

# **VTRANS**

**Vermont Agency of Transportation**

## **REQUEST FOR PROPOSALS**

Part 4  
Project Specifications

**A DESIGN-BUILD PROJECT**

I-91 Bridge Improvements

Bridges 24N & 24S

Rockingham, Vermont

Project No:  
Rockingham IM 091-1(66)

**November 10, 2015**

## PART 4

### Project Specifications

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## Special Provisions

1. LABOR SUPPLY. Available workers for this Contract may be obtained from Manager, Employment & Training, Montpelier, VT. The latest edition of the DBE Registry can be obtained from the Office of Civil Rights and Labor's Webpage at the following address: [www.aot.state.vt.us/CivilRights](http://www.aot.state.vt.us/CivilRights). Contractors that do not have access to the internet may obtain a copy from the Office of Contract Administration upon request.
2. CONTRACT COMPLETION DATE. This Contract shall be completed on or before the Final Completion Date defined in RFP Part 1.
3. NOTICE TO BIDDERS. U.S. Department of Labor Davis-Bacon wage rates are applicable to this Contract. Copies of the applicable rates are included in this proposal.
4. STANDARD SPECIFICATIONS. The provisions of the 2011 STANDARD SPECIFICATIONS FOR CONSTRUCTION, as modified herein, shall apply to this Contract.
5. NOTICE TO BIDDERS - ADDITIONAL CONTRACT REQUIREMENT. For construction and transportation projects over \$250,000.00, a payroll process by which during every pay period the Contractor collects from the subcontractors or independent contractors a list of all workers who were on the jobsite during the pay period, the work performed by those workers on the jobsite, and a daily census of the jobsite. This information and similar information for the subcontractors regarding their subcontractors shall also be provided to the Department of Labor and to the Department of Banking, Insurance, Securities, and Health Care Administration, upon request.
6. NOTICE TO BIDDERS - RE-DESIGNATION OF VTRANS OFFICIALS. The Contractor is hereby notified of the following re-designation of VTrans officials as referenced in the Contract Documents:

| Where in the Contract Document it reads:  | It shall be read as and shall mean:              |
|---|--|
| Director of Program Development   | Chief Engineer                                   |
| Assistant Director of Program Development   | Deputy Chief Engineer                            |
| Roadway, Traffic, and Safety Engineer;<br>Roadway Program Manager; Highway<br>Safety & Design Engineer; Structure<br>Engineer; Structures Program Manager | Director of Project Delivery Bureau              |
| Chief of Local Transportation<br>Facilities   | Director of Municipal Assistance<br>Bureau       |
| Construction Engineer; Materials and<br>Research Engineer   | Director of Construction and Material<br>Bureau  |
| Director of Operations  | Director of Maintenance and<br>Operations Bureau |

7. NOTICE TO BIDDERS. The Contractor is hereby notified that in the absence of the Engineer, the Agency's Safety Officer and the Agency's Hazardous Materials and Waste Coordinator shall each have the authority to suspend work when they determine that a serious safety or environmental violation exists on the job site. The period of time work is suspended due to a serious safety or environmental violation will not be justification for an extension of time.
8. NOTICE TO BIDDERS. All temporary construction signs shall meet the following requirements:
  - A. Where sign installations are not protected by guardrail or other approved traffic barriers, all sign stands and post installations shall meet National Cooperative Highway Research Program (NCHRP) Report 350 or the AASHTO Manual for Assessing Safety Hardware (MASH). The appropriate resource shall be determined as described in the MASH publication. No sign posts shall extend over the top of the sign installed on said post(s). When anchors are installed, stub shall not be greater than 100 MM (4 inches) above the existing ground.
  - B. As a minimum, roll up sign material shall have ASTM D 4956 Type VI fluorescent orange retroreflective sheeting.
  - C. All post-mounted signs and solid substrate portable signs shall have ASTM D 4956 Type VII, Type VIII, or Type IX fluorescent orange retroreflective sheeting.
  - D. All retro-reflective sheeting on traffic cones, barricades, and drums shall be at a minimum ASTM D 4956 Type III sheeting.
  - E. All stationary signs shall be mounted on two 4.5 kg/m (3 lb/ft) flanged channel posts or 51 mm (2 inch) square steel inserted in 57 mm (2 ¼") galvanized square steel anchors. No sign posts shall extend over the top edge of sign installed on said posts.
  - F. Prior to placing temporary work zone signs on the project, the Contractor must furnish for the Engineer's approval a detail for temporary work zone signs on steel posts showing stubs projecting a maximum of 100 mm (4 inches) above ground level and bolts for sign post.
  - G. Construction signs shall be installed so as to not interfere with nor obstruct the view of existing traffic control devices, stopping sight distance, and corner sight distance from drives and town highways.
  - H. Speed zones, if used, should be a maximum of 16 kph (10 mph) below existing posted speeds. Temporary speed limit certificates must be approved by the Director of Program Development.
9. NOTICE TO BIDDERS. All retro-reflective sheeting on permanent signs (signs to remain after the project is completed) shall be at a minimum ASTM D 4956 Type III sheeting, unless otherwise shown on the Plans.
10. NOTICE TO BIDDERS - REQUIREMENTS FOR NIGHTTIME WORK. The Contractor is hereby notified that work may be performed at night upon written approval from the Resident Engineer. For the purposes of this Contract, "night" shall mean from the hours of 6:00 p.m. until 6:00 a.m. of the following day. The

Engineer may abbreviate this time period as necessary for safety considerations.

Night work shall be performed in accordance with the National Cooperative Highway Research Program (NCHRP) Report 476 - "Guidelines for Design and Operation of Nighttime Traffic Control for Highway Maintenance and Construction". A copy of this guideline specification may be downloaded from the following website:

[http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_476.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_476.pdf).

Prior to beginning night work, the Contractor shall design a lighting system and present it to the Engineer for approval. The Contractor shall not perform any night work or activities within the project limits until the lighting system has been fully approved and is in place on the project.

The designed lighting system shall be mobile, shall be mounted separately from other construction equipment, shall illuminate the entire work area to daylight intensity with minimal glare, and shall be a surrounding design that minimizes shadows in the work area as much as possible.

The locations at which Flaggers and/or Uniformed Traffic Officers are stationed, whether within, on the edge of, or outside of the work area, shall be separately illuminated to the same intensity, minimal glare, and minimal shadow requirements as the work area.

11. HIGHWAY PARKING RESTRICTIONS. Only such trucks and equipment as are necessary for the construction of this project will be permitted to stop or park on the shoulders or right-of-way of the highway or intersecting highways. All trucks or equipment so stopped or parked shall be at least 1.2 m (4 feet) from the edge of the thru traffic lanes. Parking or stopping on the traveled portion of the roadway will not be permitted unless authorized by the Engineer to meet field conditions.

Private automobiles of workers will not be permitted to stop or park on the shoulders or right-of-way of the highway or intersecting highways.

Each of the Contractor's trucks or equipment used for the construction of this project and permitted to park or stop as provided above shall be equipped with flashing light signals on the front and rear and the signals shall be operating at all times when parked or stopped on the highway unless otherwise authorized by the Engineer. Equipment, materials, or vehicles must be parked or placed a minimum of 10 m (30 feet) from the edge of pavement in all directions or a minimum of 3 m (10 feet) behind guardrail when not being utilized.

The flashing light signals shall be visibly distinct from and physically separate from the hazard warning system required by Federal and State motor vehicle laws and regulations. At least one of these flashing light signals shall be visible to traffic approaching from any angle at all times.

Qualified traffic control personnel shall be employed whenever the Contractor's vehicles or equipment (including that which belongs to the individual workers) enter or leave the traffic flow. All movement, in or out of the traffic flow, shall be with the flow of traffic.

12. SPECIAL CONSTRUCTION REQUIREMENTS.

- A. Unless otherwise permitted in writing by the Engineer, the Contractor shall not perform construction work during the holiday periods for Memorial Day, July Fourth, Labor Day, Columbus Day, Veterans Day, and Thanksgiving Day. The Engineer shall give a written order designating the time of observance of these holidays and

of any additional holidays required by the season, anticipated traffic, and local custom. As specified in Subsection 105.14 of the Special Provisions, construction operations shall not be performed on any Sunday without the specific authorization of the Engineer.

Designated holiday periods shall begin at 12:00 noon on the day before the weekend or holiday, whichever applies, and shall end at 7:00 a.m. on the day after the holiday or the weekend, as appropriate.

B. The Contractor shall maintain a safe access to all ramps, U-turns, drives, and intersecting side roads at all times during the construction of this project.

C. The Contractor shall position Portable Changeable Message Signs at the locations indicated in the approved Transportation Management Plan, and adjusted as directed by the Engineer, warning northbound and southbound motorists of roadway conditions ahead. The message to be displayed shall be submitted to the Engineer in advance for approval. The displayed message should accurately reflect what motorists can expect to encounter through the project area. The Contractor shall also install and maintain appropriate construction signing warning the traveling public of the roadway conditions.

D. Two-way radios shall be provided by the Contractor when requested by the Engineer for use by traffic control personnel.

E. The Contractor shall have available on the project the current editions of the Manual on Uniform Traffic Control Devices (MUTCD) and the Standard Highway Signs (SHS) book. Information for obtaining these publications may be found at:  
<http://mutcd.fhwa.dot.gov/index.htm>.

13. NOTICE TO BIDDERS.

This project shall be constructed in accordance with VTrans Standard Specifications for Construction, 2011 Edition, and subsequent revisions (hereafter referred to as the 2011 Standard Specifications). The 2011 Standard Specifications shall control the work on this project except where modified by the Request for Proposal or the contract Special Provisions.

The 2011 Standard Specifications are written to govern work on Design-Bid-Build unit price construction projects. This Design-Build project is contracted on a Lump Sum basis with no allowances for any additional payment, except when specifically identified by the Contract.

References and requirements contained in DIVISION 100 of the 2011 Standard Specifications are specifically modified by the following Special Provisions included in this RFP to conform to a Lump Sum contract. References and requirements contained in DIVISION 200-700 of the Standard Specifications are modified as follows:

The subsection "Basis of Payment" IS hereby deleted from each Section of DIVISIONS 200-600 of the 2011 Standard Specifications, General Special Provisions, and Supplemental Specifications (because they do not apply to lump sum contracting). Payment for the work on this project will be made under the 900.615 and 900.630 items.

Special Provisions for:

Rockingham IM 091-1(66)

Notice to Bidders

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14. NOTICE TO BIDDERS.

The ECO has the primary responsibility for environmental issues related to the project. The ECO shall be responsible for all environmental permitting and for meeting the requirements of permit conditions.

The "Resident Engineer" has the exclusive authority for the Acceptance of all work and materials for the Project.

Consistent with this instruction, particular provisions of Sections 100-700 of the Supplemental Specifications, 2011 Standard Specifications, and these Special Provisions refer to the Routine Quality Assurance responsibilities of the Resident Engineer (or the Engineer), and may describe work for which the QAM or ECO shall be responsible for in this project.

Special Provisions

DIVISION 100

15. DIVISION 100. Division 100 of the Specifications and the General Special Provisions are hereby deleted in their entirety and replaced with the following Sections:

SECTION 101 - DEFINITIONS AND TERMS

16. 101.01 ABBREVIATIONS. Wherever the following abbreviations are used in these Specifications or in the RFP, they are to be construed the same as the respective expressions represented.

|                                       |   |
|---------------------------------------|---|
| A                                     | Ampere(s)   |
| A                                     | Arch (Section 601)  |
| ABS                                   | Acrylonitrile-Butadiene-Styrene                                 |
| ADA                                   | Americans with Disabilities Act                                 |
| AAN                                   | Americans Association of Nurserymen                             |
| AAR                                   | Association of American Railroads                               |
| AASHTO                                | American Association of State Highway Transportation Officials  |
| ACI                                   | American Concrete Institute                                     |
| AGC                                   | Associated General Contractors of America                       |
| AI                                    | Asphalt Institute   |
| AIA                                   | American Institute of Architects                                |
| AISC                                  | American Institute of Steel Construction                        |
| AISI                                  | American Iron and Steel Institute                               |
| AITC                                  | American Institute of Timber Construction                       |
| Amp(s)                                | Ampere(s)   |
| AMRL                                  | AASHTO Materials and Reference Laboratory                       |
| ANR                                   | Agency of Natural Resources                                     |
| ANSI                                  | American National Standards Institute                           |
| AREA                                  | American Railway Engineering Association                        |
| AREMA                                 | American Railway Engineering and Maintenance-of-Way Association |
| ASCE                                  | American Society of Civil Engineers                             |
| ASLA                                  | American Society of Landscape Architects                        |
| ASME                                  | American Society of Mechanical Engineers                        |
| ASR                                   | Alkali-Silica Reactivity  |
| ASTM                                  | American International Standards Worldwide                      |
| AWPA                                  | American Wood-Preservers' Association                           |
| AWS                                   | American Welding Society  |
| AWWA                                  | American Water Works Association                                |
| BTU                                   | British Thermal Unit  |
| °C                                    | Degrees Celsius   |
| CAAP                                  | Corrugated Aluminum Alloy Pipe                                  |
| CCRL                                  | Cement and Concrete Reference Laboratory                        |
| CF, FT <sup>3</sup> , ft <sup>3</sup> | Cubic Foot (Feet)   |
| CFR                                   | Code of Federal Regulations                                     |
| CIP                                   | Cast Iron Pipe  |
| CM, M <sup>3</sup> or m <sup>3</sup>  | Cubic Meter(s)  |
| CPEP                                  | Corrugated Polyethylene Pipe                                    |
| CPM                                   | Critical Path Method  |
| CPPP                                  | Corrugated Polypropylene  |
| CRSI                                  | Concrete Reinforcing Steel Institute                            |



|                                       |  |
|---------------------------------------|--|
| CSP                                   | Corrugated Steel Pipe  |
| CWT                                   | Hundredweight  |
| CY, YD <sup>3</sup> , yd <sup>3</sup> | Cubic Yard(s)  |
| DIP                                   | Ductile Iron Pipe  |
| DN                                    | Diameter nominal for metric pipes                                      |
| DTA                                   | District Transportation Administrator                                  |
| EA                                    | Each   |
| EPA                                   | Environmental Protection Agency  |
| ES                                    | End Section (Section 601)  |
| °F                                    | Degrees Fahrenheit   |
| FAA                                   | Federal Aviation Administration, US Department of Transportation       |
| FHWA                                  | Federal Highway Administration, US Department of Transportation        |
| FRA                                   | Federal Railroad Administration, US Department of Transportation       |
| FSS                                   | Federal Specifications and Standards (General Services Administration) |
| FTA                                   | Federal Transit Administration, US Department of Transportation        |
| G or g                                | Gram(s)  |
| Gal or gal                            | Gallon(s)  |
| HA or ha                              | Hectare(s)   |
| HDPE                                  | High Density Polyethylene  |
| Hz                                    | Hertz  |
| in <sup>2</sup>                       | Square Inch(es)  |
| ISEA                                  | International Safety Equipment Association                             |
| ISO                                   | International Standards Organization                                   |
| ITE                                   | Institute of Transportation Engineers                                  |
| J                                     | Joule(s)   |
| KG or kg                              | Kilogram(s)  |
| kips                                  | Thousand pounds  |
| KM or km                              | Kilometer(s)   |
| kN                                    | Kilonewton(s)  |
| kPa                                   | Kilopascal(s)  |
| Kw                                    | Kilowatt(s)  |
| lbf                                   | Pounds of Force  |
| L                                     | Liter(s)   |
| Lb(s) or lb(s)                        | Pound(s)   |
| LF                                    | Linear Foot (Feet)   |
| LRFD                                  | Load and Resistance Factor Design                                      |
| LS                                    | Lump Sum   |
| LU                                    | Lump Unit  |
| M or m                                | Meter(s)   |
| mm                                    | Millimeter(s)  |
| MC                                    | Medium Curing  |
| MS                                    | Medium Set   |
| MFBM                                  | Thousand Feet Board Measure  |
| MGAL                                  | Thousand Gallons   |
| MNL                                   | Manual   |
| MPa                                   | Megapascal(s)  |
| MUTCD                                 | Manual on Uniform Traffic Control Devices for Streets and Highways     |
| NBFU                                  | National Board of Fire Underwriters                                    |
| NCHRP                                 | National Cooperative Highway Research Program                          |
| NDS                                   | National Design Specification  |
| NDT                                   | Nondestructive Testing   |
| NEC                                   | National Electric Code   |
| NEMA                                  | National Electrical Manufacturers Association                          |

