacing.
6. Shims shall not be used for leveling on wood or metal bearings; the members shall be cut and fit accurately.
7. Wood Backing shall be provided to secure installation and support of work of other Sections, such as for casework, hardware, plumbing, heating, ventilating, and electrical work. Accepted for installation at metal stud partitions as well as for wood framing, except where not permitted by Code.
8. Structural nailing shall follow IBC unless more stringent requirements are indicated on the Structural Drawings.

10.14.13. SUBFLOORING AND UNDERLAYMENT

1. Maintain 1/8-inch gap between sheathing panel end and edge joints.
2. Subfloor shall be Glued to framing with construction adhesive and nail with ring-shank nails or screw shank nails. Space fasteners to penetrate fully into solid framing. Conform to the Structural Drawings.
 - 2.1 Edge Nail Spacing: 6 inches on center maximum.
 - 2.2 Panel Face Nail Spacing: 12 inches on center each way maximum.
 - 2.3 Refer to the Structural Drawings for more stringent requirements.

10.14.14. WALL SHEATHING

1. Stagger panel ends per the Structural Drawings.
2. Nail to framing at exterior wall sheathing at 6 inches on center at panel edges maximum and 12 inches on center at panel field. Include additional fasteners as necessary to set securely in place.
3. Refer to the Structural Drawings for more stringent nailing requirements.

10.14.15. PANEL BOARDS

1. Provide panel boards and backings for support of Mechanical and Electrical work.
2. Use fire-retardant plywood for Electrical panel boards.
3. Oversize panel boards 12 inches beyond mounting requirements.

10.14.16. BLOCKING, NAILERS, AND CURBS

1. Provide blocking, nailers, and curbs for sheathing, roof construction, metal flashing, and other construction as indicated, and as necessary for firm support. Unless otherwise indicated, solid wood backing shall be a minimum 2-inch nominal thickness, installed flat.
2. Blocking: Install wood blocking to receive mechanical fasteners for support of plumbing and electrical fixtures and equipment, cabinets, doorstop plates, wood base, wainscots, coat hooks, toilet and bath accessories, kitchen equipment, and all other wall- and ceiling-mounted components.

10.14.17. FASTENERS

10.14.17.1. All fasteners shall comply with NDS

10.14.17.2. All fasteners shall comply with IBC

10.14.18. BUG AND BIRD SCREENING

1. Install at exterior openings and vents at exterior building envelope, except where other systems are specified.

10.14.19. FIELD QUALITY CONTROL

1. Conform to testing requirements of Section 01450, Structural Testing, Inspection, and Quality Assurance, and Owner requirements for testing moisture content of lumber and for shear wall nailing.

10.14.20. STRUCTURAL INSULATED ROOF PANELS

10.14.20.1. GENERAL

Manufactured structural insulated sandwich panels for sloped roof.

10.14.20.2. REFERENCE STANDARDS

Comply with the provisions of the latest versions of the publications listed below except as otherwise shown or specified.

1. American Society of Structural Engineers (ASCE)
2. ASCE 7: Minimum Design Loads for Buildings and Other Structures.
3. American Society for Testing and Materials (ASTM) International 1. ASTM C578:
4. Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
5. APA, The Engineered Wood Products Association and Engineered Wood Systems, a Related Corporation (APA and APA-EWS)
6. APA Product Guide: Grades and Specifications.
7. APA Product Guide: Performance Rated Panels.
8. U.S. Department of Commerce, National Institute of Standards and Technology (DOC):
9. DOC PS-2: Performance Standard for Wood-Based Structural-Use Panels.
10. International Building Code (IBC).
11. International Conference of Building Officials (ICBO) Legacy Evaluation Reports.
12. International Code Council, Evaluation Services (ICC-ES) Evaluation Reports.

- 13. National Evaluation Service (NES) Evaluation Reports.
- 14. Underwriters' Laboratories (UL)
- 15. Fire Resistance Manual.

10.14.20.3. SUBMITTALS

10.14.20.3.1. The drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, shall apply to this Section.

1. Product Data:

Product span tables, load tables, design performance, and physical characteristics.

2. Evaluation Reports:

National Evaluation Services (NES) Report or International Building Code/International Code Council Evaluation Services (ICC-ES) Evaluation Report for each structural insulated panel type.

10.14.20.4. SYSTEM DESCRIPTION

Structural insulated panels (SIPs), oriented strand board (OSB), and expanded polystyrene (EPS) foam stressed skin sandwich panels at sloped metal roof. Deck and system suitable as substrate for fastening metal roofing clips and fasteners.

10.14.20.5. DESIGN REQUIREMENTS

Provide complete structural insulated panel system including splines, plates, fasteners, and other accessories as needed for complete and finished installation.

Provide engineered design, conforming to design specifications of the Structural Insulated Panel Association (SIPA) and the APA-Engineered Wood Association for spans and conditions shown on the Drawings

10.14.20.6. Design Loads:

- 1. Wind Loads: Conform to ASCE 7 Chapter 6 and the Structural Notes and Drawings.
- 2. Snow Loads: Conform to ASCE 7 Chapter 7 and the Structural Notes and Drawings.
- 3. Dead Load: As specified by the Structural Notes and shown on the Drawings.
- 4. Diaphragm Capacity: Refer to the Structural Notes. Provide complete system, including blocking, framing, nailing, and other accessories required to meet diaphragm and drag loads shown on the Drawings.
- 5. Design for shapes, bearing points, intersections, and as shown on the Drawings.
- 6. Determine exact composition of special intersection areas, except as otherwise shown on the Drawings.
- 7. Provide engineered design of SIP-to-SIP and SIP-to-beam connection details, connection fasteners, and joinery details.

10.14.20.7. Design Calculations:

Signed and sealed by an engineer, licensed in the jurisdiction where the Project is located, employed by manufacturer, qualified to design work of this Section.

10.14.20.8. Manufacturer's Instructions:

1. Include installation instructions, special procedures, and conditions requiring special attention.
2. Fire-Resistance
3. Test Data:
Underwriters' Laboratory (UL) tested fire tests for each fire-rated assembly.
4. Sample Warranty:
Meet or exceed provisions specified by this Section.
5. LEED Submittals:
 - 5.1. Provide information required to complete LEED Credit Template submittals to obtain LEED credits. Include the following:
 - 5.2. EQ 4.1 - Low Emitting Materials - Adhesives and Sealants: Verify VOC content of interior adhesives.
 - 5.3. EQ 4.4 - Composite Wood and Agrifiber Products: Verify that the composite or agrifiber products used do not contain any ureaformaldehyde.
 - 5.4. MR 7.0 - Certified Wood: Submit LEED electronic Credit Template.
 - 5.5. Include list of certified wood and Chain of Custody certification numbers.