|                                       |   |
|---------------------------------------|---|
| NETC                                  | New England Transportation Consortium   |
| NHS                                   | National Highway System   |
| NIST                                  | National Institute of Standards and Technology  |
| NPS                                   | Nominal Pipe Size   |
| NSBA                                  | National Steel Bridge Alliance  |
| NSPE                                  | National Society of Professional Engineers  |
| OSHA                                  | Occupational Safety and Health Administration   |
| Pa                                    | Pascal(s)   |
| PCA                                   | Portland Cement Association   |
| PCC                                   | Portland Cement Concrete  |
| PCCSP                                 | Polymeric Coated Corrugated Steel Pipe  |
| PCI                                   | Precast/Prestressed Concrete Institute  |
| PI                                    | Paved Invert  |
| PSI or psi                            | Pounds Per Square Inch  |
| PVC                                   | Polyvinyl Chloride  |
| QA                                    | Quality Acceptance  |
| QC                                    | Quality Control   |
| RAP                                   | Recycled Asphalt Pavement   |
| RCP                                   | Reinforced Concrete Pipe  |
| RC                                    | Rapid Curing  |
| RS                                    | Rapid Set   |
| ROW or R.O.W                          | Right-Of-Way  |
| RT                                    | Refined Tar   |
| SAE                                   | Society of Automotive Engineers   |
| SF, FT <sup>2</sup> , ft <sup>2</sup> | Square Foot (Feet)  |
| SM, M <sup>2</sup> or m <sup>2</sup>  | Square Meter(s)   |
| SI                                    | The International System of Units. The version of the metric system used in these Specifications. |
| SL                                    | Smooth Lined  |
| SSPC                                  | Steel Structures Painting Council   |
| SY, YD <sup>2</sup> , yd <sup>2</sup> | Square Yard(s)  |
| T                                     | Metric Ton  |
| TL                                    | Test Level (NCHRP 350)  |
| UL                                    | Underwriters' Laboratories, Inc.  |
| µm                                    | Micrometer  |
| µW                                    | Microwatt   |
| USC or U.S.C.                         | United States Code  |
| UTO                                   | Uniformed Traffic Officer(s)  |
| V                                     | Volt(s)   |
| VAOT, AOT<br>or VTrans                | Vermont Agency of Transportation  |
| VCP                                   | Vitrified Clay Pipe   |
| VOSHA                                 | Vermont Occupational Safety and Health Act  |
| VSA or V.S.A.                         | Vermont Statutes Annotated  |
| W                                     | Watt  |
| YD or yd                              | Yard(s)   |

All standard recognized abbreviations may be used in connection with the Contract.

17. 101.02 DEFINITIONS. Wherever in these Specifications or in other Contract Documents the following terms or pronouns in place of them are used, the intent and meaning shall be interpreted as follows. In addition, all definitions contained in other Contract documents shall apply.

ACCEPTANCE DATE - Date noted in the Completion and Acceptance memorandum on which designated responsible Agency personnel have accepted the

completeness and quality of all material incorporated in and work performed to complete the project(s).

ACTUAL COMPLETION DATE - Date noted in the Completion and Acceptance memorandum on which designated responsible Agency personnel have reviewed the project(s) and determined that all Contract work is complete and all Contract requirements have been met.

ACT OF GOD - An "Act of God" means an earthquake, flood, cyclone, or other cataclysmic phenomena of nature beyond the ability of a prudent Contractor to foresee and make preparation to defend against damage.

ADMINISTRATIVE SUBMITTALS - Submittals of administrative information required following Execution of the Design-Build Contract but prior to Authorization to Design and Construct. Requirements of the administrative submittals are defined in the RFP.

AGENCY - Agency of Transportation, State of Vermont (VAOT or VTrans).

AGGREGATE - Inert material such as sand, gravel, crushed gravel, broken stone, or crushed stone, or a combination thereof.

ALTERNATIVE TECHNICAL CONCEPT (ATC) - Any innovative deviations from the BTC, which are consistent with the standards set forth in the Contract Documents, which may either result in improved best value or a shorter Project duration and which will not reduce but may increase the quality or functionality of the facility.

APPROVED PRODUCTS LIST (APL) - A listing of products and materials that have been tested and/or evaluated by the Materials and Research Section and have been deemed satisfactory for use on Agency projects without additional certification requirements. This definition refers to the current APL in the year that materials are being installed.

AUTHORIZATION TO DESIGN AND CONSTRUCTION - The on which the Design-Builder has received approval and Release for Construction of all Administrative Submittals.

AUTHORIZED REPRESENTATIVE

Contractor's - An individual registered with the Office of Contract Administration having the legal authority to sign Contract documents on behalf of the Contractor.

Agency's - The Director of Program Development's Duly Authorized Representative(s) who are responsible for engineering supervision of the construction project.

BASE COURSE - The layer or layers of specified or selected material of designed thickness on a subbase to support a surface course.

BASE TECHNICAL CONCEPT (BTC) - The contents and requirements of the procurement documents, inclusive of the BTC Plans, collectively form the "Base Technical Concept", or "BTC".

BEST VALUE - The overall combination of quality, price and other elements of the required services that, in total, are in the best interest relative to VTrans' needs, as determined by VTrans and defined in the solicitation.

BID - See "Proposal".

BID BOND (PROPOSAL GUARANTY) - The security furnished with a bid to ensure that the bidder will enter into a contract if the Bidder's proposal is accepted by the Agency.

BIDDER - Any company, firm, partnership, joint venture, corporation, association, or other entity that formally submits a Design-Build Proposal in response to the solicitation for the Work contemplated, or for any portion thereof, acting directly or through a duly authorized representative. Typically "Bidder" terms are used prior to the execution of the Design-Build Contract.

BOARD - Transportation Board of the State of Vermont or its successor.

BRIDGE - A structure, including supports, erected over a depression or an obstruction such as water, a highway, or a railway, having a track or passageway for carrying traffic or other moving loads and having a clear span of more than 6.1 m (20 feet) [1.8 m (6 feet) on Non-Federal-Aid projects] measured along the center of the roadway between abutments, spring lines of arches, extreme ends of openings for multiple boxes, or multiple pipes where the clear distance between openings is less than 50 percent of the smaller contiguous opening.

Bridge Length - The dimension of a structure measured along the center of the roadway between backs of abutment backwalls or between the ends of a bridge floor, whichever is greater.

Bridge Width - The clear dimension of structure measured at right angles to the center of the roadway between the inner faces of parapet or railing.

CALENDAR DAY - Any day shown on the calendar, beginning and ending at midnight.

CHANGE (RFQ/RFP) - A supplement to the original Request for Qualifications or Request for Proposal covering additions, deletions, corrections, changes or clarifications in the qualification or procurement conditions that may be issued prior to the Technical Proposal submission date.

CHANGE ORDER/SUPPLEMENTAL AGREEMENT - A written agreement made and entered into by and between the Contractor and the Agency covering work not otherwise provided for in the Contract, revisions in or amendments to the terms of the Contract or conditions specifically described in the Contract Documents as requiring a change order or Supplemental Agreement. Change Orders/Supplemental Agreements constitute amendments to the original Contract once properly signed and executed.

CHANNEL - A natural or artificial water course.

CHIEF ENGINEER - See DIRECTOR OF PROGRAM DEVELOPMENT.

CHIEF OF UTILITIES AND PERMITS - The Agency's authorized representative to Release for Construction temporary and permanent utility relocation plans to assure conflicting utility facilities are relocated appropriately as part of the project work.

CLAIM

Contractor's Claim - A claim by the Contractor for adjustment or dispute under Subsection 105.20 of these Special Provisions.

DAMAGE CLAIM - A claim by an individual or entity for damage to property or for personal injury.

Labor And Materials Claim - A claim by a subcontractor, supplier, or other entity covered by 19 V.S.A. Section 10(9) for monies claimed to be due and payable.

CLEAR ZONE - The roadside border area starting at the edge of the traveled way available for use by errant vehicles. Specified clear zones are as shown in the Plans.

COLLUSION - A secret agreement among two or more persons for a deceitful or fraudulent purpose.

CONDUIT - A tube used for carrying, holding, and protecting electrical or other utilities.

CONSTRUCTION AREA - The entire portion of a project site within the right-of-way and easement limits during construction.

CONSTRUCTION EASEMENT - See EASEMENT

CONSTRUCTION ENGINEER - The duly authorized representative of the Agency responsible for engineering supervision of a specific project after the Contract has been signed and until project completion and final acceptance.

CONSTRUCTION ENVIRONMENTAL ENGINEER - The Agency's authorized representative of the Construction Section to provide guidance and technical assistance to Resident Engineers in order to assure compliance with environmental regulations.

CONSTRUCTION MANAGER - Team member of the Design-Builder, who shall be on the Project site for the duration of all construction operations, shall be responsible for managing all construction activities during the construction process, including all QC activities. This individual shall also implement the Traffic Control Plan for the project and be the key point of contact for issues arising relative to the traffic control. This individual shall be able to demonstrate relevant licensing, certification(s), and training.

CONSTRUCTION SERVICES ENGINEER - The duly authorized representative of the Construction Engineer for the purposes of providing expertise in matters of claims, specifications, policy, procedures, and Contract finals.

CONTRACT - The written agreement between the Agency and the Contractor setting forth the obligations of the parties relative to the performance of the work.

The Contract includes the documents stipulated in Part 3 of the RFP, Notice to Proceed, and any supplemental agreements that are required to complete the work in an acceptable manner. It shall be inclusive, but not limited to the RFP, RFP Changes, the most recent revision of the VTrans Standard Specifications for Construction; General Special Provisions; Supplemental Specifications; Special Provisions; the Agency's

RFQ and RFP; the Design-Builder's SOQ and Proposal; any Clarification document finalized by the Agency; any and all pertinent supporting documents, and plans; and the accepted Administrative Submittals.

CONTRACT BONDS - The approved forms of security, signed and furnished by the Contractor and the Contractor's surety or sureties, guaranteeing complete performance of the Contract, compliance with the Contract, and the payment of all legal debts pertaining to the construction of the project or work.

CONTRACT COMPLETION DATE - The calendar date by which the work shall be completed. If the Contract is a duration type Contract, the Notice to Proceed shall also indicate the Contract Completion Date.

CONTRACT DOCUMENTS - See CONTRACT.

CONTRACT DURATION - The number of working days or calendar days allowed for completion of the Contract.

CONTRACT ITEM - A specific unit of work for which a price is provided in the Contract.

CONTRACT NOTICE TO PROCEED - Written notice to the Contractor stipulating the date on which the Contractor can begin work on the Project and from which date Contract duration can be charged.

CONTRACTOR - The Design-Builder (as defined in other Contract documents) which is a party to the Contract with the Agency which is undertaking the performance of the work under the terms of the Contract and acting directly or through its agent(s) or employee(s). The term "Contractor" means the prime Contractor as differentiated from a subcontractor. All Contractors must be registered with the Secretary of State. The Contractor will act in an independent capacity and not as officers or employees of the State.

CONTRACT PLANS - The Contract drawings prepared by the Contractor that show the location, character, and dimensions of the work, including layouts, profiles, cross-sections, and other details. See also PLANS.

CPM (CRITICAL PATH METHOD) - A Schedule that must depict work activities in a time-based, logic diagram format showing the relationship with preceding and succeeding activities with the critical path clearly indicated.

DESIGN-BUILD (D-B) CONTRACT - A written agreement executed between the State and a Design-Builder that sets forth the obligations of the Design-Builder, including, but not limited to, the performance of work, furnishing of materials and labor, quality of the materials, and basis of payment to both design and construct the Work specified to be performed in the Contract. Oral representations or promises shall not be considered a part of the Contract.

DESIGN-BUILDER - The Bidder who executes the Contract with the Agency is the Design-Builder. The Design-Builder shall be a company, firm, partnership, joint venture, corporation, association, or other entity permitted by law to practice engineering, and construction contracting in the State of Vermont. The Design-Builder shall have the capability, in all respects, to perform fully the contract requirements and have the

business integrity and reliability which will assure good faith performance.

DESIGN-BUILD PROJECT MANAGER - The Key Person, a team member of the Design-Builder, who shall be responsible for the overall management, scheduling, design, construction, quality management and contract administration for the Project.

DESIGNER - The team member(s) of the Design-Builder responsible for the final design of the Project to be constructed.

DESIGN MANAGER - The Key Person of the Design-Builder, who shall be responsible for coordinating all individual design disciplines, including design of traffic control and ensuring the overall Project design is in conformance with the Contract Documents. The Design Manager shall be responsible for establishing and overseeing Design Quality for all pertinent disciplines involved in the design of the Project, including: review of design, working plans and drawings, specifications, and constructability for the Project. This individual shall be a licensed Professional Engineer in the State of Vermont.

DETOUR - A temporary route to carry traffic.

DIAMETER NOMINAL (DN) -- The metric version of nominal pipe size (NPS), applying to all plumbing, gas, oil, drainage, and other piping used in the project.

DIRECTOR or DIRECTOR OF PROGRAM DEVELOPMENT - Director of the Program Development Division of the Agency.

Wherever the terms "Director," "Chief Engineer," "Director of Engineering and Construction," "Director of Construction and Maintenance," or "Director of Project Development" appear in the Contract Document, they shall be read as, and shall mean, "Director of Program Development."

DISTRICT TRANSPORTATION ADMINISTRATOR (DTA) - The duly authorized representative of the Agency for a maintenance district subdivision of the State who is responsible for maintenance of State transportation facilities.

DRAFT SPECIAL PROVISIONS - Additions and revisions to the Standard Specifications, Supplemental Specifications, General Special Provisions, Plans, or other documents that are proposed by the Design-Builder, but have not been approved by the Agency.

DRAINAGE - The system of pipes, drainage ways, ditches, and structures by which surface or subsurface waters are collected and conducted from the project area or a transportation facility.

EARTH - See SOIL.

EASEMENT (RIGHT-OF-WAY) - A right acquired to use or control property outside of the established right-of-way limits for a designated purpose.

EMBANKMENT - That portion of a filled area situated between the previously existing ground level and the subgrade (roadbed).

ENCROACHMENT - Use of highway right-of-way or easement unlawfully and/or without authority or permission.

ENGINEER - See RESIDENT ENGINEER.

ENGINEER OF RECORD - The Engineer of Record for the Project shall be the Design-Manager.

ENGLISH - Other than when referring to the English language, the U.S. Customary Units of Measurement.

ENVIRONMENTAL COMMITMENTS - The term environmental commitments includes any action that (1) is intended to avoid, minimize, and mitigate environmental impacts of a project, and (2) is required to be implemented as a condition of project approval as part of the environmental review, clearance or permitting process required for this project. These actions shall be compiled into a list of items that will be defined as the Environmental Commitments.

ENVIRONMENTAL COMMITMENTS OFFICER (ECO) - The Key Person who shall be the environmental lead for the Design-Builder and the single point of contact for all matters relating to the project environmental review, clearances and permitting, compiling the environmental commitments and conformance to the commitments. The ECO shall be independent from the Construction Contractor and the QAM firm.

EQUIPMENT - All machinery, instruments, tools, vehicles, and apparatus together with the necessary supplies for upkeep and maintenance, for the proper construction and acceptable completion of the work.

EXTRA WORK - An item of work not provided for in the Contract as awarded but determined by the Engineer to be essential to the satisfactory completion of the Contract. Extra Work shall be performed at agreed upon prices or on a force account basis as provided in the Contract.

EXTRA WORK ORDER - A form used to provide for the performance of work or furnishing of materials involving Extra Work.

FEDERAL AVIATION ADMINISTRATION - The agency within the US Department of Transportation, Washington, D.C., with authority concerning airports and aviation.

FEDERAL HIGHWAY ADMINISTRATION - The agency within the US Department of Transportation, Washington, D.C., with authority concerning highways.

FEDERAL RAILROAD ADMINISTRATION - The agency within the US Department of Transportation, Washington, D.C., with authority concerning railroads.

FEDERAL TRANSIT ADMINISTRATION - The agency within the US Department of Transportation, Washington, D.C., with authority concerning public transit.

FINAL ESTIMATE - A compilation of item quantities prepared upon completion of the Contract stating the whole amount of work done by the Contractor and the final amount to be paid under the Contract.

FINALS ENGINEER - The duly authorized representative of the Construction Engineer responsible for handling all issues related to finalizing a Contract.



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FORCE ACCOUNT - Prescribed Extra Work paid for on the basis of actual costs, including appropriate extra work, as defined in Subsection 109.06.

GENERAL SPECIAL PROVISIONS - Additions and revisions to the *Standard Specifications for Construction* approved pursuant to the Specification approval process.

GRADE SEPARATION - A crossing of two or more transportation facilities at different elevations.

HAZARDOUS MATERIALS AND WASTE COORDINATOR - The Agency's duly authorized Hazardous Materials and Waste Coordinator.

HOLIDAYS - In the State of Vermont, "Holidays" occur on:

|                       |  |
|-----------------------|--|
| New Years Day         | January 1                              |
| M.L.King's Birthday   | Third Monday in January                |
| President's Day       | Third Monday in February               |
| Town Meeting Day      | First Tuesday in March                 |
| Memorial Day          | Last Monday in May                     |
| Independence Day      | July 4                                 |
| Bennington Battle Day | August 16                              |
| Labor Day             | First Monday in September              |
| Veteran's Day         | November 11                            |
| Thanksgiving Day      | Fourth Thursday and Friday in November |
| Christmas Day         | December 25                            |

If a Holiday falls on a Sunday, the following Monday shall be considered the Holiday; if a Holiday falls on a Saturday, the Friday immediately preceding shall be considered the Holiday.

INDEPENDENT ASSURANCE PROGRAM - Activities that are an unbiased and independent evaluation of all the sampling and testing procedures used in the acceptance program.

INSPECTOR - An authorized representative of the Engineer assigned to make detailed inspections of Contract performance.

INTERDEPENDENT ATC - A grouping of Alternative Technical Concepts composed of multiple deviations from the Base Technical Concept whose implementation is dependent on all components being approved.

KEY PERSONNEL - Individuals designated as Key Personnel pursuant to the RFQ for this project.

LABORATORY - The Agency's Materials and Research Section Central Laboratory or any other testing laboratory which may be designated by the Engineer.

LIQUIDATED DAMAGES - The charge assessed to the Contractor pursuant to the Contract because the Contractor did not complete the Contract within the Contract time or by the Contract completion date, not as a penalty but as an assessment of damages that are impossible or difficult to determine with accuracy.

LOAD TICKET - A ticket accompanying a load of material and indicating the gross weight of the load less the tare weight of the delivery vehicle, and other information as specified and/or as required by the Engineer.

MASS - The words "mass" and "weight" are used interchangeably. Mass must be converted to force (by multiplying by gravity) before computing structural reactions, shears, moments, or internal stresses.

MATERIALS - Any substance(s) specified for use in the construction of the project and its appurtenances.

MATERIALS ENGINEER - The duly authorized representative of the Agency responsible for advising VTrans' Project Manager and Resident Engineer with regard to the acceptance of materials specified in contract.

MEDIAN - Unless different in context, the portion of a divided highway separating opposing traveled ways.

METRIC TON - A unit of measure equivalent to 1000 kg, denoted in the Contract Documents as "Metric Ton" or "T." See also TON.

NON-PARTICIPATING - Designates work in which the cost is not shared by the Federal and/or State Government.

PAY ITEM - See CONTRACT ITEM.

PAVEMENT STRUCTURE - The combination of subbase, base course, and surface course (wearing course or travel course) placed on a subgrade to support the traffic load and distribute it to the roadbed.

PLANS - The plans and drawings that show the location, character, sequence, and dimensions of the work, including layouts, profiles, cross-sections, and other details.

Contract Plans - See CONTRACT PLANS.

Standard Drawings - See STANDARD DRAWINGS.

POINT OF CONTACT (POC) - The duly authorized representative of the Agency who is solely responsible for all communication between the Agency and all interested parties.

PLANT INSPECTOR - An authorized representative of the Agency assigned to perform detailed inspections of methods and materials at plants, including bituminous, concrete, and structural steel assembly plants.

PROFESSIONAL ENGINEER - A qualified registered Professional Engineer licensed in the State of Vermont or eligible to practice engineering in the State of Vermont under the transient practice provisions of Title 26 VSA Section 1181a.

PROFILE GRADE - The trace of a vertical plane intersecting the top surface of the proposed wearing surface, usually along the longitudinal centerline. Depending on the context, "profile grade" means either the elevation at one or more points or the gradient of such trace.

PROJECT - Work specified to be performed in the Design-Build Contract that VTrans is authorized by law to undertake.

PROJECT MANAGER (PM) - VTrans' designee for managing all phases of contract procurement, project development and administering the Design-Build contract. This individual is responsible for managing the

procurement development, proposal evaluation, contract execution, project scope, project schedule, and project budget.

PROPOSAL - Separately sealed technical and price information submitted by a Bidder in response to a Request for Proposal (RFP) to perform the Work at the price set forth therein; valid only when properly signed and guaranteed. This documentation includes the Technical and Price Proposals required by the RFP. The pricing of a prospective Design-Builder's Proposal shall be considered a "Bid".

QUALIFIED PRODUCTS LIST (QPL) - A listing of protective coatings for steel for bridges that have been tested and/or evaluated by the North East Protective Coating Committee (NEPCOAT) and have been deemed satisfactory for use on Agency projects without additional certification requirements.

QUALITY ASSURANCE MANAGER (QAM) - The QAM is a representative of the Engineer and is responsible for providing representation and oversight for continuous quality assurance monitoring and inspection for 100 percent of all construction activities related to the project, both onsite and offsite, and testing of all materials used. The QAM will also monitor the contractors QC program.

QUALITY ASSURANCE (QA) - All those planned and systematic actions necessary to provide confidence that a product or service will satisfy given requirements for quality.

QUALITY CONTROL (QC) - All Design-Builder/vendor operational techniques and activities that are performed or conducted to demonstrate fulfillment of the contract requirements.

REGIONAL CONSTRUCTION ENGINEER - The duly authorized representative of the Agency for a Construction regional subdivision of the State who is responsible for administering and overseeing construction contracts.

RELEASE FOR CONSTRUCTION - VTrans concurrence that components of the Project including, but not limited to: Design, Specifications, Plans and Working Drawings are in general conformance with the Contract requirements. RELEASE FOR CONSTRUCTION is not an acceptance or approval by VTrans for any portion of the Work.

REQUEST FOR PROPOSAL (RFP) - All documents, whether attached or incorporated by reference, utilized for soliciting a proposal. The advertisement of the RFP initiates the second phase of a two-phase selection process.

REQUEST FOR QUALIFICATIONS (RFQ) - All documents, whether attached or incorporated by reference, utilized for soliciting Bidders to submit specific qualifications/ certifications for a project. The RFQ initiates the first phase of a two-phase selection process for the purpose of qualifying interested Bidders for short-list consideration.

RESIDENT ENGINEER or ENGINEER - VTrans' designee for managing all phases of active project construction and administration once the Design-Build Contract is awarded. The "Resident Engineer" has the exclusive authority for the acceptance of all work and materials for the Project.

RIGHT-OF-WAY - The land or property, or interests therein, devoted to transportation purposes.

ROADBED - The graded surface prepared as a foundation for the pavement structure and shoulders of a transportation facility. (See also: SUBGRADE).

ROADSIDE - The area adjoining the outer edge of the traveled way or shoulder of a highway. Extensive median areas between the roadways of a divided highway may also be considered roadside.

ROADWAY - The portion of a highway within limits of construction.

ROADWAY, TRAFFIC, AND SAFETY ENGINEER - The Agency's duly authorized representative responsible for advising VTrans' Project Manager and Resident Engineer with regard to the design aspects of roadway, traffic, and safety projects. (Sometimes referred to as the "Roadway Program Manager" or "Highway Safety & Design Engineer").

SAFETY OFFICER

Contractor's - An individual designated by the Contractor charged to assure that all construction operations under the Contract are performed safely and according to all VOSHA regulations.

Agency's - The Agency's duly authorized Occupational Safety Coordinator whose job duties include safety inspection of Agency construction projects.

SCHEDULE OF WORK - The approved CPM chart Baseline Schedule prepared and submitted by the Contractor as required by the Contract documents.

SECRETARY - The appointed head of the Agency of Transportation of the State of Vermont.

SHORT-LIST - The qualifying list of Bidders presented in ranked order as determined by SOQ evaluation to advance to the next phase of the selection process. Only Short-listed Bidders will be invited to submit proposals in response to the RFP.

SHOULDER - The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

SIDEWALK - That portion of the roadway primarily constructed for the use of pedestrians.

SLOPES - The inclined areas extending from the shoulders to the previously existing surface of the ground.

SOIL (EARTH) - Sediments or other unconsolidated accumulations of solid particles produced by the chemical and physical disintegration of rocks and which may or may not contain organic matter.

SOLICITATION - All documents comprising the RFQ and RFP.

SPECIAL PROVISIONS - Additions and revisions to the *Standard Specifications for Construction*, Supplemental Specifications, and General Special Provisions applicable to the Contract, as well as other provisions specific to the Contract.

SPECIALTY ITEM - Work that requires highly specialized knowledge, ability or equipment not ordinarily available in contracting organizations qualified to bid on the Contract as a whole; in general specialty items are limited to minor components of the overall Contract.

SPECIFICATIONS - The compilation of provisions and requirements for the performance of prescribed work including the Selecting Contractors and Specifications for Contractor Services document including Customary State Contract Provisions and Revised Customary State Contract Provisions, Standard Specifications, Supplemental Specifications, General Special Provisions, Special Provisions, Plans, and other documents that are part of a particular contract.

STANDARD DRAWINGS - Agency approved drawings used for typical repetitive use, showing details to be used where appropriate.

STANDARD SPECIFICATIONS or STANDARD SPECIFICATIONS FOR CONSTRUCTION - The book entitled *Standard Specifications for Construction*, as approved for general application and repetitive use in Agency construction contracts.

STATE - Unless different in context, the State of Vermont acting through its Agency of Transportation and authorized representative(s).

STATEMENT OF QUALIFICATIONS (SOQ) - The formal documentation submitted by a Bidder in response to an RFQ. Information must be limited to qualification and experience as specified in the RFQ.

STRUCTURAL CONCRETE ENGINEER - The Agency's duly authorized representative of the Materials and Research Section responsible for the supervision of plant inspectors utilized at precast and/or prestressed concrete plants and for review of all Portland cement concrete mix designs.

STRUCTURAL EMBANKMENT AREA - The cross-sectional area of an embankment situated between the lines projected downward from the outer edges of the subgrade on a 1:1.5 (vertical:horizontal) slope to the intersection with the previously existing ground.

STRUCTURES ENGINEER - The Agency's duly authorized representative responsible for review of structural engineering for the project. (Sometimes called the "Structures Program Manager.")

SUBBASE - The layer or layers of specified or selected material of designated thickness placed to support a base and/or surface course.

SUBCONSULTANT - An individual or legal entity to which the Designer sublets a part of the Work included in a contract.

SUBCONTRACTOR - An individual or legal entity to whom or which the Contractor sublets part of the work.

SUBGRADE - The graded surface prepared as a foundation for the pavement structure and shoulders of a transportation facility. (See also: ROADBED).

SUBSTANTIAL COMPLETION DATE - The date when, each element of highway, street, and structure is completed to allow the safe use by the travelling public. Each highway and street shall be open to the required number of lanes and widths (including shoulders), to allow full vehicle capacity to utilize the infrastructure. In general, the work is considered

substantially complete when the work meets the following minimum criteria: 1) All courses of permanent pavement are complete; 2) permanent curbing and sidewalks are placed; 3) all permanent project drainage is complete; 4) guardrail and terminal sections are properly installed; 5) permanent pavement markings are in place; 6) permanent regulatory and warning signs are installed; 7) permanent highway lighting is operational; 8) all project grading is completed including side slopes, removal of crossovers, and removal of lane shifts; and 9) all quality control and quality assurance documents, including materials testing results and materials certifications have been approved and accepted by the Engineer.

SUBSTRUCTURE - All of that part of a structure below the bearings of simple and continuous spans, skewbacks of arches, and tops of footings of rigid frames; included are backwalls, wingwalls, and wing protection railings.

SUPERINTENDENT - The Contractor's authorized representative in responsible charge of the work. For the purpose of these Specifications, the Superintendent shall be the same individual defined in other Contract documents as the Design-Builder's Construction Manager.

SUPERSTRUCTURE - All that part of a structure supported by the substructure, excluding the approach slabs.

SUPPLEMENTAL AGREEMENT- See CHANGE ORDER/ SUPPLEMENTAL AGREEMENT.

SUPPLEMENTAL SPECIFICATIONS - Specifications so designated that are not included in the Standard Specifications, General Special Provisions, or Special Provisions.

SURETY - The individual, partnership, firm, or corporation, or any acceptable combination thereof, other than the Contractor, executing the bond or bonds furnished by the Contractor. Surety Companies must be authorized to do business in the state of Vermont [See 19 VSA Section 10 (8)].

SURFACE COURSE - The uppermost component of a pavement structure, also called the wearing course or travel surface.

TECHNICAL EVALUATION COMMITTEE (TEC) - The Committee appointed by the Director of Program Development to review and evaluate the Design-Build Proposals. The Committee members will be limited to VTrans staff, unless otherwise approved by the Director.

TON - The word "ton" by itself is a unit of measure equivalent to 2000 pounds. See also "METRIC TON."

TRAFFIC ENGINEER - See ROADWAY, TRAFFIC, AND SAFETY ENGINEER.

TRAVELED WAY - The portion of the roadway for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

UNIT PRICE - The Contract price for one unit of work, as defined by the Contract.

UTILITY - The privately, publicly, or cooperatively owned lines, facilities, and systems for producing, transmitting, or distributing communications, power, electricity, light, heat, gas, oil, crude products, water, steam, waste, storm water not connected with highway

drainage, and other similar commodities, including publicly owned fire and police signal systems and street lighting systems, which directly or indirectly serve the public or any part thereof. The term "utility" shall also mean the utility company, inclusive of any wholly owned or controlled subsidiary.

VERIFICATION SAMPLING AND TESTING - Sampling and testing performed by qualified testing personnel employed by the Agency or its designated agent, excluding the contractor and vendor, to validate the quality of the product.

VTRANS OR AGENCY - The State of Vermont Agency of Transportation or any duly authorized representative thereof.