10.14.21. QUALITY ASSURANCE

In event that load and deflection requirements specified or shown on the drawings are not achievable, submit written notification to the Design Professional prior to Bid, and before submitting a cost proposal for negotiated work.

Fabricate so that exposed stamps and marks are not visible on exposed bottom side of panels.

10.15. WOOD DECKING

10.15.1 SCOPE OF WORK

This section will cover the requirements for the followings:

1. Wood decking.
2. Stairs for elevated decks.
3. Railings for elevated decks.
4. Support framing for elevated decks.

10.15.2 RELATED WORK

1. Flashing and Sheet Metal, for sheet metal flashing used with patio decking.

10.15.3 SUBMITTALS

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

10.15.4. DEFINITIONS

Boards: Lumber of less than 2 inches nominal in thickness and 2 inches nominal or greater in width.

Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

Timber: Lumber of 5 inches nominal or greater in least dimension.

Lumber grading agencies, and the abbreviations used to reference them, include the following:

NeLMA: Northeastern Lumber Manufacturers' Association.

NLGA: National Lumber Grades Authority.

RIS: Redwood Inspection Service.

SPIB: The Southern Pine Inspection Bureau.

WCLIB: West Coast Lumber Inspection Bureau.

WWPA: Western Wood Products Association.

10.15.5. SUBMITTALS

10.15.5.1. Product Data: For preservative-treated wood products and metal framing anchors.

1. For preservative-treated wood products. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. For metal framing anchors. Include installation instructions.

10.15.5.2. LEED Submittals:

1. Product Certificates for Credit MR 5: For wood products, certificates indicating location of manufacturer, point of harvest, and distances to Project. Include statement indicating cost.

10.15.5.3. Material Certificates:

1. For lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by ALSC's Board of Review.
2. For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

10.15.5.4. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

10.15.5.5. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood products.
2. Expansion anchors.
3. Metal framing anchors.
4. Decking fasteners.

10.15.6. DELIVERY, STORAGE, AND HANDLING

10.15.6.1. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

10.15.7. LUMBER, GENERAL

10.15.7.1. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with the Building Code (IBC) requirements.

1. Factory mark each item with grade stamp of grading agency.

2. For items that are exposed to view in the completed Work, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Provide dressed lumber, S4S, unless otherwise indicated.

10.15.7.2. Maximum Moisture Content:

Boards: 19 percent.

Dimension Lumber: 19 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness.

Timber: 19 percent.

10.15.8. WOOD DECKING AND STAIR TREADS

1. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.
2. Dimension Lumber Decking and Stair Treads: No. 1 grade mixed southern pine; SPIB.
3. Board Decking: 1-1/2-inch actual decking of the following species and grades:
 - 3.1 Southern pine, Standard; SPIB.
4. Board Stair Treads: 1-1/2-inch actual thickness stepping with eased-edge nosing and of the following species and grades:
 - 4.1 Southern pine; SPIB.

10.15.9. WOOD GUARDRAILS

1. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.
2. Dimension Lumber Railing Members: No. 1 grade and of the following species:
 - 2.1. Mixed southern pine; SPIB.
3. Railing Boards: No. 1 grade and of the following species:
 - 3.1 Southern pine, B & B finish; SPIB.

10.15.10. DIMENSION LUMBER FRAMING

1. Deck and Stair Framing: No. 2 or better of the following species:
 - 1.1 Southern pine; SPIB.
2. POSTS
 - 2.1 Dimension Lumber Posts: No. 2 or better of the following species:
 - 2.1.1. Southern pine; SPIB.

10.15.11. PRESERVATIVE TREATMENT

10.15.11.1. Preservative Chemicals: Acceptable to authorities having jurisdiction.

1. Do not use chemicals containing arsenic, chromium or copper azole.

10.15.12. EXAMINATION

10.16.11.1. Proceed with installation only after unsatisfactory conditions have been corrected.

10.15.13. PREPARATION

1. Clean all lumbers from all debris.
2. Treat the cut ends to protect against the elements.
3. Stain all lumbers indicated to be stained, including both faces and edges and cut ends.

10.15.14. INSTALLATION, GENERAL

1. Set work to required levels and lines, with members plumb, true to line, cut, and fitted.
2. Fit work to other construction; scribe and cope as needed for accurate fit.
3. Framing Standard:
 - 3.1 Comply with AF&PA WCD1 unless otherwise indicated.
4. Install wood decking and stair treads with crown up (bark side down).
5. Secure decking to framing with screws.
6. Do not splice structural members between supports unless otherwise indicated. All structural splicing shall be over the supports.
7. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
8. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
9. Securely attach exterior rough carpentry work to supports by anchoring and fastening as indicated on the plans, complying with the following:
 - 9.1. ICC-ES AC70 for power-driven fasteners.
 - 9.2 Fastening Schedule in ICC's International Building Code.
 - 9.3 Fastener Schedule for Structural Members and Alternate Attachments as indicated in the ICC and IBC.
10. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members. The fasteners penetration in members shall be per IBC and NFPA re where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.
11. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

10.15.15. ELEVATED DECK JOIST FRAMING INSTALLATION

10.15.15.1. General:

1. Install joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal. Attach floor joists where framed into wood supporting members by using metal joist hangers. **Do not notch joists.**
2. Lap members framing from opposite sides of beams or girders not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

10.15.16 STAIR INSTALLATION

10.15.16.1. Provide stair framing members of size, space, and configuration indicated:

1. Stringer Size: See drawings.
2. Stringer Spacing: See drawings.
3. Treads and Risers: See details.

10.15.16.2. RAILING INSTALLATION

1. Guardrail Panels: Assemble guardrail panels and rails per plans.
2. Newel Posts: Secure to stringers and risers per plans and as required per IBC.
3. Railings: Fasten railings to newel posts and to trim at walls with countersunkhead
4. wood screws. as required by IBC.