WEIGHT - In these Specifications, the words "weight" and "mass" are used interchangeably.

WEIGHTS AND MEASURES - The Vermont Department of Agriculture, Division of Weights and Measures.

WORK - The furnishing of all design, labor, materials, equipment, and incidentals necessary or convenient to the successful completion of the project and carrying out of the duties and obligations imposed by the Contract.

WORKING DAY - A calendar day on which construction operations could proceed as determined by the Engineer; unless excepted, "Working Day" excludes Saturdays, Sundays, and Holidays.

WORKING DRAWINGS - Supplemental design sheets or similar data which the Contractor is required to submit to the Engineer such as stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, and bending diagrams for reinforcing steel.

WRITTEN ORDER - A statement in writing from the Resident Engineer to the Contractor that:

- (a) Authorizes or directs work to be done that is not part of the Contract, including method of payment.
- (b) Informs the Contractor of work that is not being accomplished according to the Plans and these Specifications, and directs corrective action.
- (c) Documents quantities to be paid for designated Contract items.
- (d) Directs that safety, environmental, or other requirements or measures be followed.
- (e) Directs that certain work or all work be stopped or discontinued.
- (f) Brings to the Contractor's attention any other information or concerns that the Engineer may wish to emphasize.

18. 101.03 INTENTION OF TERMS.

- (a) By/To the Engineer. In order to avoid cumbersome and confusing repetition of expressions in these Specifications, whenever anything is, or is to be, done if, as, when, or where "contemplated,

required, determined, directed, specified, authorized, ordered, given, designated, indicated, considered necessary, deemed necessary, permitted, reserved, suspended, established, approval, approved, disapproved, acceptable, unacceptable, suitable, accepted, satisfactory, unsatisfactory, sufficient, insufficient, rejected, or condemned," it shall be read and understood as if the expression were followed by the words "by the Engineer" or "to the Engineer."

- (b) As Ordered/Directed by the Engineer. When the phrases "as ordered by the Engineer," "as directed by the Engineer," or similar phrases are used in the Contract, they shall be understood to provide the Engineer latitude to meet field conditions, but in no case shall these phrases be construed to permit changing the intent of the Contract Documents.
- (c) Furnish and Provide. "Furnish," "provide," and words of similar meaning, when used in relation to the "Contractor," shall mean at the Contractor's expense unless otherwise specifically provided in the Contract.
- (d) Headings and Caption of Sections, Subsections, and Paragraphs. All headings and captions are inserted for convenience and identification only and are in no way intended to define, limit, or expand the scope and intent of the Contract.
- (e) Approval of/Ordered by/Consent of Engineer. As they appear in these specifications, phrases like "approval of the Engineer," "as ordered by the Engineer," "with the consent of the Engineer," and any similar phrase indicating the acceptance or direction by the Engineer shall not supersede any requirement of the Contract that the Contractor meet all contractual obligations, including but not limited to, compliance with permit conditions and applicable laws, rules, regulations, ordinances, and bylaws.
- (f) Construction/Interpretation of Contract Documents. The Contract and its provisions shall not be construed or interpreted for or against the Agency because the Agency drafted or caused its representative(s) to draft its provisions.

## SECTION 102

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## SECTION 103 - TAXES AND INSURANCE

- 19. 103.01 CONSTRUCTION EQUIPMENT TAX. The Contractor shall pay all construction equipment tax assessed under Title 32 VSA Section 3603 for machinery and other personal estate; the provisions of Title 32 VSA Section 3603 are made a part hereof by reference.
- 20. 103.02 WITHHOLDING OF TAXES. The Contractor shall comply with the requirements of subchapter 4 of Chapter 151 of Title 32 VSA relating to the withholding of taxes from employees, and all taxes withheld pursuant to subchapter 4 shall be reported and paid to the Commissioner of Taxes.
- 21. 103.03 STATE SALES TAX. Contractors are not required to pay the Vermont sales tax for materials incorporated into a state funded project completed



on property owned or held in trust for the benefit of any governmental body or agency and used exclusively for public purposes or owned or held in trust for the benefit of any organization holding a valid Exemption Certificate [see Vermont Sales and Use Tax Regulations No. 226-2 and 226-7 and 32 V.S.A. Section 9743(4)] and used exclusively in the conduct of its business or purpose, or for materials incorporated in a rail line in connection with the construction, maintenance, repair, improvement or reconstruction of the rail line [see 32 V.S.A. Section 9741(44)].

Therefore, no sales tax shall be included in the cost of these materials.

Contractors are responsible for maintaining records sufficient to justify eligibility for sales tax exemption. Forms for maintaining these records are available from the Vermont Department of Taxes.

22. 103.04 INSURANCE REQUIREMENTS. Insurance obtained by the Contractor to cover the below-listed requirements shall be procured from an insurance company registered and licensed to do business in the State of Vermont. All insurance coverage for property damage shall provide coverage for "Replacement" cost. Before the Contract is signed and becomes effective, the Contractor shall file with the Agency certificates of insurance, in duplicate, executed by an insurance company or its licensed agent(s), on a form satisfactory to the Agency, stating that with respect to the Contract awarded, the Contractor carries insurance in accordance with the following requirements. Renewal certificates for keeping the required insurance in force for the duration of the Contract shall also be filed as specified above.

No warranty is made that the coverages and limits listed herein are adequate to cover and protect the interests of the Contractor and any subcontractor for the Contractor's and any subcontractor's operations. These are solely minimums that have been established to protect the interests of the State. The Contractor shall also obtain applicable insurance(s), including but not limited to professional liability, as required in Part 3 of the RFP documents.

- (a) Workers Compensation Insurance. With respect to all operations performed the Contractor shall carry Workers Compensation Insurance in accordance with the laws of the State of Vermont, 21 V.S.A. Chapter 9. The Contractor shall also ensure that all subcontractors carry Workers Compensation Insurance in accordance with 21 V.S.A. Chapter 9 for all work performed by them.
- (b) Commercial General Liability Insurance. With respect to all operations performed by the Contractor and subcontractors, the Contractor shall carry Commercial General Liability Insurance on an occurrence form providing all major divisions of coverage, including but not limited to:

Premises - Operations

Independent Contractor's Protective

Products and Completed Operations

Personal Injury Liability

Contractual Liability applying to the Contractor's obligations under Subsection 107.16, Broad Form Property Damage

Collapse and Underground (CU) Coverage

Explosion (X) Coverage, unless this requirement is waived in writing by the Agency of Transportation

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Limits of Coverage shall be not less than:

\$5,000,000 Each Occurrence  
\$5,000,000 General Aggregate applying, in total, to this project only  
\$5,000,000 Products/Completed Operations Aggregate  
\$ 50,000 Fire Damage Legal Liability

- (c) Automobile Liability Insurance. The Contractor shall carry Automobile Liability Insurance covering all motor vehicles, including owned, hired, borrowed, and non-owned vehicles, used in connection with the project. Limits of Coverage shall be not less than:

Bodily Injury: \$1,000,000 Each Person,  
\$1,000,000 Each Occurrence

Property Damage: \$ 500,000 Each Occurrence

OR

Combined Single Limit: \$1,500,000 Each Occurrence

- (d) Railroad Protective Liability Insurance. When the Contract involves work on, over, or under the right-of-way of any railroad, the Contractor shall cooperate with and allow the railroad company or its agents free and full access to the project during construction along with all materials and equipment necessary in order that their duly authorized employees or agents may do any and all railroad construction, inspection, flagging and watching.

The Contractor shall defend, indemnify, and save harmless the railroad and all of its officers, employees, and agents against any claim or liability arising from or based on any delay to the Contractor as a result of railroad construction or maintenance, whether by the railroad company, its employees, or agents.

- (e) General Insurance Conditions. The insurance specified under parts (a), (b), and (c) above shall be maintained in force until acceptance of the project by the Agency.

Under part (b) above, Products and Completed Operations Coverage shall be maintained in force for at least one year from the date of acceptance of the project.

Under part (d) above, the Railroad Protective Policy shall remain in force until all work required to be performed on railroad property is completed to the satisfaction of the Railroad and of the Director of Program Development of the Agency.

The contractual liability insurance requirements detailed in the Contract Documents, including Subsection 107.16, are to indemnify, defend, and hold harmless the Municipality(ies), the State, the Agency, and railroad(s), as applicable, and their officers, agents, representatives, and employees, with respect to any and all claims, causes of actions, losses, expenses, or damages that arise out of, relate to, or are in any manner connected with the Contractor's work or the supervision of the Contractor's work on this project.

Each policy, except the Workers Compensation Policy, shall name the Municipality(ies), the State, the Agency, and railroad(s), as additional insureds for actions, losses, expenses, or damages that arise out of, relate to, or are in any manner connected with the Contractor's work or the supervision of the Contractor's work on this project.

Umbrella Excess Liability Policies may be used in conjunction with primary policies to comply with any of the limit requirements specified above.

"Claims-made" coverage forms are not acceptable without the prior written consent of the Agency.

The Contractor shall investigate and the Contractor and/or insurance company shall either adjust or defend all claims against the insured for damages covered, even if groundless.

Each policy furnished shall contain a rider or non-cancellation clause reading in substance as follows:

*Anything herein to the contrary notwithstanding, no cancellation, termination, or alteration of this policy by the company or the assured shall become effective unless and until notice of cancellation, termination, or alteration has been given by registered mail to the Director of Program Development of the Vermont Agency of Transportation, National Life Building, Montpelier, Vermont 05633-5001, at least 30 calendar days before the effective cancellation, termination, or alteration date unless all work required to be performed under the terms of the Contract is satisfactorily completed as evidenced by the formal, final acceptance of the project by the Agency.*

There shall be no directed compensation allowed the Contractor on account of any premium or other charge necessary to take out and keep in effect such insurance or bond; the cost thereof shall be considered included in the general cost of the work.

#### SECTION 104 - SCOPE OF WORK

23. 104.01 INTENT OF CONTRACT. The intent of the Contract is to provide for the permitting, design, construction and completion in every detail of the work described. The Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the Contract Documents.
24. 104.02 ALTERATION OF PLANS OR CHARACTER OF WORK. To suit conditions disclosed as the work progresses, the Engineer may, without notice to the Sureties on the Contractor's bonds, make alterations in the design, in type of materials, in the quantities or character of the work or materials required, in the cross-sections, in dimensions of structures, in length of project, in locations, and any other ways deemed appropriate. Alterations will not constitute a change in other parts of the Contract or a waiver of any condition of the Contract, and shall not invalidate any of the provisions of the Contract Documents.

If the altered or added work as directed by the Engineer is of sufficient magnitude to require additional time in which to complete the project, a time adjustment will be made pursuant to Subsection 108.11.

25. 104.03 EXTRA WORK. The Contractor shall perform extra or unforeseen work according to the Contract Documents and as directed by the Engineer whenever it is deemed necessary or desirable by the Engineer; payment will be made pursuant to Subsection 109.06.
26. 104.04 MAINTENANCE OF TRAFFIC.
  - (a) All Facilities Safe and Passable. All facilities to be used by the traveling public, including temporary highways, bridges, sidewalks, and approaches as necessary to accommodate the vehicular or pedestrian traffic diverted from the facility undergoing improvements, shall be provided and maintained in a safe and passable condition. All traffic control plans and devices shall conform to the latest edition of the MUTCD.
  - (b) Service Shall Be Maintained. Service shall be maintained in accordance with the Contract Documents.
  - (c) Transportation Management Plan. The Traffic Management Plan shall be in accordance with the Contract documents.
  - (d) Detours and Temporary Bridges. Detours necessary for public travel which are not contiguous to the work will be designated by the Agency unless otherwise provided. When contiguous to the work, detours shall be constructed and maintained by the Contractor and no compensation will be allowed to the Contractor except as provided in the Contract. If the Contractor elects to construct a temporary bridge on a detour contiguous to the work over which traffic is to be maintained while a culvert or bridge is being constructed, the temporary bridge shall be constructed according to Section 528. The Contractor shall be responsible to the public for the structural adequacy and safety of these structures and approaches. The Contractor shall provide, erect, and maintain all necessary barricades, lights, signs, signals, other traffic control devices and flaggers required in accordance with Subsections 107.08 and 107.09.
  - (e) Winter Maintenance On Active Projects. If conditions on active projects (not closed down for the winter) require snowplowing, sanding, or salting of the highway, including temporary highways, temporary sidewalks, detours, and bridges, the contractor shall make provisions to allow the state or municipality to accomplish such snowplowing, sanding, and salting.
  - (f) Winter Maintenance On Closed Projects. When a project or any portion thereof is closed down for the winter season, the Contractor shall leave the project in a satisfactory condition for the traveling public and in a condition suitable for normal and satisfactory winter maintenance. The full depth of subbase shall be placed over portions of the road under construction and used by the traveling public unless otherwise shown on the Plans or directed by the Engineer. During the period that the project is closed down for the winter season, the State, a political subdivision thereof, or other properly designated entity will assume responsibility for snowplowing, salting, and sanding. This shall not relieve the

Contractor of any other responsibilities regarding public convenience and safety as specified in this Section, from the liabilities as specified in Section 107, or as specified elsewhere in the Contract. If unsatisfactory travel conditions or ruts develop in the traveled way or other construction defects or conditions dangerous to the traveling public develop, whether arising from the execution or non-execution of the work, the Contractor may be directed to return to the construction site and carry out necessary measures to satisfactorily remedy the situation; the cost for said work will be included as part of the Contract lump sum price, with no additional payment. If the Contractor fails to carry out the measures to satisfactorily remedy the situation immediately, the Engineer may cause the work to be performed and deduct the cost from any monies due or to become due to the Contractor. If the partial or complete closing of a project is due to the Contractor's inability to complete the Contract before the Contract completion date, the Contractor shall bear all costs associated with making the project acceptable to the Engineer for winter shut down.

- (g) Closed Projects; Temporary Traffic Control Devices. When a project or any portion thereof is closed down for the winter season or for any other reason, the Contractor shall erect and maintain temporary guardrail, guide posts, barricades, warning signs, and other traffic control devices throughout the length of the project as directed by the Engineer. These temporary installations shall conform to Contract Documents for permanent traffic control devices except that approved, used material may be substituted; they shall be removed when the Engineer indicates they are no longer required.
- (h) Closed Projects; Guardrail. When the Contract specifies that the base course or the binder course of pavement be placed prior to suspension of work for the winter season, permanent, rather than temporary, guardrail shall be installed in accordance with the Plans.
- (i) Suspension of Work; Contractor Responsibility. If, regardless of the cause, construction is suspended on the project before the completion, acceptance, and termination of the Contractor's responsibility as defined under Subsection 108.15, the Contractor shall take precautions against injury or damage to the work and shall reinstall any damaged work as specified under Subsection 107.18.
- (j) Traffic Control Devices. All traffic control devices shall be presented to the Engineer for approval prior to placement on the project. At no time will traffic control devices that do not have the specified reflectivity sheeting or are dirty, damaged, or unacceptable to the Engineer be placed or remain on the project.

All traffic control devices, including but not limited to signs, pavement markings, pavement marking removals, temporary traffic barrier, barricades, reflectorized plastic drums, cones, flashing arrow boards, and detours shall conform to the latest edition of the MUTCD, shall be approved by the Engineer, shall be installed to the satisfaction of the Engineer, and shall be functioning prior to the beginning of construction work.

- (k) Reflectorized Sheeting; Cleaning. All reflectorized sheeting on the project shall be cleaned on a bi-weekly basis unless more frequent cleaning is directed by the Engineer.

- 27. 104.05 REMOVAL AND DISPOSAL OF STRUCTURES AND OBSTRUCTIONS. The Contractor shall remove any existing structure, parts of structure, or other obstructions which interfere in any way with the new construction or which is shown on the Plans to be removed. Removal and disposal shall be in accordance with the Contract Documents.

Unless otherwise provided, all salvageable material being removed shall become the property of the Contractor and shall be disposed of and/or recycled as authorized by the Engineer. Salvage generated by utility relocation shall remain the property of the applicable utility.

- 28. 104.06 USE OF MATERIALS FOUND IN THE ROADWAY; AUTHORIZATION.

- (a) General. With the written approval of the Engineer the Contractor may use stone, gravel, sand, or other materials found in the excavation for construction of the project provided the materials meet the requirements of the Contract.

The Contractor shall not excavate or remove any material that is not within the slope and grade lines of an excavation as shown on the Plans without written authorization from the Engineer. If the Engineer allows over-excavation for the use of the Contractor, the State will be compensated for the quantity of material removed, and the replacement of material, if necessary, shall be done at no additional cost to the Agency and shall conform to the requirements of embankment construction as specified in the Contract. The over-excavation, if allowed by the Engineer, shall only occur within the State's right of way.

- 29. 104.07 FINAL CLEANING UP FOLLOWING COMPLETION OF PROJECT.

- (a) Cleanup of Project. Upon completion of the work, before acceptance, and before final payment will be made, the Contractor shall satisfactorily and completely clean and remove from the right-of-way and grounds occupied by the Contractor in connection with the work all equipment, falsework, surplus and discarded materials, rubbish, temporary structures, buildings, tools, lumber, refuse, and other unsightly material.
- (b) Restoration of Property. The Contractor shall restore in an acceptable manner satisfactory to the Engineer all property, both public or private, which has been damaged during the prosecution of the work; replace or renew any fences damaged; leave the waterways unobstructed; and leave the construction area in a neat and presentable condition throughout the entire length of the work.
- (c) Drainage Structures and Ditches. The removal and disposal of silt, debris, and other material from drainage structures and ditches, whether deposited prior to or during construction under the Contract, shall be accomplished prior to acceptance of the project as ordered by the Engineer.
- (d) Closure of Material Supply and Disposal Areas. Material supply and disposal areas shall be closed in accordance with Subsection 105.28.

30. 104.08 DIFFERING SITE CONDITIONS.

- (a) During the progress of the work, if subsurface or latent physical conditions are encountered at the site differing materially from those specified in the Contract or if unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in the work provided for in the Contract, are encountered at the site, the party discovering such conditions shall promptly notify the other party in writing of the specific differing conditions before they are disturbed and before the affected work is performed.
- (b) Upon written notification, the Engineer will investigate to determine if the conditions materially differ and will cause an increase or decrease in the cost or time required for the performance of any work under the Contract. The Contractor will be notified of the Engineer's determination, whether or not an adjustment of the Contract is warranted. If an adjustment is warranted, the Contract will be modified in writing accordingly. Any adjustment made will exclude loss of anticipated profits.
- (c) No Contract adjustment that results in a benefit to the Contractor will be allowed unless the Contractor has provided the required written notice.
- (d) No Contract adjustment will be allowed under this clause for any effects caused on unchanged work.

SECTION 105 - CONTROL OF THE WORK

31. 105.01 AUTHORITY OF THE ENGINEER.

- (a) General. The Engineer shall decide all questions which arise concerning the quality and acceptability of materials furnished, the manner of performance of the work, the rate of progress of the work, and compliance with the requirements of the Contract; the Engineer shall decide all questions concerning interpretation of the Contract.
- (b) Quality Assurance Manager (QAM). The QAM shall report directly to the Engineer and shall act under the Engineer's authority. When designated by the Engineer, the QAM shall provide construction quality assurance monitoring including but not limited to management of all quality acceptance sampling and testing, management of all verification sampling and testing, management of quality assurance inspections, and monitoring of the construction quality control plan.
- (c) Orders; Disputes; Rejection of Materials, Work; Suspension of Work. The Engineer shall have authority to enforce and make effective decisions and orders the Contractor fails to carry out promptly. In case of any dispute arising between the Contractor and the Engineer as to materials furnished or the manner of performing the work, the Engineer has the authority to reject the materials and/or to suspend the work until the dispute is decided by the Director of Program Development. The Engineer is not authorized to revoke,

alter, enlarge, relax, or release any requirements of the Contract Documents. The Engineer has authority to suspend the work or withhold payment of all estimates due the Contractor when necessary to secure proper compliance with the Contract.

- (c) Performance of Work by Engineer; Setoff. If the Contractor fails to perform work ordered by the Engineer, the Engineer may, upon written notice, proceed to perform the work as deemed necessary; the cost of the work will be deducted from any monies due or which may become due the Contractor under the Contract.
- (d) Advice by Engineer. Advice given the Contractor by the Engineer shall not be construed as binding the Agency in any way, or releasing the Contractor from any obligations under the Contract.

32. 105.02 DIRECTOR OF PROGRAM DEVELOPMENT TO BE REFEREE.

- (a) General. The Director of Program Development shall act as referee in all questions of dispute arising under the terms of the Contract. If the Contractor is aggrieved by the decision of the Director, the Contractor may appeal the decision in writing to the Transportation Board via the Director. Included with the notice of appeal shall be a complete outline of the nature and extent of the question or questions appealed together with any supporting documentation.
- (b) Limitation of Time to Appeal. Notwithstanding any other provision of law, case law, regulation, or the Contract, all appeals shall be made within 30 calendar days of the decision to which the Contractor is aggrieved, and not thereafter.

33. 105.03 PLANS AND WORKING DRAWINGS. A complete description of the Work requires both the Plans and Working Drawings, which are submitted to VTrans by the Contractor. The Plans and Working Drawings shall be provided as follows:

- (a) Contract Plans. Design-Builder shall furnish all plans consisting of general drawings and showing such details as are necessary to give a comprehensive understanding of the Work specified. Except as otherwise shown on the plans, dimensions shown on the plans are measured in the respective horizontal or vertical planes. Dimensions that are affected by gradients or vertical curvatures shall be adjusted as necessary to accommodate actual field conditions and shall be specifically denoted on the working drawings.
- (b) Working Drawings. The Design-Builder shall furnish approved working drawings and maintain a set for VTrans as may be required. Working drawings shall not incorporate any changes from the requirements of the Contract unless the changes are specifically denoted, together with justification, and are approved in writing by Design Engineer and Release for Construction by VTrans. Design-Builder shall identify working drawings and submittals by the complete State Project and job designation numbers. Items or component materials shall be identified by the specific Contract Specification reference in the Contract.



- (1) General. Certain items and construction activities require plans, drawings, procedures, and other information to document the Contractor's proposed actions to conform with Contract requirements.

Drawings and procedures shall be submitted sufficiently in advance of the anticipated work to allow for review(s), comment(s), and correction(s).

The cost of furnishing Working Drawings, including obtaining any necessary design or field measurements, shall be included in the Contract unit price for the item involved.

When a Contract item requires calculations to be submitted, the calculations shall be included with the submittal of the Working Drawings. Manufacturer's engineering data for prefabricated materials, including that for falsework and forms, shall be submitted with each set of Working Drawings.

All submittals to VTrans shall be made to the VTrans Resident Engineer through the Project Collaboration Worksite.

- (2) Required Submittals.

- a. Submittals to VTrans: The Design-Builder or Fabricator shall not begin Work without drawings and/or procedures that have been approved by the Design Manager and Released for Construction by VTrans. One set of "approved" or "approved as noted" drawings and/or procedures shall be submitted to VTrans for review and Release for Construction. VTrans Release for Construction of drawings and/or procedures indicates concurrence with the information presented and does not relieve the Design-Builder or Fabricator of compliance with all specifications and code requirements. VTrans assumes no responsibility for error(s) and/or omission(s) in the drawings and procedures.

Drawings and procedures identified "approved as noted" indicate that specific clarification or conditional changes have been identified and take precedence over submitted information. Withholding of Release for Construction by VTrans for selected details or procedures shall not constitute a basis for delay of performance of a non-related item of Work that has approval to proceed.

After approval of the drawings and/or procedures, no changes shall be made without the written approval of the Design Manager and subsequent Release for Construction by VTrans. No materials shall be ordered or work performed by the Design-Builder or Fabricator prior to approval by the Design Manager and Release for Construction by VTrans.

- b. Release for Construction: VTrans will review each submittal for compliance with the requirements of the specification and, if acceptable, issue a Release for Construction. The Design-Builder shall submit the required drawings and/or procedures for review in advance of the proposed Work. The Design-Builder shall anticipate a review time in accordance with RFP Part 2. The Design-Builder is entirely responsible for the Work associated with these submittals; VTrans will not be responsible for errors in dimensions, incorrect erection procedures, design requirements, or completion of the Work.

In the event that any condition requires a change to the Construction Drawings of record, the Contractor is required to submit updated approved Construction Drawings and receive Release for Construction prior to performing the Work.

(3) Categories of Working Drawings.

a. Fabrication Drawings.

1. General. Fabrication Drawings shall be approved by the Design Manager and submitted to VTrans for review and Release for Construction. Fabrication Drawings are required for Work performed by or in conjunction with materials furnished by a Fabricator or supplier. They shall consist of complete details developed from information in the Plans, Contract Documents, and field measurements to define dimensions, sizes, procedures, and materials necessary to complete fabrication and installation or erection of the Work specified.
2. Size. Drawing and detail sheets shall be 34 inches horizontal by 22 inches vertical. A 1 1/2 inch margin shall be provided on the left and 1/2 inch margins on the remaining three sides. A title block shall be provided in the lower right hand corner and shall include the following:

Town(s) in which project is located

Project name and number

Route number and location information

Prime contractor or Fabricator's name and address

Sheet title or identification of details shown

Name of supervisor in charge

Detailer's and checker's name

Date

Sheet number \_\_\_\_\_ of \_\_\_\_\_.

3. Ownership; Delivery; Procedures. Original Fabrication Drawings shall be the property of the Agency. Prior to processing the final estimate, all Fabrication Drawings shall be submitted to the Agency. Original drawings shall be submitted as a PDF file to the Project Collaboration Site. All "approved as noted" changes must be transferred to the originals prior to transmittal to the Agency.

b. Construction Drawings.

1. General. For an item or element of work that permits the Contractor optional details, procedures, and materials that affect structural capacity, safety, and/or the results of the work, the Contractor shall prepare and submit to be reviewed for conformance detailed drawings and procedures of how the Contractor proposes to perform and control the work. Construction Drawings and procedures shall be prepared, stamped, and signed by a qualified Licensed Professional Engineer. The Professional Engineer is responsible for the design, performance of the designed element, and preparation of the Construction Drawings and procedures.
2. Size. Drawing and detail sheets shall be 34 inches horizontal by 22 inches vertical. A 1 1/2 inch margin shall be provided on the left and 1/2 inch margins on the remaining three sides to provide a border size of 32 inches horizontal by 22 inches vertical. The drawings shall have appropriate scale and detail, and shall convey sufficient information to provide for successful prosecution and inspection of the proposed Work. A title block shall be provided in the lower right hand corner of each drawing and shall including the same information as specified for Fabrication Drawings.

(4) List of Working Drawings

| Section  |
|--|
| 204 Excavation for Structures (structure excavation support)   |
| 208 Cofferdams   |
| 501 HPC Structural Concrete (false work and form work plans - when shown on the Plans or directed by the Engineer) |
| 501 HPC Structural Concrete (stay-in-place corrugated metal forms (SIPCMF))  |
| 502 Shoring Superstructures  |
| 505 Piling (temporary sheet piling)  |

|  |
|--|
| 506 Structural Steel (details and field welding procedures)    |
| 506 Structural Steel (erection plan)                           |
| 507 Reinforcing Steel (reinforcing steel schedule)             |
| 510 Prestressed Concrete (details)                             |
| 510 Prestressed Concrete (erection plan)                       |
| 516 Expansion Devices  |
| 522 Lumber and Timber (i.e. Glued Laminated Decking)           |
| 522 Lumber and Timber (erection plan)                          |
| 525 Bridge Railings  |
| 528 Temporary Bridge   |
| 531 Bearing Devices  |
| 540 Precast Concrete (details and structural design)           |
| 540 Precast Concrete (erection plan)                           |
| 621 Traffic Barriers (bridge approach railing)                 |
| 629 Water Systems (pipe insulation)                            |
| 641 Traffic Control (Contractor designed traffic control plan) |
| 677 Overhead Traffic Sign Supports                             |
| 678 Traffic Control Signals                                    |
| 679 Street Lighting  |
| 900 Other Submission as Required by Specifications             |

34. 105.04 CONFORMITY WITH PLANS AND ALLOWABLE DEVIATIONS.

- (a) General. The work shall be performed in reasonably close conformity with the lines, grades, cross-sections, dimensions, and material requirements, including tolerances, as designed and shown on the Plans or specified in the Contract Documents. Any deviation from the Contract as required will be determined by the Engineer and authorized in writing.
- (b) Acceptance of Non-Conforming Materials/Work; Price Adjustment. If the materials or the finished product in which the materials are used do not conform to the Contract requirements, but reasonably acceptable work has been produced, the Engineer will determine if the work will be accepted and remain in place. If accepted, the Engineer will document the basis of acceptance, which may require a Contract modification and price adjustment.

- (c) Rejection of Non-Conforming Materials/Work; Treatment of Rejected Materials/Work. If the materials or the finished product in which the materials are used do not conform to the Contract requirements, and the Engineer determines that the product is unsatisfactory, the Engineer will direct the work or materials be removed, replaced or otherwise corrected by the Contractor at the Contractor's expense.

35. 105.05 COORDINATION OF CONTRACT DOCUMENTS - PERMITS, SPECIAL PROVISIONS, CONTRACT PLANS, GENERAL SPECIAL PROVISIONS, STANDARD DRAWINGS, SUPPLEMENTAL SPECIFICATIONS, STANDARD SPECIFICATIONS, AND SPECIFICATIONS ADOPTED BY REFERENCE.

- (a) General. The Project Permits, Special Provisions, Contract Plans, General Special Provisions, Standard Drawings, Supplemental Specifications, Standard Specifications, and all supplemental documents are essential parts of the Contract; a requirement occurring in one is as binding as though occurring in all. The Contract Documents are complementary and intended to describe and provide for a complete work. In case of discrepancy, precedence of the Contract Documents will be determined in the following order:

Contract Document Precedence

- (1) RFP Parts 1, 2, 3, and 4 including all attachments and references.

RFP Part 4 will be in the following order:

- a. Special Provisions
- b. Supplemental Specifications
- c. General Special Provisions
- d. Standard Specifications (by reference)

- (2) Request for Qualifications.
- (3) Project Permits. In the event of a conflict between permit requirements, the more protective or stringent shall take precedence as determined by the Engineer and Environmental Commitments Officer.
- (4) Released for Construction Documents. Deviations from the Base Technical Concept or the Approved Alternative Technical Concept will only be allowed with written approval from VTrans.
- (5) Standard Drawings.
  - a. Calculated Dimensions
  - b. Scaled Dimensions
- (6) Alternative Technical Concept(s). Only those ATCs which have been formally approved by VTrans in writing and have been included in the Design-Builder's Proposal.
- (7) Base Technical Concept. The BTC shall take precedence unless the changes to the BTC have been approved in writing by VTrans.