10.15.17. TOLERANCE

10.15.17.1. Framing Members: 1/2 inch maximum from true position.

10.15.18. CLEANING

10.15.18.1. Leave installations clean and free of defects ready for staining, painting and Coating.

10.15.19. ADJUSTING

10.15.19.1. Repair damaged units or replace with new member.

10.15.20. PROTECTION

10.15.20.1. Protect from damage for duration of the Project.

10.16. WOOD-POLYMER COMPOSITE DECKING

10.16.1. Scope: The work consists of furnishing all labor, materials and equipment necessary for the installation of wood-polymer composite decking & handrail on proposed heavy timber framing for piers and boardwalk.

10.16.2. References

1. ASTM International (ASTM):

- 1.1 C177-04 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- 1.2 D143-94(2000) - Standard Test Methods for Small Clear Specimens of Timber.
- 1.3 D198-05 - Standard Test Methods of Static Tests of Lumber in Structural Sizes.
- 1.4 D1037-06 - Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
- 1.5 D1413-05 - Standard Test Method for Wood Preservatives by Laboratory Soil-Block Cultures.
- 1.6 D1761-06 - Standard Test Methods for Mechanical Fasteners in Wood.
- 1.7 D1929-96(2001) - Standard Test Method for Determining Ignition Temperature of Plastics.
- 1.8 D2047-04 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.

- 1.9 D2394-05 - Standard Methods for Simulated Service Testing of Wood and Wood-Base Finish Flooring.
 - 1.10 D2395-06 - Standard Test Methods for Specific Gravity of Wood and Wood-Based Materials.
 - 1.11 D4761-05 - Standard Test Methods for Mechanical Properties of Lumber and Wood-Base Structural Material.
 - 1.12 E84-07 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 1.13 F1679-04 Standard Test Method for Using a Variable Incidence Tribometer (VIT).
 2. American Wood Preservers Association (AWPA) E1-06 - Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites.
- 10.16.3. SUBMITTALS
 - 10.16.3.1. Submit a current ICC_ES product listing, manufacturer's installation instructions and loading for all products used in decking prior to installation.
 - 10.16.3.2. Product Data: Indicate sizes, profiles, surface finishes, and performance characteristics.
 - 10.16.3.3. Samples: 12 inch long decking and fascia samples illustrating size, products profile, color, and surface finish.
 - 10.16.3.4. Submittal shall include the requirement for the followings:
 1. Anti-slip surface
 2. Will not splinter, split, rot or warp
 3. Easy to work and fit
 4. Simple to maintain
 - 10.16.3.5. Maintenance Data: Manufacturer's instructions on care and cleaning of composite wood
- 10.16.4. DELIVERY, STORAGE AND HANDLING
 1. Store and protect products under manufacturer's recommendations.
 2. Store composite wood level flat, off ground or floor, with supports at each end as recommended by the manufacturer.
 3. Do not stack composite wood over the manufacturer's specification.
 4. Cover composite wood with waterproof covering, vented to prevent moisture buildup.
- 10.16.5. WARRANTIES

Manufacturer's warranty providing coverage against checking, splitting, splintering, rotting, structural damage from termites, and fungal decay of composite wood.
- 10.16.6. ACCESSORIES

Fasteners: Hot dip galvanized steel or stainless steel composite wood screws, nails of length recommended by composite wood manufacturer for the shape being fastened.

10.16.7. INSTALLATION

1. Install composite wood in accordance with manufacturer's instructions.
2. Cut, drill, and rout composite wood using carbide tipped blades.
3. Pre-drill fastener holes located closer than 1 inch from edges.
4. Cut ends square and true.
5. Do not use composite wood products as structural members.
6. Do not exceed maximum spans recommended by manufacturer.
7. Place boards perpendicular or diagonal to supports.
8. Stagger end joints in adjacent rows at least one support.
9. Leave expansion spaces between abutting boards and between boards and adjacent construction:
10. End gaps between boards shall be per manufacturer's specification as outlined and listed by ICC-ES.
11. Side gaps between boards: per manufacturer's specification as outlined and listed by ICC-ES.
12. Gaps between boards and adjacent construction: per manufacturer's specification as outlined and listed by ICC-ES.
13. Place boards to span three or more supports.
14. Fasten each board to each support with two fasteners.

10.16.8. CLEANING

10.16.8.1. Clean composite wood to remove stains from:

1. Mold, mildew, and berry and leaf stains: Clean surfaces with conventional deck wash containing detergent or per manufacturer's specifications.
2. Rust and ground-in dirt: Clean surfaces as recommended by the manufacturer.
3. Oil and grease: Clean surfaces with detergent containing degreasing agent or per manufacturer's specifications.

10.17. FINISH CARPENTRY AND MILLWORK

10.17.1. GENERAL

All work under this section is subject to the provisions of Standards & codes

10.17.2. SCOPE OF WORK

This Section includes the following:

1. Interior standing and running trim.
2. Shelving.

10.17.3. SUBMITTALS

1. Product Data: For each type of process and factory-fabricated product.
2. Samples: For each type of paneling indicated.
3. Interior Contractor shall submit to the Consultant or owner three samples 20" minimum in length of all mouldings or moulding assemblies to be used for the Project. These shall be full size and finished as specified in the Contract Documents.

10.17.4. Quality Assurance

10.17.4.1. All work shall be performed by licensed contractor of the trade and work shall be of highest quality.

10.17.4.2. All Finish Carpentry shall be finished as indicated on drawings and specifications. Transparent and Opaque Finishes shall match approved samples submitted

1. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

10.17.4.3. All finishes and processes shall be in compliance with IBC.

10.17.4.4. Such Industry Standards are to include but not be limited to the applicable provisions or standards of the following:

1. American Society for Testing and Materials (ASTM)
2. ICC-ES Reports.
3. National Hardwood Lumber Associate (NHLA).
4. National Particleboard Association (NPA).
5. American Plywood Association (APA) plywood grades:
 - 5.1. for softwood plywood: Product standard PS-1.
 - 5.2. for hardwood plywood: Product standard PS-51

10.17.4.5. The Interior Contractor shall be responsible for obtaining and complying with all code and regulatory agency requirements for materials and methods.

10.17.4.6. The Interior Contractor shall be responsible for accurately obtaining all field dimensions related to his work prior to fabrication. Where discrepancies are found, he shall notify the Consultant immediately in writing.

10.17.4.7. All Finish Carpentry materials shall be stored in a dry, ventilated place, protected from the weather and complying with the temperature and humidity conditions specified by the product manufacturer and standards.

10.17.4.8. Protect sanded and finished surfaces from soiling and damage during handling and installation.

10.17.4.9. Maintain requirements for heating, cooling and ventilation in installation areas as required by the manufacturer, to protect the material from damage.