- (8) Design-Builder's Proposal. The Design-Builder shall meet the commitments that they have made in their proposal, except where they conflict with specific requirements of the RFP or BTC.
- (9) Design-Builder's Statement of Qualifications.
- (10) Any Other Specifications Adopted by Reference.
- (b) No Advantage from Errors or Omissions in Contract Documents. Neither the Contractor nor the Agency shall take advantage or be afforded any benefit as the result of apparent error(s) or omission(s) in the Contract Documents. If either party discovers error(s) or omission(s), it shall immediately notify the other.
- (c) Corrections to Contract Documents. The Engineer will make corrections and interpretations deemed necessary and appropriate to fulfill the intent of the Contract Documents. When there is an apparent absence or mention of a detail or an apparent omission of a detailed description in the Contract Documents, the detail or description shall be interpreted/understood/determined using the best general engineering and construction practice.
- (d) Effect of Other Specifications/Standards. Other specifications (e.g. ASTM, NDS, CRSI, ACI) cited by reference shall become effective only if the work or material covered by them is not included in the Contract Documents. Specifications so referenced shall be the latest revision in effect on the date of issuance of the RFP.

36. 105.06 COOPERATION BY CONTRACTOR.

The Contractor shall:

- (a) Plans and Specifications. Have available on the project at all times during the prosecution of the work one copy each of the Plans, Specifications and all other Contract Documents;
- (b) Competent Contractor Superintendent. Have on the project at all times a competent and reliable English-speaking Superintendent authorized to receive orders and to act for the Contractor. The Contractor shall make every effort to provide continuity in the position of Superintendent. However, the Agency reserves the right to refuse or terminate the assignment of any Superintendent on the project; this shall not be grounds for a claim under Subsection 105.20.
- (d) Competent Safety Officer. Have available on the project at all times during the prosecution of the work a competent and reliable English-speaking employee designated as the safety officer; this person shall be authorized to receive orders and issue binding directions concerning safety to all persons associated with the project who are employed by the Contractor, subcontractors or material suppliers. This individual shall be well versed in OSHA and VOSHA regulations, shall be capable of implementing a plan to conform to these regulations, and shall have the authority to stop construction operations on the project.

The safety officer shall maintain a complete copy of the safety plan(s) for the project, which shall be available at all times during the prosecution of the work for inspection and/or copying by the Engineer.

- (d) Emergency Contacts. Furnish to the Engineer, and update every time it changes, a list of addresses and telephone numbers of the Contractor's personnel who can be reached in an emergency. The Contractor shall alert certain personnel to stand by and shall inform the Engineer of all arrangements therefore;
- (e) Facilities; Information; Assistance; Samples; Control Points. Provide all reasonable facilities and furnish the information, assistance, and samples required by the Engineer, Contractor or Inspector to properly inspect and test materials and quality of work; and cooperate in setting and preserving stakes, bench marks, and other control points used in laying out the work.

37. 105.07 COOPERATION WITH UTILITIES.

- (a) General. The Contractor shall notify the Agency and all utility companies, pipeline owners, and other known parties affected and endeavor to have all necessary adjustments of the public or private utility fixtures, pipelines, and other appurtenances within or adjacent to the limits of construction made as soon as practical.
- (b) Utility Interference; No Claim for Delays. The Contractor acknowledges and understands that, at the time of submitting its Design-Build Proposal, it has considered all of the permanent and temporary utility facilities or appurtenances in their present and/or relocated positions as evident at the site. Notwithstanding any other provision of law, case law, regulation, or the Contract, no additional compensation will be allowed for any delays, inconvenience or damage sustained by the Contractor due to any interference from utilities, utility companies, utility facilities, appurtenances, or the operation of moving them.
- (c) Utility Relocation for Contractor's Convenience. Should the Contractor desire temporary changes of location of any utility facilities or appurtenances for convenience in performing the work, the Contractor shall satisfy the Agency that the proposed relocation does not interfere with its own or other contractors' operations or the requirements of the work and does not cause an obstruction or a hazard to traffic. The Contractor shall be responsible for requesting such relocation work of a utility and/or other affected parties. Such relocation work shall be made solely at the Contractor's expense.

38. 105.08 COOPERATION BETWEEN CONTRACTORS.

- (a) Agency Right to Contract. The Agency reserves the right to contract for and perform other or additional work on or near the work covered by the Contract at any time.
- (b) No Interference of Other Contractors. When separate contracts are let within the limits of a project, each contractor shall conduct its own work so as not to interfere with or hinder the progress or completion of the work being performed by other contractors.

Contractors working on the same project shall cooperate with each other as specified or ordered by the Engineer.

- (c) Liability, Indemnification, Defense. Each contractor involved shall assume all liability, financial or otherwise, in connection with its own contract and shall defend, indemnify, protect and save harmless the Agency from any and all damages or claims that may arise because of inconvenience, delay, or loss experienced by the Contractor because of the presence and operations of other contractors working within the limits of the same project.

39. 105.09 CONSTRUCTION STAKES.

- (a) Initial Layout. Unless other methods of placing stakes are provided in the Contract, the Contractor shall be responsible for setting sufficient points to establish the initial alignment and elevation of the proposed work; this shall include centerline offset stakes marked with centerline finish grades, offsets for establishing working points for any structures on the project, critical horizontal control points, and an adequate number of benchmarks for establishing vertical control.
- (b) Layout of Subgrade. Prior to fine-grading the subgrade, the Contractor shall rerun the centerline, from which the Contractor shall set working stakes. After the Contractor has set the working stakes at the outer limits of the subbase course, the Contractor shall reestablish the finished centerline grades.
- (c) Permanent Marking Layout. Once the wearing course has been placed, the Contractor shall establish the layout for the centerline permanent traffic markings, including passing zones, breaks for town highways and side roads, and any other items required for the centerline markings.
- (d) Responsibility for Layout. The Contractor shall be responsible for the preservation of all stakes and markings, and shall replace any stakes or grades that are destroyed or disturbed.
- (e) Qualified Personnel. All other stakes, templates, and other materials, either in addition to or in replacement of the original set, which may be required for the construction operations, shall be furnished, set, and properly referenced by qualified personnel employed by the Contractor.
- (f) Engineer Verification. The Contractor shall stake out the work and make known the immediate plan or procedure of the next work contemplated sufficiently in advance of construction to permit, if desired, the Engineer to take the necessary measurements to check the Contractor's layout. The Contractor shall lay out in a timely manner and maintain a sufficient number of grade stakes so the Engineer can monitor and regulate all portions of the Contract work.

40. 105.10 AUTHORITY AND DUTIES OF RESIDENT ENGINEER (ENGINEER) AND QUALITY ASSURANCE MANAGER (QAM). As the direct representative of the Director of Program Development, the Resident Engineer on a project has immediate charge of the project; and is responsible for the administration of the project. The Resident Engineer and the QAM shall have the right to inspect all work; and have the authority to reject nonconforming work and defective material, to suspend any work that is being improperly performed, and to



withhold payment until defective or nonconforming work has been corrected. The Resident Engineer, in the sole discretion of the Resident Engineer, also has the authority to suspend work, or specific aspects of the work, if necessary to address a concern for safety of the workers or traveling public, or a serious environmental concern or violation. Notwithstanding any other provision of law, case law, regulation, or the Contract, no additional compensation shall be provided for any work suspensions of this sort.

41. 105.11 AUTHORITY AND DUTIES OF INSPECTORS. Inspectors employed by the Agency are authorized to inspect all work done and materials furnished and to perform other duties as directed by the Engineer. Inspections can extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials used. An Inspector is not authorized to alter or waive the provisions of the Contract, to issue instructions contrary to the Contract Documents, or to act for the Contractor.
42. 105.12 INSPECTION OF WORK.
  - (a) General; Contractor To Help Engineer. The Engineer or designated representative shall be allowed access to all parts of the work at all times and shall be furnished by the Contractor all information and assistance to be able to make a complete and detailed inspection. The Contractor shall promptly and fully cooperate with any such requests by the Engineer and furnish such help as the Engineer desires and/or needs to ascertain whether or not the work is performed in accordance with the requirements and the intent of the Contract.
  - (b) Examination of Completed Work. If, before the acceptance of the work, the Engineer requests, the Contractor shall remove or uncover portion(s) of the finished work as the Engineer may direct. After the examination, the Contractor shall restore the portion of the work to the standard required by the Contract. If the work thus exposed or examined proves acceptable, the expenses of uncovering or removing and replacing the parts removed shall be paid for as Extra Work as defined in Subsection 109.06; but if the work exposed or examined is unacceptable, the expenses of uncovering or removing and replacing the parts removed shall be borne by the Contractor.
  - (c) All Work Requires Supervision or Inspection. The Agency will not be required to pay for any work done or materials used without supervision or inspection by the Engineer or an Inspector. Supervision/inspection includes project, mill, plant, or shop inspection of any material furnished under the Contract.
  - (d) Inspection By Others. When any unit of government or of a public or private entity is to pay a portion of the cost of the work covered by the Contract, its respective representative(s) shall have the right to inspect the work. Such inspection shall not make any entity a party to this Contract and shall not interfere with the rights of either party hereunder.
43. 105.13 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK.
  - (a) General. All work which does not conform to the requirements of the Contract will be considered unacceptable unless otherwise determined to be acceptable under the provisions of Subsection 105.04.

- (b) Removal and Replacement of Unacceptable Work. Unacceptable work, whether the result of poor quality of work, use of defective materials, damage through carelessness or any other cause found to exist prior to the acceptance of the work, shall be removed immediately and replaced in an acceptable manner at the Contractor's sole cost. No time extensions will be granted for any delays resulting from such removal or replacement.
- (c) All Work Must Be Authorized. Work performed contrary to that Released for Construction by the Engineer, beyond the lines shown on the Plans, or without authority will be considered unauthorized. Work so done may be ordered removed or replaced at the Contractor's expense.
- (d) Failure To Comply With Order of Engineer. Upon failure by the Contractor to comply forthwith with any order of the Engineer communicated under the provisions of this Subsection, the Engineer will have authority to require unacceptable work to be remedied or removed and replaced and to require unauthorized work to be removed; in either case, the Engineer is authorized to deduct the costs from any monies due or to become due the Contractor.
- (e) Responsibility for Agency Expense. Any expense incurred by the Agency in making removals, renewals, or repairs which the Contractor has failed or refused to make shall be paid for out of any monies due or which may become due the Contractor or may be charged against one or more Contract Bonds.
- (f) No Compensation for Additional Time. No additional Contract time shall be warranted for any of the work described in this Subsection.

44. 105.14 SUNDAY AND HOLIDAY WORK.

- (a) Sundays. The Contractor shall not carry on construction operations on Sundays except as authorized by the Engineer.
- (b) Holidays. If the Contractor's operations are of such a nature, the project is so located, or traffic is of such volume that the Engineer deems it expedient to do so, the Engineer may require the Contractor to cease construction operations on holidays, the day before if a holiday falls on Tuesday, and the day after if a holiday falls on Friday.
- (c) Application. The limitations in this Subsection shall not apply for the purposes of maintenance, emergency repairs, and proper protection of the work, including but not limited to the curing of concrete and the repair and servicing of equipment.
- (d) Other Provisions Not Affected. The above limitations shall not relieve the Contractor of any responsibility for the work involved as set forth in Subsections 105.06, 107.18, or elsewhere in the Contract.

45. 105.15 CONVICT LABOR. No incarcerated convict labor shall be employed on the project.

46. 105.16 LOAD RESTRICTIONS.

- (a) General. The Contractor and all subcontractors, suppliers, or others involved in any project-related activities shall comply with all legal load restrictions specified in Title 23 VSA § 1392 in the hauling of equipment or material on public roads, including that beyond the limits of the project. The application for and possession of a hauling permit will not relieve the Contractor of liability for any damage that results from use or the moving of equipment and vehicles.
- (b) Limitations or Use of Equipment and Vehicles. The operation of equipment and vehicles of such mass (weight) or loaded so as to cause damage to structures, the roadway, or to any other type of construction shall not be allowed. Hauling materials over the base course, surface course, or structure during construction shall be limited and allowed only as directed. No loads will be permitted on a concrete pavement, cement treated base course, or concrete structure prior to expiration of the curing period and until the concrete reaches its specified 28-day compressive strength. No vehicle or equipment exceeding the load restrictions cited in Title 23 VSA § 1392 shall be allowed on a structure. The Contractor shall be responsible for all damage done by the Contractor's equipment and vehicles.
- (c) Speed Prior to Wearing Surface; Expansion Joints On Structures. Prior to placement of the wearing surface, vehicle travel speed over any structure shall not exceed 15 km/h (10 miles per hour); an acceptable transition ramp shall be constructed at any expansion joint that projects above the travel surface.
- (d) Penalty and Reduction for Overweight Operation. Each vehicle entering or leaving the project limits must be within the legal load limit or the load limit imposed by a current overload permit for the roadways and structures. Should any vehicle not meet these requirements, in addition to the appropriate penalty under Title 23 V.S.A. § 1391a shall be assessed, at a minimum. The Contractor shall not deduct this amount from the payment to its trucking subcontractor(s)/supplier(s).
- (e) Provision of Overweight Permit Copies. The Contractor shall provide copies of overweight permits to the Engineer prior to the commencement of hauling. Copies of permits provided after hauling has begun will not be considered to be in effect for the project prior to the time that the Engineer receives the copy.
- (f) Provision of Tare Masses(Weight). The Contractor shall provide the Engineer with tare masses (weights) for all vehicles carrying or delivering materials to be used on a project. A tare mass (weight) shall be the mass (weight) of the unloaded vehicle with full fuel tank and water tank as applicable.
- (g) Application to All Vehicles Used for Project. These requirements, including the overload reduction, shall apply to the Contractor's vehicles as well as all other vehicles used in conjunction with the construction of this project, including the vehicles of subcontractors and suppliers.

- (a) General. The Contractor shall maintain the work during construction and until the work is finally accepted. This maintenance shall constitute continuous and effective performance of the work day by day with adequate equipment and forces so that the roadway, structures, or other portions of the project are kept in satisfactory condition at all times.
  - (b) Maintenance During Shutdown. In the event the work is ordered shut down for failure to comply with the provisions of the Contract or for any other reason, the Contractor shall maintain the project as provided herein and provide such ingress and egress for local residents as necessary during the period of shutdown.
- 48. 105.18 FAILURE TO MAINTAIN PROJECT; COST. Failure on the part of the Contractor to properly maintain the work will result in the Engineer immediately notifying the Contractor to comply with the required maintenance provisions. If, after receipt of such notice, the Contractor fails to remedy the situation to the Engineer's satisfaction, the Engineer will proceed with adequate forces and equipment to maintain the project; the cost of this maintenance will be deducted from monies due or which may become due the Contractor under the Contract.
- 49. 105.19 FINAL ACCEPTANCE AND FINAL INSPECTION.
  - (a) General. None of the work shall be accepted until all of the work required by the Contract has been satisfactorily completed.
  - (b) Procedure. Upon notice from the Contractor of presumptive completion of the project, the Engineer will arrange a date for inspection of the work. If all construction provided for and contemplated by the Contract is found to be completed, the Contractor will be informed in writing immediately following the inspection that the Acceptance Date is the date of the inspection of the project; should any of the work be found unsatisfactory or incomplete, corrective action will be in accordance with the Contract documents. As soon as the deficiencies have been corrected to the satisfaction of the Engineer, notification will be made in writing to the Contractor establishing the Acceptance Date.
- 50. 105.20 CLAIMS FOR ADJUSTMENT.
  - (a) Notice Requirements. In order to bring a claim for additional compensation not clearly covered by the Contract for conditions substantially different than represented by the information VTrans provided in the Contract and not ordered by the Engineer as Extra Work as defined herein, the Contractor must provide written notice ("the Notice of Intent to File a Claim" or the "Notice") to the Engineer before conducting any work or purchasing any materials subject to the claim (the "Claim"). The words "Notice of Intent to File a Claim" must appear in large print at the top of the document. The Notice must specify the basis for the Claim, including the nature of the Claim, the reason why the Contractor believes that the Agency is responsible for payment of the Claim, and a description of the additional compensation, including reference to each activity associated with the work and/or materials, including reference to any impacts to the Contractor's Progress Schedule, as defined in Subsection 108.03 (the "Critical Path"). If the Contractor fails to provide the Notice as specified

herein, the Contractor waives its right to bring the Claim under the Contract.