10.17.5. PRODUCTS

10.17.5.1. Materials

10.17.5.1.1. All woodwork materials shall be new and shall conform to the requirements of IBC and applicable referenced codes.

10.17.5.1.2. All lumber shall be kiln-dried to the moisture content as recommended the manufacturer and the applicable codes.

10.17.5.1.3. All solid wood elements shall be clear, straight-grain lumber of the best grade of specified species as listed by the NHLA. Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish.

1. All veneer core elements shall be clear straight-grain lumber of the best grade of the specified species. Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Where veneer differs on two sides, veneers shall be of similar thickness, density, and characteristics to prevent any warp age. Veneer core elements shall also be specified on the drawings or specifications:

2. All adhesives shall be water-resistant resin or an approved equal.

10.17.5.1.4. All particle board shall be resin impregnated wood flakes of high density construction.

10.17.6. All plastic laminate finishes shall be of the quality, color and finish as indicated on the drawings and specifications.

10.17.7. Hardware and Accessories

1. All required hardware and accessories shall be furnished and installed by Interior Contractor and shall be as indicated on drawings and specifications.
2. Where specific products are not specified in the Contract Documents the Interior Contractor shall recommend hardware to provide the function or condition as indicated in the Contract Documents.
3. Hinges, screws, clips and other mounting, attachments or fasteners to be concealed unless noted otherwise on drawings.
4. Interior Contractor shall submit samples of each hardware item/type and accessory item/type to Consultant and owner for approval.

10.17.7.1. All Finish Carpentry hardware and accessories shall be free of all defects and shall be installed in accordance with Manufacturer's recommendations.

10.17.8. Materials substitution

10.17.8.1. Interior Contractor shall be responsible for providing and installing all items and materials as indicated on drawings and specifications. Such items and materials shall be fabricated and/or installed according to manufacturer's recommendations and in accordance with applicable Code.

10.17.9. All paint and other finish material shall be pure, and best quality from specified manufacturer as indicated on the drawings and/or specifications.

10.17.10. Examination

10.17.10.1.1. The Interior Contractor shall be responsible for examination of the base material and the conditions under which the work is to be performed, and notify the Consultant and or the owner in writing of any unsatisfactory conditions.

10.17.11. Fabrication

10.17.11.1. All work shall be performed in such manner as to fulfill the intent of the drawings and specifications.

- 10.17.11.2.** All items to be finishes shall be mill fabricated in accordance with the sizes and designs indicated on the drawings and specifications, and assembled in single and complete units.
- 10.17.11.3.** All items where paint is required shall be shop sprayed, except where impractical or otherwise specified.
- 10.17.11.4** Backsides of all Finish Carpentry concealed by the building shall be given a prime coat of paint with same color as the face finish.

10.18. Shelving

- 10.18.1.** All shelving shall be adjustable unless indicated otherwise on drawings and specifications.
 - 1. Install all shelving straight, plumb, level and in true alignment except where otherwise indicated.
 - 2. Fit all joints closely and fasten all pieces rigidly in place.
 - 3. Nails shall be finish or casing nails. Countersink nail heads and leave ready for putty.
 - 4. Joints shall be neatly matched and mitered.
 - 5. Fill exposed joints prior to jointing.
 - 6. Finished size shall be as indicated on the drawings.
 - 7. Surfaces shall be left free from hammer marks, free from warp, twist, open joints or other defects and shall be cleaned, scraped and sanded ready for finishing.
 - 8. Lengths of all running trim shall be as long as practical.
 - 9. Where shims are required use concealed shims.

10.19 Trims

- 10.19.1.** Cut Finish Carpentry to fit unless specified to be shop fabricated or shop-cut to exact size.
- 10.19.2.** Where Finish Carpentry abuts other finished work, scribe and cut for accurate fit. Before making cutouts, drill pilot holes at corners.
- 10.19.3.** Install trim and moldings in single, unjointed lengths for openings and for runs less than maximum length of lumber available. For longer runs, use only one piece less than maximum length available in any straight run. Stagger joints in adjacent members.
- 10.19.4.** Cope mouldings at returns, mitre interior angles and corners.
- 10.19.5.** Attach Finish Carpentry securely in place with uniform joints providing for thermal and building movements.
- 10.19.6.** Attach to substrates by anchoring and fastening as shown.
 - 10.19.6.1.** Nailing:
 - 1. Blind nail where possible.
 - 2. Use fine finishing nails where exposed.
 - 3. Set exposed nail heads for filling except for exterior wood which is to receive a natural finish (if any).
 - 10.19.6.2.** Anchoring:
 - Secure Finish Carpentry to anchors or blocking built-in or directly attached to substrates.
- 10.19.7.** Where finishes are applied at job site, clean items and fill nail holes to prepare for finish application.
 - 1. Where work is to receive a transparent finish, use matching wood filler.

10.19.8. For Fire-Retardant Finish Carpentry, handle, store and install in accordance with manufacturer's direction and as required to meet the required classification or rating.

1. Provide special fasteners, adhesives and other accessories as tested and listed for the type of fire-retardant work indicated.
2. Re-coat any and all cut surfaces with a heavy brush coating of the same compound used for wood treatment.
3. Fit Finish Carpentry to other work; scribe and cope as required for accurate fit.
4. Attach furring, nailers, blocking, and similar supports to allow proper support.

10.20. Cleaning and Protection

10.20.1. Clean shop finished work, touch-up finish as required and remove and refinish damaged or soiled areas of finish.

10.20.2. Protect installed Finish Carpentry from damage by work of other trades until Owner's acceptance of the work.

10.21. EXTERIOR PAINTING

10.21.1. GENERAL

All work under this section is subject to the provisions of General References for All Sections.

10.21.2. SCOPE

The work consists of providing all labor, materials and services necessary for painting.

10.21.3. MATERIALS

For the purpose of establishing an acceptable basis of quality, all paint shall be equal to material specified or highest grade products as manufactured by Duron Paints or equal as approved by PRCS.

10.21.4. Exterior work

1. Primer – Two (2) touchup coats on bare metal areas only: PPG inhibitive red primer 6-208 or equal.
2. First & second coat - PPG Industries quick dry alkyd enamel or equal.
3. The color shall match a color chip supplied at time of construction.
4. Unless specifically approved or otherwise specified, use products of one manufacture only in combination; the same manufacturer as finish coats shall produce undercoats.

10.21.5. EXECUTION

10.21.5.1. Preparation of surfaces

1. All surfaces to be painted or finished shall be adequately protected from dampness and shall be clean, dry, smooth and free from dust and all foreign matter which will adversely affect adhesion or appearance.

2. Remove dirt, grease and oil from surfaces to be painted, using mineral spirits and wipe dry with clean cloths.
3. Remove rust and/or scale to sound surface with wire brush, scraper or sandpaper and wipe clean before touchup priming and painting.
4. Sand abraded and rough surfaces smooth after each coat.

10.21.6. Inspection

10.21.6.1. The Contractor shall correct the following at no additional cost to PRCS:

1. Paint contamination (splatter, spills, etc.) of adjacent surfaces not scheduled to receive paint.
2. Unsatisfactory finish applied to improperly prepared surfaces.

10.21.7. WEATHER AND SITE CONDITIONS

1. Do not apply exterior paint in damp or rainy weather, when temperature is below 50 degrees F., or when the temperature is likely to drop to freezing (32 degrees F) within 24 hours unless noted otherwise by the manufacturer.
2. Avoid painting surfaces while they are exposed to hot sun.
3. Do not apply materials to extremely hot or cold metal.

10.21.8. APPLICATION

1. The first and second coat must have visual evidence of solid hiding and uniform appearance. The color shall be consistent from surface to surface. Painting shall be done in a workmanlike manner so as to produce and even film of uniform thickness. Edges, crevices, corners and joints shall receive special attention to insure that they are thoroughly cleaned and receive an adequate film thickness of paint.
2. There shall be no physical evidence of runs, sags, curtains or other evidence of poor application.
3. Inter-mix, thin and apply only in accordance with manufacturer's latest published directions.
4. Allow each coat of paint to dry thoroughly before applying succeeding coats; minimum of 48 hours between exterior coats.
5. Sand enamel undercoating between coats with fine sandpaper to produce smooth, even finish. Where high gloss is used, sand with very fine grit between coats. Remove all dust after each sanding to produce an even, smooth finish.
6. At completion, touch up and restore finish where damaged and leave in proper condition.
7. Touch-Up kit to be provided to PRCS, along with name and number of manufacturer and color of each used paint.

11.0 Passive Recreation

11.1 PICNIC SHELTER

11.1.1 GENERAL

All work under this section is subject to the provisions of General References for All Sections.

11.1.1.1. Please note a SPAM drawings along with grading permit may be required. Contact Loudoun County Land & Building Development Department to obtain information on permit requirements.

11.1.1.2. The shelter shall comply with current ADA requirements.

11.1.2. SCOPE

11.1.2.1. The work includes, but is not limited to, the provision of all material, services, labor, and equipment necessary to construct wood picnic shelter as specified in the construction drawings and/or the scope of work. Picnic shelter shall be wood construction, either pre-engineered or stick built, which includes wood support columns, and beams. Also included shall be fascia, connecting hardware and nails, roofing material and floor system (slab on grade).

11.1.2.2. Size and location:

11.1.2.2.1. The structure's size shall comply with IBC's height and area requirement as well as other requirements as outlined in IBC.

1. 30'x 60' minimum or site specific.
2. Finished ceiling height 8'-0" minimum.
3. Location per approved Site Plan Amendment or the zoning approval as required by the governing agency.

11.1.3. Picnic Shelter -wood

11.1.3.1. Pre-Engineered Structure:

1. The pre-engineered picnic shelter's components shall be designed with approved product from one manufacturer.
2. Structural Loading:
3. The shelter shall be designed to withstand applicable gravity and lateral loads as specified in current edition of ASCE-7, and as referenced by IBC.
4. The drawings shall be sealed, dated and signed by a professional engineer registered in the Commonwealth of Virginia.
5. Material specification shall be included in the drawings with all material lists.
6. All column reactions shall be calculated and provided to the owner by the shelter manufacturer, to submit to the foundation engineer.
7. The foundation for the pre-engineered shelters shall be designed by an engineer registered in the Commonwealth of Virginia.

11.1.3.1.1. The sealed drawings, specifications, reactions along with erection instructions/drawings for the picnic shelter provided by the supplier, along with the foundation plans, provided by PRCS, shall be submitted to Loudoun County Land and Building Development for permitting and approval.

11.1.3.1.2. The supplier shall provide a written warranty in accordance with the industry's standard coverage. The warranty shall guarantee, to repair or replace free of charge any building components that prove to be defective in materials during that period.

11.1.3.1.3. Reference Specification:

All material shall comply with the following specifications and as outlined in this document for each material:

1. American Society for Testing and Materials (ASTM)
2. American Institute of Timber Construction (AITC)
3. American Wood Preserver's Association (AWPA)

11.1.3.2. Picnic Shelter stick built

11.1.3.2.1. The contractor shall comply with all applicable sections of this manual and the followings:

1. The shelter structure and supporting foundation shall be designed by an engineer registered in the Commonwealth of Virginia.
2. The drawing shall include all material specifications to complete the construction.
3. The sealed drawings, specifications, reactions shall be submitted to Loudoun County Land and Building Development for permitting and approval.

11.2. PLAY APPARATUS AREA

11.2.1. SCOPE

1. The work consists of construction of a play apparatus area, including safety ground cover.
2. The shelter shall comply with current ADA requirements.

11.2.2. REGULATORY REQUIREMENTS

The Contractor shall insure that the play apparatus area and all equipment meet all requirements as set forth by the Consumer Products Safety Commission (CPSC), Public Playground Safety Handbook, current edition.

The handbook is available on the site below:

<http://playgroundsafety.org/standards/cpsc>

"This handbook presents safety information for public playground equipment in the form of guidelines. Publication of this handbook is expected to promote greater safety awareness among those who purchase, install, and maintain public playground equipment. Because many factors may affect playground safety, the U.S. Consumer Product Safety Commission (CPSC) staff believes that guidelines, rather than a mandatory rule, are appropriate. These guidelines are not being issued as the sole method to minimize injuries associated with playground equipment. However, the

Commission believes that the recommendations in this handbook along with the technical information in the ASTM standards for public playgrounds will contribute to greater playground safety.

Some states and local jurisdictions may require compliance with this handbook and/or ASTM voluntary standards. Additionally, risk managers, insurance companies, or others may require compliance at a particular site; check with state/local jurisdictions and insurance companies for specific requirements.”