- (b) Notice Documentation Requirements. Upon providing the Notice of Intent to File a Claim, the Project Superintendent must commence daily records for all labor hours, equipment hours (idle and operating), and materials involved with the work or materials at issue in the Notice. The Contractor must submit such records to the Engineer on a daily basis. Such records must include a written analysis of how the work and/or materials at issue in the Notice impact/s the Critical Path. If the Contractor fails to provide such records to the Engineer as required herein, the Contractor waives its right to bring the Claim.
- (c) Claims Procedure. The Engineer's written acknowledgement of the Notice and receipt of the Contractor's daily reporting under this Subsection shall not be construed as an approval by the Agency of the merits of the Claim. Claims are evaluated by the Construction Engineer. If the Construction Engineer rules in favor of the Contractor, the Claim will be allowed, in whole or in part, and paid as provided in the Contract. If the Construction Engineer denies the Claim, in whole or in part, the Contractor may appeal to the Director of Program Development. Notwithstanding any other provision of law, case law, regulation, or the Contract, an appeal from the decision of the Construction Engineer shall be made within 30 calendar days of denial, and not thereafter.
- (d) Claims Documentation Requirements. The Contractor must provide the Construction Engineer with the following documentation in support of the Claim:
  - (1) A detailed statement of the Claim, including all necessary dates, location, and work and material items at issue in the Claim;
  - (2) The date on which the Contractor first became aware of the actions or conditions giving rise to the Claim;
  - (3) A copy of the Notice of Intent to File a Claim;
  - (4) A list of the names of all Agency employees and agents, including consultants, the Contractor believes have knowledge or information concerning the facts giving rise to the Claim;
  - (5) A list of the names of all Contractor employees and agents, including subcontractors, whom the Contractor believes have knowledge or information concerning the facts giving rise to the Claim;
  - (6) A list of the specific provisions of the Contract that the Contractor believes support the Claim, and a description of why the Contractor believes those provisions support the Claim;
  - (7) A list of all documents and all oral statements that the Contractor believes support the Claim;
  - (8) A statement as to whether additional compensation and/or a time extension are being requested in the Claim;

- (9) If a time extension is being requested in the Claim, a statement as to the specific number of days being requested, supported with reference to how the facts underlying the Claim affected the Contractor's performance schedule, including how such facts affected the Critical Path;
- (10) A description of the amount of additional compensation being sought, itemized by category of work, including delays associated with performing the work, work items, materials costs, and any and all other costs at issue in the Claim. Such documentation includes, but is not limited to, invoices for rented equipment, a Blue Book analysis for owned equipment; and subcontractor agreements.
- (11) If additional compensation for delays associated with performing the work is included in the Claim, the Contractor must provide a description of the operations that were delayed, the reasons for the delay, the impact of the delay on the operations, and how the delay impacted the Contractor's progress schedule, including the Critical Path.
- (12) For every claim seeking additional compensation in excess of \$50,000, the Contractor must provide a separate document certifying that the documentation provided in support of the Claim and that the amount of additional compensation sought in the Claim is accurate and that the Contractor has a good faith basis for believing that the Agency is responsible for payment of the Claim (the "Claims Certification"). The Claims Certification shall be notarized and executed by a senior officer of the Contractor with legal authority to bind the Contractor, or if the Contractor is a sole proprietor, by the proprietor. The Claims Certification may be used in any proceeding under the False Claims Act, 18 U.S.C.A. §1020 23 C.F.R. §635.119.
- (e) Appeal to the Director of Program Development. Appeals will be judged by the Director of Program Development. Should an appeal be judged in favor of the Contractor, it will be allowed and paid as provided in the Contract. Should a claim be denied by the Director of Program Development, the Contractor may appeal under Subsection 105.02.
- (f) Time for Claims; Appeals. Notwithstanding any other provision of law, case law, regulation, or the Contract, all claims by the Contractor shall be submitted in writing within 90 calendar days after the Acceptance Date of the project or within 90 calendar days of the Notice of Intent to File a Claim, whichever occurs first, and not thereafter (the "Claim Filing Period"). Such claims must meet the requirements set forth above, including but not limited to complete documentation supporting the Claim. If the Contractor fails to meet these requirements, the Construction Engineer may grant the Contractor additional time to meet the requirements. Any additional time granted for such purpose shall not be the subject of any demand for interest payments or for attorneys' fees and/or other costs. If the Contractor fails to file the Claim within the Claim Filing Period, the Contractor waives its right to bring the Claim. If the disputed work continues to be performed beyond the Claim Filing Period, the Contractor must submit a written request to extend the Claim Filing Period prior to the expiration of the Claim Filing Period. The Contractor shall submit such requests for

extension of the Claims Filing Period every 90 calendar days until the disputed work is completed.

51. 105.21 PAYROLLS.

- (a) General. The Contractor shall maintain and make available payroll records as required in the Contract. This requirement shall also apply to the work of any subcontractor having a subcontract for any part of the work performed on the job.
- (b) Examination, Authority. The Contractor hereby authorizes the Engineer or the Engineer's authorized representative to examine the Contractor's orders for construction workers on file with the local employment office of the Vermont Department of Employment and Training.

52. 105.22 ENVIRONMENTAL PROTECTION. The Contractor shall perform all project related operations so as to give adequate protection to the natural and cultural resources of the State.

The Contractor shall conduct the work in conformance with all regulations and permit conditions applicable to the project. If additional permits are required, or if the Contractor proposes to perform the work differently than the manner provided in the Contract, the Contractor shall obtain approval from the appropriate regulating entities prior to performing the work.

53. 105.23 EROSION PREVENTION AND SEDIMENT CONTROL.

- (a) Design and Submission of Plans. The Contractor shall complete a Risk Evaluation for the project. Based on the results of the Risk Evaluation, the Contractor shall develop an Erosion Prevention and Sediment Control Plan (EPSC Plan) using a combination of structural, non-structural, and vegetative practices to adequately prevent erosion and control sedimentation and pollution on the Project and on associated access roads, material waste and borrow areas, and staging areas. The EPSC Plan shall meet the requirements of the *VTrans Erosion Prevention & Sediment Control Plan Designer Checklist (Non-Jurisdictional and Low Risk)* or the *General Permit 3-9020 Parts 4 through 6 (Moderate Risk projects)* and the *Vermont Standards & Specifications for Erosion Prevention & Sediment Control* based on area of disturbance and risk.

The Contractor shall use the EPSC Plan at the onset of construction as well as throughout the duration of the project, modify it to describe changing conditions and illustrate how the criteria of the determined risk will be upheld. For Non-Jurisdictional and Low Risk projects, the Contractor shall use the *VTrans Erosion Prevention and Sediment Control Plan Contractor Checklist* and follow the requirements of the Construction General Permit. For Moderate Risk projects, the Contractor shall modify the Contract EPSC Plan in accordance with the General Permit 3-9020 Parts 4 through 6. If a modification to the EPSC Plan at a Low or Moderate Risk project alters any criteria of the determined risk, an updated Risk Evaluation shall be prepared.

All work shown in the EPSC Plan shall be included in a separate Work Package and shall be included in the Contractor's CPM Progress Schedule.

The Risk Evaluation, EPSC Plan, and permit application shall undergo a Design Quality Review by the Design-Builder and shall be submitted to VTrans for Review.

No ground disturbance shall occur until the plan has been Released for Construction.

- (b) Erosion Prevention and Sediment Control Measures. Erosion prevention and sediment control measures shall be installed and maintained in conformance with the Contract. Unless otherwise specified in the Contract, this work shall be performed as described in this Section.
- (c) Engineer's and Environmental Commitment Officer's Authority; General. The Engineer and ECO have authority to limit the surface area of erodible earth material exposed by excavation, borrow, and fill operations and to direct the Contractor to provide immediate permanent or temporary erosion prevention and sediment control measures to minimize adverse effects on resources. Such work may include the construction of berms, dikes, dams, sediment basins, slope drains and use of mulches, mats, seeding, or other control devices or methods as necessary to control or prevent erosion and siltation. As the earthwork proceeds, slopes shall be graded to finish grade whenever practical and all disturbed areas shall be stabilized by seeding and mulching or other acceptable methods within 48 hours of disturbance.
- (d) Temporary and Permanent Erosion Prevention and Sediment Control. As shall be specified in the Erosion Prevention and Sediment Control Plan Released for Construction, the Contractor shall incorporate all temporary and permanent erosion prevention and sediment control measures into the project at the earliest reasonable time. Temporary erosion prevention and sediment control measures shall be used to prevent erosion and to correct conditions that develop during construction prior to installation of permanent measures.
- (e) Erosion; Clearing and Grubbing. Where erosion is likely to occur and project conditions permit, clearing and grubbing shall be scheduled and performed so that grading operations and the installation of permanent erosion prevention and sediment control measures may be performed immediately thereafter; otherwise temporary erosion prevention and sediment control measures shall be required between successive construction stages.
- (f) Limiting Operations. The Engineer may limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent erosion prevention and sediment control measures current in accordance with the Erosion Prevention and Sediment Control Plan Released for Construction. Without prior approval by the Engineer the amount of surface area of erodible earth material exposed at one time within the project limits shall not exceed 2 ha (5 acres) or as designated in any permit conditions.
- (g) Conflicts. In the event of conflict between the requirements of this Subsection and those of Federal, State, or local agencies, the more restrictive provision(s) shall apply as determined by the



Engineer. In the event of a conflict, no additional time or monetary compensation will be allowed.

- (h) Suspension of Operations. If construction operations are suspended, the excavation and embankment areas shall be stabilized. If permanent stabilization is not possible, exposed areas shall be shaped and then covered with mulch or matting in order that water runoff will be intercepted and diverted to locations where the least amount of erosion will result. During a suspension of construction operations, the Contractor shall act immediately to correct any deficiencies that develop with the erosion prevention and sediment control measures and/or stabilized areas.
- (i) Monitoring Erosion Prevention & Sediment Control Plan. The Contractor shall designate a person (On-Site Plan Coordinator) who is directly responsible for the on-site implementation of the EPSC Plan. This person shall generally be on-site on a daily basis during active construction and have the authority to halt construction activities if necessary. The On-Site Plan Coordinator shall have demonstrated experience in construction practices as they relate to erosion prevention and sediment control as well as a general understanding of State and Federal environmental regulations and permits pertaining to the National Pollutant Discharge Elimination System Construction Program. The On-Site Plan Coordinator shall be proficient at reading and interpreting engineering and EPSC plans. Preference will be given to a Licensed Professional Civil Engineer registered in the State of Vermont or a qualified professional in erosion prevention and sediment control, certified by CPESC, Inc. or equivalent. The qualifications of the On-Site Plan Coordinator shall be included in the EPSC Plan. The Engineer or ECO, if not satisfied with the performance of this individual, may at any time request a replacement.

During active construction and periods of inactivity, the On-Site Plan Coordinator shall be responsible for inspections and reporting.

- (1) Active Construction. Inspections shall occur once every seven calendar days and within 24 hours of the end of a storm event that results in a discharge of stormwater from the site. During the winter construction season (October 15<sup>th</sup> to April 15<sup>th</sup>, inclusive), inspections at all sites shall occur daily.

For Non-Jurisdictional and Low Risk projects, inspections shall be conducted using the Agency's *EPSC Plan Inspection Report (Non-Jurisdictional and Low Risk Projects)*.

For Moderate Risk projects, inspections shall be conducted using the *General Permit 3-9020 Inspection Report for Moderate Risk Projects*.

Immediate action shall be taken to correct the discharges of sediment, including halting or reducing construction activities as necessary, until the discharge and/or the condition is fully corrected. Corrective actions shall be recorded on the monitoring reports and shown on the EPSC Plan. Each report shall be signed by the On-Site Plan Coordinator.

- (2) Inactive Construction. Periods such as shutdown during the winter season shall require inspection and reporting of erosion prevention and sediment control measures. The Contractor shall contact the Engineer prior to conducting any inspections. The inspections shall be conducted at least once every 30 days and within 24 hours of any storm or significant snow melt event that may cause stormwater runoff to leave the construction site. The Contractor shall provide, within 24 hours, the necessary personnel, equipment, and materials to repair or correct any deficiencies identified during inspection. All deficiencies and corrective measures taken shall be documented on the reports.

Copies of all reports shall be submitted to the Engineer within 24 hours of inspection or when corrective measures were taken. Copies of all reports shall be kept on site in the Contractor's project files.

- (j) Maintenance of Temporary Erosion Prevention and Sediment Control Measures. This Contractor shall provide all labor and equipment necessary for field maintenance of erosion prevention and sediment control items, and provide materials and labor necessary for installing, monitoring, maintaining and, where necessary, removing additional measures needed to correct deficiencies that develop during construction that lessen the performance of the EPSC Plan. Erosion prevention and sediment control measures shall be maintained by the Contractor and removed when authorized by the Engineer. The Contractor shall establish vegetation in all areas disturbed during removal of the erosion prevention and sediment control measures.
- (k) Limits on Use of Mechanized Equipment. Unless otherwise approved in writing and permitted by the appropriate Federal or State regulating authority, mechanized equipment shall not be operated in flowing streams except as required and permitted to construct changes in the channel and permanent or temporary structures. Rivers, streams, and impoundments shall, as soon as construction will allow, be cleared of all falsework, piling, and debris caused by construction operations.
- (l) Water Quality. Any construction activity in or adjacent to rivers, streams, brooks, creeks, lakes, ponds, reservoirs, wetlands, and any other regulated surface water shall not cause the average downstream water quality values to fall outside the classification limits specified in the Vermont Water Quality Standards. Should the Contractor desire a variance from the Vermont Water Quality Standards, the Contractor must obtain a 1272 Permit (Regulation of Activity Causing Discharge - Title 10 VSA § 1272) from the Agency of Natural Resources. When work in a river, stream, brook, creek, lake, pond, reservoir, wetland, or any other regulated surface water is prohibited, such work will be allowed only if the Contractor obtains a 1272 Permit for such work.
- (m) Access Roads. Access roads shall not be constructed unless included in plans Released for Construction. Access roads shall have proper erosion prevention and sediment control measures. All access roads shall be restored to their original condition unless a permit allows for a permanent change from that condition.

- (n) Failure to Control Erosion, Pollution, or Siltation. In case of repeated failures by the Contractor to control erosion, pollution, or siltation, the Engineer may employ outside assistance or use State forces to provide the necessary corrective measures. Such incurred direct costs, plus project engineering costs, will be charged to the Contract and appropriate deductions made from any money or monies due or to become due the Contractor.

Costs for damages to waste, borrow, and staging areas, to the owners thereof, or to adjacent property owners shall be the responsibility of the Contractor.

54. 105.24 POLLUTION CONTROL.

- (a) General. The Contractor shall exercise every reasonable precaution to prevent pollution of the waters of the State. Pollutants, including but not limited to chemicals, paints, fuels, lubricants, bitumens, raw sewage, sediment or sediment laden water, and other waste, shall not be discharged into or alongside the waters of the State or into natural or constructed channels leading thereto. The Contractor shall comply with applicable statutes and regulations relating to the prevention and abatement of pollution.
- (b) Bridge Operations. When bridge painting, cleaning, cutting, welding, or grinding operations are in progress, the Contractor shall utilize containment devices to retain all materials which are generated. All waste materials generated that contain lead, zinc, or other hazardous materials shall be disposed of appropriately as hazardous waste.
- (c) Coated/Treated Materials. The Contractor shall comply with all air, ground, and water pollution control, health, and transportation regulations when cleaning, handling, moving, repainting, cutting, welding, sanding, or grinding any coated or treated materials.
- (d) Noise and Air Pollution. The Contractor shall employ standard methods to minimize noise and air pollution occurring in conjunction with and as a result of construction operations, including, but not limited to, clearing, grubbing, drilling, blasting, excavation, and hauling operations. The method(s) employed shall be acceptable to the Engineer and compatible with the location of the work. The burning of tires or other manufactured products is prohibited.
- (e) Hazardous Materials and Waste. The Contractor shall provide documentation to the Engineer that any generated hazardous waste and any hazardous materials and waste found were disposed of in conformance with all applicable regulations governing the handling, transporting, and disposal of such materials and waste.