11.2.3. QUALITY ASSURANCE & Submittals:

1. The Contractor shall coordinate with the manufacturer of the play apparatus equipment to provide a certified installer, who shall observe all phases of the equipment assembly and installation.
2. The Contractor shall provide PRCS with a written statement certifying that all equipment is installed in compliance with Consumer Products Safety Commission (CPSC) guidelines, shop drawings supplied by the supplier, and other applicable specifications.
3. The play apparatus area shall conform to the configuration as shown on the approved plans.

11.2.4. SAFETY GROUND COVER

The playground cover shall be per CPSC requirements “Selecting a surfacing material”.

“Concrete, asphalt, or other hard surfaces should never be directly under playground equipment.”

11.2.4.1. TOUCH UP KIT

Provide Touch-Up kit.

11.2.6. TRAIL LAYOUT

11.2.6.1. GENERAL

All work under this section is subject to the provisions of Section 1. “General References for All Sections”.

11.2.6.1.Scope:

11.2.6.1.1. In order to plan and construct trails in a consistent, usable and orderly fashion the following pre requirements are related:

1. Trail type, width and surface treatment shall be approved by PRCS’ Director.
2. Trail location shall be based on safety, circulation, and access considerations. The trail location shall be approved by the Director of PRCS, before review by other regulatory agencies.

11.2.6.2. STANDARDS AND CRITERIA

FHWA “Trail Planning, Design, Construction, and Maintenance Guides”:

http://www.fhwa.dot.gov/environment/recreational_trails/publications/index.cfm#Trail

VDOT Road Design Manual (Trails accepted for VDOT maintenance shall be constructed in accordance with VDOT criteria and standards and be located fully within the dedicated right-of-way.):

<http://www.nrvpdc.org/nrvmpo/resources/VDOT-RoadDesignManual-AppA.pdf>

Loudoun County Facilities and Standards Manual (FSM):

<http://www.loudoun.gov/documentcenter/view/90495>

Loudoun County Zoning Ordinance:

11.2.6.3. Execution:

11.2.6.3.1. General: Proposed trail shall be staked-out; developer shall contact PRCS Park Planner(s) to schedule a field review of the proposed trail site.

11.2.6.3.2. Earthwork:

11.2.6.3.2.1. Scope: The scope of work for this section shall include the followings as minimum:

1. Clearing and grubbing:

1.1. Work consists of clearing, grubbing, trimming, removing, and treating trees, logs, limbs, branches, brush, plants, and other vegetation within the clearing limits. Work includes the clear-cutting and treatment of designated trees outside the clearing limits. Also included are the protection from injury of trees and other objects not designated for removal.

Note: Where possible, trails shall be located so as to minimize the loss of trees and disruption of natural environmental conditions.

2. Disposal of Clearing Slash, Logs, Stumps, Brush, and Roots

3. Excavation and Embankment:

3.1 Work consists of the excavation and placement of excavated material, regardless of its nature, from within the trailway or from other sources. The work includes excavation, embankment, and backfill construction required to shape and finish the trailbed, ditches, backslopes, fill slopes, drainage dips, trail passing sections, and turnouts. Also includes excavation and embankment work required to construct shallow streams and gully crossings, and rubble rock sections, and climbing turns.

4. Removal of Structures and Obstructions:

4.1. Work consists of removal and disposal of existing structures, including turnpikes, walkways, bridges, culverts, signs and posts, and other material within the trailway, above or below ground.

5. Drainage:

5.1. Work consists of furnishing and installing culverts, including excavation and backfill, selecting and hauling of log and rock materials, and constructing catch basins and headwalls.

6. Surfacing (as approved by the PRCS Director, and FSM):

6.1. This work consists of furnishing, hauling, watering, placing, and compacting aggregate surfacing or base course; and geosynthetics.

6.2. Asphalt pavements:

This work consists of constructing a single course of hot bituminous plant mix on a prepared base and furnishing or installing geosynthetics.

6.3. Cold Bituminous Mix Trail Surfacing:

This work consists of constructing a single course of cold bituminous mix on a prepared base course or trailbed.

Use cold bituminous mix design that is currently in use by VDOT, and submit a certificate of compliance that the mix meets their requirements.

6.4. Grid Pavement Units:

This work consists of furnishing and installing grid pavement units, including excavation, backfilling, and geosynthetics.

Place pavement units so they interlock, are stable, and form a smooth and uniform walking surface. Fill void areas to full depth. Dispose of unused block material by removing from site.

6.5. Mobilization:

This work consists of moving personnel, equipment, material and incidentals to the project and performing all work necessary before beginning work at the project site.

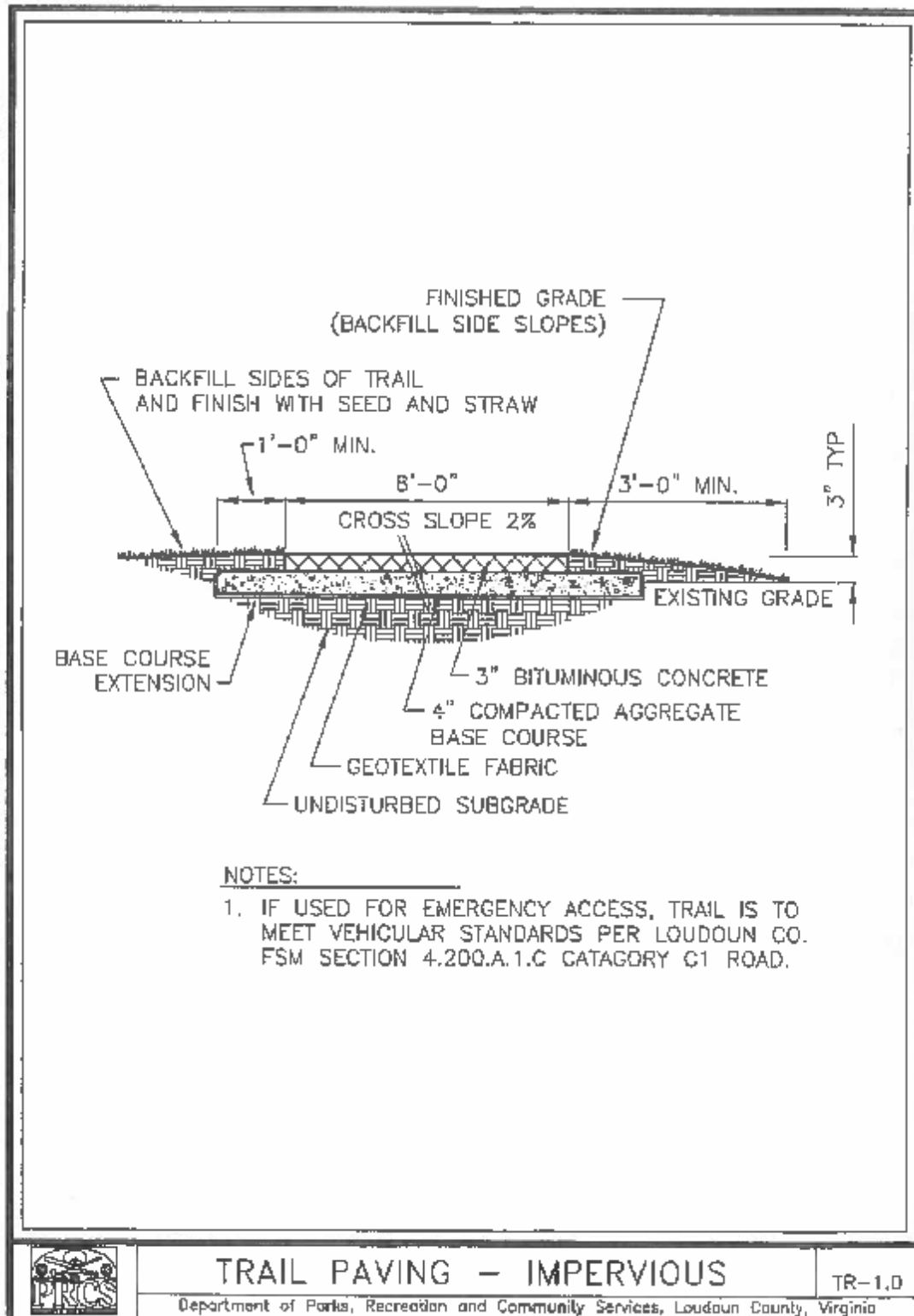
11.2.6.4. Maintenance:

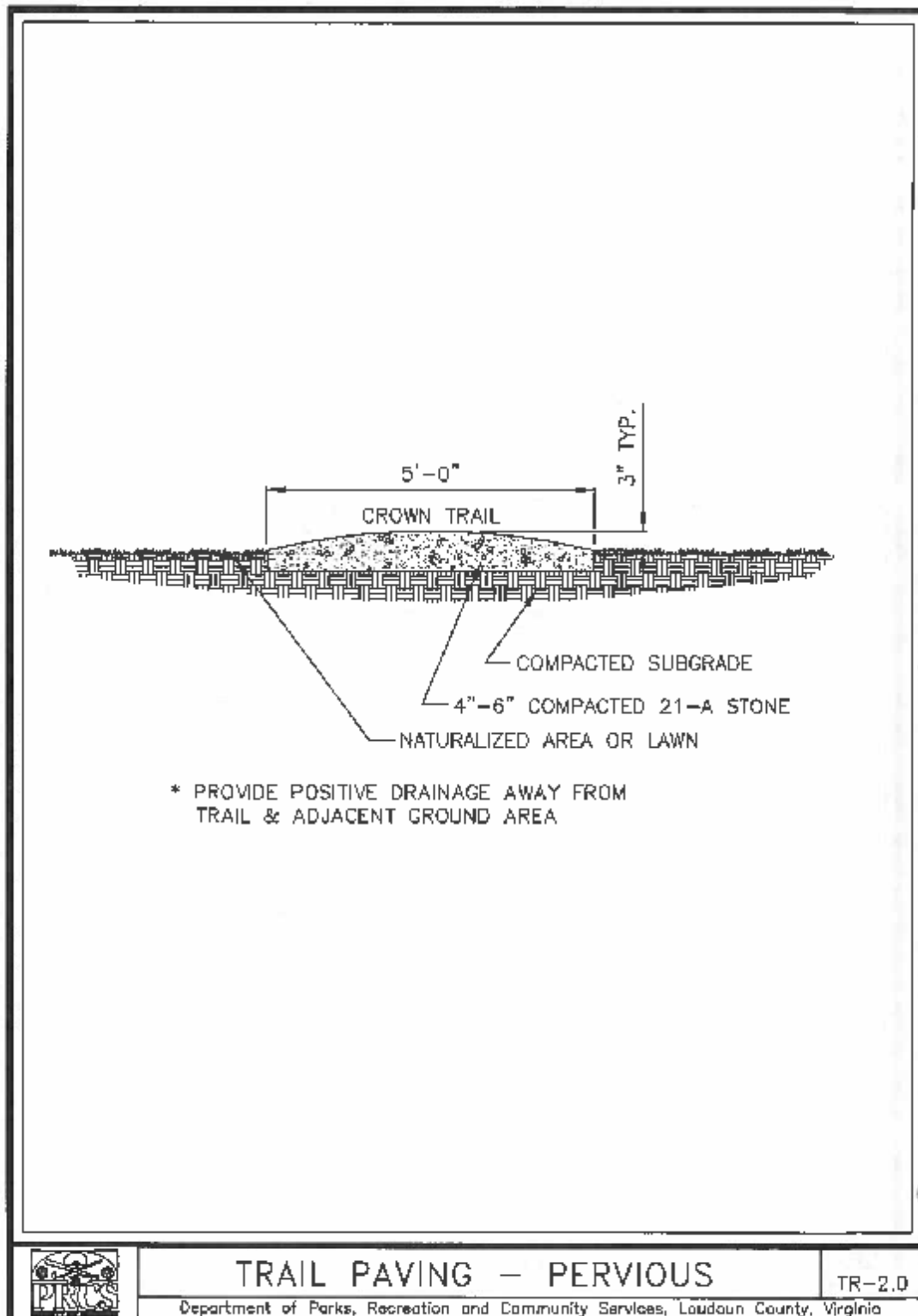
1. Remove all limbs of shrubs and trees that extend across or into the clearing limits as shown on the drawings. Cut all brush and small, woody plants as near flush to the ground's surface as possible.
2. Fill holes in the trail tread caused by removing woody material with suitable material.
3. Scatter the clearing debris removed from the clearing limits outside and below the clearing limits.

Note: Do not place materials in stream channels, drainageways, ditches, culvert inlets, or other locations where they would prevent the free flow of water away from the trailbed.

11.2.6.4.1. Drainage Maintenance:

1. This work consists of cleaning culverts, waterbars, drainage dips, ditches, and rock spillways; directing water from the trail where washing of the trailbed is or has been occurring, and trails low spots that holds water.
 - 1.1. Where trail drainage facilities have been plugged and the water has been diverted from the intended channel, remove the debris from the diversion and return the drainage to the channel. Divert water off and away from the trailbed. If washing or ponding of water is occurring, dig a shallow ditch sloped 2 percent to 5 percent to the downstream side of the trail. Clean ditches to permit the free flow of water into culverts and away from the trail. Scatter all unusable or unneeded material that is cleared from the drainage structures 1 m or more beyond and below the trail or drainage facility and out of water courses.





12.0 SIGNAGE

12.1. General:

To establish a cohesive, comprehensive, distinctive, and functional system to direct and communicate with users who visit and experience all opportunities provided by PRCS. Standard Signage for Parks and Facilities

12.2. Scope:

12.2.1. Information: Entrance/Welcome/Arrival, Exit, Fee (if any), Special Events (changeable), Site Specific (e.g., map, resources), Area Specific Designation, Facility Identification, and Future Construction.

12.2.2. Interpretation: Environmental/Ecological and Cultural/Historical/Man-made

12.2.3. Direction: Park Approaches (VDOT), Internal Vehicular Traffic, Internal Pedestrian Traffic, and Trail Markers.

12.2.4. Regulation: Fee (if any), Rules/Restrictions (County/PRCS and Site Specific), Safety/Warning, Roadway/Traffic, Boundary, Temporary Closure (Maintenance).

13.0 HISTORIC AND CULTURAL SITES

13.1 GENERAL

13.1.1. Reference is made to the Loudoun County Board of Supervisors' Policy for Acceptance and Maintenance of Historical Properties, as adopted by the Loudoun County Board of Supervisors on May 7, 1997.

13.1.2. Reference is made to the Loudoun County Heritage Preservation Plan, as adopted by the Loudoun County Planning Commission on November 5, 2003.

13.1.3. References:

Loudoun County Zoning Ordinance

<http://www.loudoun.gov/DocumentCenter/View/99645>

13.1.4. Facilities Planning and Development is currently developing a separate historic and cultural resource management plan that will provide information and procedures for existing and proposed historic sites within County parks.

13.1.4.1. "The Loudoun County Planning Department and the Office of Mapping and Geographic Information have prepared maps of the county's six Historic and Cultural Conservation Districts in Loudoun County and the Historic Roadways "

1. District:Loudoun County Historic District maps can be accessed through this URL:

<http://www.loudoun.gov/index.aspx?NID=1877>

<http://www.gsa.gov/portal/category/20992>

2. Documentation:

"Documenting the historical significance and physical condition of the property will provide information necessary for setting priorities and allocating funds."

<http://www.nps.gov/tps/how-to-preserve/briefs/31-mothballing.htm#documentation>

3. Stabilization:

"Stabilization as part of a mothballing project involves correcting deficiencies to slow down the deterioration of the building while it is vacant. Weakened structural members that might fail altogether in the forthcoming years must be braced or reinforced; insects and other pests removed and discouraged from returning; and the building protected from moisture damage both by weatherizing the exterior envelope and by handling water run-off on the site."

4. Mothballing:

'The actual mothballing effort involves controlling the long-term deterioration of the building while it is unoccupied as well as finding methods to protect it from sudden loss by fire or vandalism. This requires securing the building from unwanted entry, providing adequate ventilation to the interior, and shutting down or modifying

existing utilities. Once the building is de-activated or secured, the long-term success will depend on periodic maintenance and surveillance monitoring.”

<http://www.nps.gov/tps/how-to-preserve/briefs/31-mothballing.htm#mothballing>

5. Mothballing Checklist:

In reviewing mothballing plans, the the information provided in the checklist may help to ensure that work items are not inadvertently omitted.

<http://www.nps.gov/tps/how-to-preserve/briefs/31-mothballing.htm#checklist>

6. Maintenance Chart:

<http://www.nps.gov/tps/how-to-preserve/briefs/31-mothballing.htm#maintain>

LOUDOUN COUNTY BOARD OF SUPERVISORS' POLICY
FOR ACCEPTANCE AND MAINTENANCE
OF HISTORICAL PROPERTIES

Adopted by Loudoun County Board of Supervisors
May 7, 1997

DEFINITIONS

The following definitions are provided for treatments that may be undertaken on historic properties:

Acquisition:

Is defined as the act or process of acquiring fee title or interest other than fee title of real property (including the acquisition of development rights or remainder interest).

Protection:

Is defined as the act or process of applying measures designed to affect the physical condition of a property by defending or guarding it from deterioration, loss or attack, or to cover or shield the property from danger or damage. In the case of buildings and structures, such treatment is generally of a temporary nature and anticipates future historic preservation treatment; in the case of archaeological sites, the protective measure may be temporary or permanent.

Stabilization:

Is defined as the act or process of applying measures designed to reestablish by temporary or permanent means, a weather-resistant enclosure and the structural stability of an unsafe or deteriorated property while maintaining the essential form as it exists at present.

Preservation:

Is defined as the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than excessive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the limited and sensitive upgrading of mechanical, electrical, and plumbing systems and other code-required work to make properties functional is appropriate within a preservation project.

14.0 PROFFERED PARK SITES AND FACILITIES

14.1 SCOPE

14.1.1. This section includes information pertaining to park sites and facilities proffered under legislative application approval conditions with the County of Loudoun.

Goal:

Acquire, develop and maintain quality parks and trails that support equity of access by users, connectivity, and create a positive sense of place for all residents in Loudoun County.

14.2. IMPLEMENTATION

14.2.1. Once proffered to the County, written notice shall be provided to the Director of the Department of Parks, Recreation and Community Services prior to any clearing, grading, mining of topsoil or earth fill, soil stockpiling, staging of equipment or materials, disposal of soil or waste material, or dumping on land that is to be dedicated to the County for purposes of public parks, active recreation, or passive open space.

14.2.2. Design and construction of park sites and facilities shall meet these standards and all other applicable state and county codes and standards once endorsed by the Board of Supervisors. Park sites and facilities designed and constructed prior to the endorsement of these standards shall be exempt.

14.2.3. Construction shall not commence until a pre-construction meeting has been coordinated with PRCS Project Manager. The Project Manager will inspect the project periodically during the course of construction to ensure compliance with the standards. Acceptance of park sites and facilities will be based on compliance with the Loudoun County PRCS Design and Construction Guidelines and all applicable state and county codes and standards.