55. 105.25 CONTROL OF WASTE, BORROW, AND STAGING AREAS.

- (a) Definitions.

- (1) Waste areas are those areas where excess material or materials unsuitable for construction are disposed.

- (2) Borrow areas are all borrow pits, gravel pits, quarries, sand pits, and similar sources of materials used in the construction of the project.
  - (3) Staging areas are any areas that the Contractor uses for storage of materials and equipment or for general use for Contract operations.
  - (b) Permits and Clearances. Waste, borrow, and staging areas are necessary adjuncts to a VAOT construction project. The Contractor and/or the property owner shall be required to obtain all necessary permits and clearances, and specifically in accordance with Title 10 VSA Chapter 151 (Act 250), if applicable, prior to opening or using an area for an Agency project.
  - (c) Establishment of Waste, Borrow, and Staging Areas. To establish a waste, borrow, or staging area, or to perform any work outside the BTC limits the Contractor shall submit a completed Waste, Borrow, and Staging application package to the Engineer (application packages are available from the VAOT Environmental Section). The application must be completed and be submitted at least twenty-one calendar days prior to the planned utilization of the area. All proposed waste, borrow, and staging areas will be reviewed by the VAOT Environmental Section for effects on cultural and natural resources. If the proposal includes the initial disturbance of soil in an area or the wasting of erodible materials, a site specific Erosion Prevention and Sediment Control Plan must be submitted and Released for Construction prior to the use of such an area.
  - (d) Required Approval. The Contractor shall not perform any preparatory work or make use of a waste, borrow, or staging area until approval is obtained in writing from the Engineer.
  - (e) Unpermitted Areas. If a proposed waste, borrow, or staging area does not have a permit as provided in part (b) above, the application must state the length of time the area has been operating and the annual rates of disposal, extraction, or use for the last five years.
56. 105.26 OPENING WASTE, BORROW, AND STAGING AREAS. Prior to issuing approval, the Engineer shall be satisfied that the area and its operation are approved in accordance with all project permits and:
- (a) Will not seriously hurt or impair the rights of any adjacent property owner;
  - (b) Will not result in undue water or air pollution;
  - (c) The final shape, slope, and contour of the land in and about the area will not be undesirable aesthetically or as it relates to drainage;
  - (d) Will not cause unreasonable soil erosion or reduction in the capacity of the surrounding land to hold water in order that a dangerous or unhealthy condition may result;
  - (e) Will not have an undue, adverse effect on the scenic or natural beauty of the area's aesthetics, historic sites, or rare and irreplaceable natural areas;

- (f) Is consistent with any duly adopted development plan, land use plan or land capability plan, whether site specific, local, or regional;
- (g) The entrance is at the most desirable angle or perspective from any nearby highways, residences, and other facilities;
- (h) The Contractor will remove, stockpile, and preserve topsoil, sod, and other suitable material from the surface of the area prior to proceeding with other operations; and
- (i) The Contractor has all erosion prevention and sediment control measures, as indicated in the Erosion Prevention and Sediment Control Plan Released for Construction, in place prior to use of the area.
- (j) If a proposed waste, borrow or staging area is not approved because the Engineer is not satisfied that the area and its operation is not compatible with the above, it shall not be cause for claim for project costs or time delay.

57. 105.27 MAINTAINING WASTE, BORROW, AND STAGING AREAS.

- (a) General. The Contractor shall conduct waste, borrow, and staging area operations so as to maintain a minimum of air pollution. The Contractor shall keep in a condition acceptable to the Engineer the portions of an area where a pit or pits have been opened and shall maintain all access roads with sufficient dust control and proper drainage to prevent damage to adjacent properties. Area operations shall be restricted to normal working hours except with the express written approval of the Engineer and shall be in accordance with all permit conditions.
- (b) Area Erosion Prevention and Sediment Control Measures. Installation and maintenance of erosion prevention and sediment control measures at waste, borrow, and staging areas shall be consistent with the Erosion Prevention and Sediment Control Plan Released for Construction for the specific area. The On Site Coordinator shall review these areas if and as required by the construction stormwater permit.

58. 105.28 CLOSING WASTE, BORROW, AND STAGING AREAS. With the exception of those areas which will remain open for commercial use, prior to abandoning or closing any area on which the Contractor has completed operations, the Contractor shall 1) shape the entire area to leave banks in a neat and presentable condition, properly and thoroughly graded and drained and 2) establish vegetation on all disturbed areas. All stones, boulders, stumps, and debris shall be removed or satisfactorily disposed of. Slopes shall not be left steeper than 1:1.5 (vertical:horizontal). The tops of slopes and toes of slopes shall be neatly rounded. After grading the slopes and surfaces of the area, the stockpiled sod, topsoil, and other stripped material shall be evenly spread over the surface of the area. The complete area shall be seeded and mulched in accordance with Section 651. The Contractor shall place screens of trees and/or other vegetation, berms, or embankments where necessary to conceal the undesirable features of a waste, borrow, or staging area.

The Contractor shall have the written approval of the Engineer prior to completely abandoning or closing any waste, borrow, or staging area.

105.29 PAYMENT FOR EROSION PREVENTION AND SEDIMENT CONTROL.

- (a) General. Costs for damages to waste, borrow, and staging areas, to the owners thereof, or to adjacent property owners shall be the responsibility of the Contractor.
- (b) Temporary Erosion Prevention and Sediment Control Measures. Temporary erosion prevention and sediment control measures required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the scheduled work or as ordered by the Engineer shall be performed by the Contractor at the Contractor's expense.
- (c) Failure to Control Erosion, Pollution, or Siltation. In case of repeated failures by the Contractor to control erosion, pollution, or siltation, the Engineer may employ outside assistance or use State forces to provide the necessary corrective measures. Such incurred direct costs, plus project engineering costs, will be charged to the Contract and appropriate deductions made from any money or monies due or to become due the Contractor.

SECTION 106 - CONTROL OF MATERIAL

106.01 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS. The material used in the work shall meet quality requirements of the Contract. In order to expedite the inspection and testing of materials, the Contractor shall notify the Engineer of the proposed sources of materials at least 96 hours prior to delivery.

At the option of the Engineer, materials may be approved at the source of supply before delivery is started. If it is found during acceptance that supplied materials from previously approved sources do not meet specifications, the Contractor shall take action to supply materials that meet specifications.

106.02 LOCAL MATERIAL SOURCES. The Contractor shall determine potential sources of material and the amount of equipment and work required to produce material meeting the specifications. The Agency's Geologist maintains a list of material sources that have previously produced materials meeting specifications. Exploration for new material sources will be the responsibility of the Contractor. The ability to purchase from the owner(s) of the source(s) and the quality of the material are not guaranteed by the Agency. The Contractor acknowledges that it is not possible to ascertain from samples the limits of a deposit and that variations in quality in a material source are normal and to be expected. The Engineer may order procurement of material from any portion of a material source and may reject portions of the material sources as unacceptable.

It shall be the responsibility of the Contractor to acquire the right to take materials from any source together with the right to use such property as required for whatever purpose, including plant sites, stockpiles, and hauling roads. The Contractor shall pay all costs related thereto together with any costs resulting from exploring and developing these sources.

106.03 SAMPLES AND TESTS. All materials will be inspected, sampled, tested or accepted by the Engineer as incorporated into the work. Under any applicable Quality Acceptance (QA) specifications, the Contractor shall perform all Process Quality Control testing with the Engineer performing all Quality Acceptance testing. Any work in which untested and/or unaccepted materials are used without the approval or written permission of the Engineer shall be performed at the Contractor's risk. Any work determined to be unacceptable and unauthorized will

not be paid for. All testing will conform to the most recent cited standard methods of AASHTO or ASTM, including AASHTO Provisional Specifications or the ASTM Tentative Specifications that are current on the date of the advertisement for bids, unless otherwise specified. In the case of conflict between the ASTM and the AASHTO methods of sampling and testing, the AASHTO method shall govern. When modified AASHTO or ASTM test methods or Vermont Agency of Transportation test methods are designated, the test method will be available at the office of the Agency's Materials and Research Section.. Tests for compliance with specification requirements will be made by and at the expense of the Agency.

Samples will be taken by authorized representatives of the Agency in accordance with the requirements of the latest edition of the Agency's Materials Sampling Manual. The Contractor shall provide such facilities, as specified in these Specifications, or as the Engineer may require, for collecting and/or forwarding samples. In all cases, the Contractor shall furnish the required samples without charge.

All materials used are subject to inspection, testing, and acceptance/rejection at any time during the Contract period. Materials contaminated by the Contractor's operations shall be removed. No work or materials shall be deemed approved until accepted by the Engineer. Copies of all test results will be furnished to the Contractor's representative upon request.

In lieu of testing, the Agency may approve the use of certain materials based upon the receipt of a certification from the manufacturer stating that such material is in compliance with these Specifications. The requirements for such certifications are specified in Subsection 700.02.

Bituminous materials designated for acceptance under QA provisions will be randomly sampled and tested in accordance with the recommended acceptance guidelines specified for the applicable Contract item. Samples may also be taken any time the material appears defective or when the Engineer determines that a change in the process or product has occurred. Acceptance tests will govern in all cases for determination of acceptance without regard to quality control tests.

- (a) The Contractor shall provide Process Quality Control adequate to produce work of acceptable quality. The Contractor shall perform Process Quality Control sampling, testing, and inspection during all phases of the work at a rate sufficient to assure that the work conforms to the Contract requirements and the minimum guidelines specified.

The Engineer will not sample or test for Process Quality Control or assist in controlling the Contractor's production operations. The Contractor shall provide personnel and testing equipment capable of providing a product which conforms to specified requirements. Continual production of non-conforming work at a reduced price, in lieu of adjustments to bring work into conformance, shall not be allowed.

- (1) The Contractor shall provide and maintain a Process Quality Control Plan, hereinafter referred to as the "Plan", including all the personnel, equipment, supplies, and facilities necessary to obtain samples, perform tests, and otherwise control the quality of the product to meet specified requirements.

The Contractor shall be prepared to present and discuss, at the preconstruction conference, quality control responsibilities for the specific Contract items. The Contractor shall submit the Plan to the Materials and Research Engineer for approval/rejection, at

least ten (10) working days prior to the start of related work. The Contractor shall not start work on the subject items without an approved Plan.

The approval process for the Contractor's Plan may include inspection of testing equipment and a sampling and testing demonstration by the Contractor's technician(s) to assure an acceptable level of performance.

- (2) All Contractor Process Quality Control testing under the Plan shall be performed by qualified technicians in laboratories approved by the Materials and Research Engineer. Technician qualifications shall be as described in the specifications for the Contract item being accepted.

Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. Major pieces of equipment shall be calibrated and/or verified in accordance with the schedule provided by Subsection 106.03(b)(4). Records indicating equipment condition and calibration status shall be maintained in the laboratory. The Engineer shall be permitted unrestricted access to inspect and review the Contractor's laboratory facility. The Engineer will advise the Contractor of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. Deficiencies shall be grounds for the Engineer to order an immediate stop to incorporating materials into the work until deficiencies are corrected.

- (3) The Plan shall be administered by a qualified individual. Administrator qualifications shall be as described in the specifications for the Contract item(s) being accepted.

The individual administering the Plan must be a full-time employee of, or a consultant engaged by, the Contractor. The individual shall have full authority to institute any and all actions necessary for the successful operation of the Plan.

- (4) The Plan shall contain a system for sampling that assures all material being produced has an equal chance of being selected for testing. The Engineer shall be provided the opportunity to witness all sampling.

When directed by the Engineer, the Contractor shall sample and test any material which appears inconsistent with similar material being sampled, unless such material is voluntarily removed and replaced or the resulting deficiency otherwise corrected by the Contractor. All sampling and testing shall be in accordance with Agency, AASHTO, or ASTM procedures.

- (5) All testing shall be performed in accordance with the acceptance test procedures applicable to the specified Contract items or other methods specified in the approved Plan. Should acceptance test procedures not be applicable to quality control tests, the Plan shall stipulate the test procedures to be utilized. Upon request, the Contractor shall provide copies of all test results on forms meeting the approval of the Engineer.



- (6) The Contractor shall maintain complete records of all Process Quality Control tests and inspections. Quality control tests that are initiated but not run to completion shall be incorporated into the records with all available information that was derived. The records shall be available to the Engineer for review and copies furnished upon request. A complete set of all such documents shall be provided upon completion of the Contract.

Control Charts acceptable to the Engineer shall be maintained and kept current at a location satisfactory to the Engineer. At a minimum, the Control Charts shall identify the project number, the Contract item number, the test number(s), each test parameter, the upper and lower specification limit applicable to each test parameter and the Contractor's test results.

The Contractor shall include the Control Charts as part of a Process Quality Control System. The charts shall be used for identifying production and equipment problems and for identifying aspects which could result in pay factor reductions before they occur. Trigger mechanisms for corrective action and suspension of operations must be identified.

- (7) The Engineer may suspend associated construction or production operations at any time that the Plan is not being followed by the Contractor.
- (8) Under such conditions where two sub-lot test results indicate that the lot will result in a sub-par Percent Within Limits (PWL), the Contractor may request that a third test, herein termed a "lot termination test," be taken. After performing a lot termination test, all production operations shall immediately be terminated for that day. The Contractor shall secure the Engineer's approval and concurrence prior to performing said test. This test shall not be cause for switching to "low production activities" as specified in Subsection 106.03(a) (9).
- (9) Upon 24 hours advance request and subsequent approval by the Engineer, the Contractor may perform production activities outside of the requirements of the Plan in the instance those activities involve "low production activities". For the purpose of this Section, low production activities are defined as those not associated with mainline activities and up to a maximum daily production of 300 metric tons (tons) of bituminous mixture.

Materials being produced for low production activities will be tested under the "method spec" provisions of materials testing and control of mixtures and shall comply with all applicable specifications for the mix type being produced.

- (b) Items specified to be sampled and tested for QA purposes will be evaluated for acceptance in accordance with the guidelines specified for those Contract items.
- (1) The Engineer may reject material which appears to be obviously defective based on visual inspection. Such rejected material shall not be used in the work.
- (2) Bituminous Concrete Lab Calibration / Verification Procedures:

This subpart provides a summary of procedures for both required internal laboratory calibration and verification and required external (independent) laboratory calibration services.

INTERNAL CALIBRATIONS / VERIFICATIONS  
PROCEDURES LISTING

| VAOT Number | Calibration (C) / Verification (V) Item                                       | Frequency (months) |
|-------------|---|--------------------|
| 4           | General Purpose Drying Oven (V)   | 12                 |
| 10          | Temperature Measuring Devices (V)   | 6                  |
| 10c         | Temperature Measuring Devices - ASTM E 1, E 77, E 230 (C)                     | 6                  |
| 10f         | Temperature Measuring Devices - Reference ASTM E 1, E 77, E 230 (C)           | 6                  |
| 11          | Sieves (V)  | 6                  |
| 20          | Marshall Compaction Molds - AASHTO T 245 (V)                                  | 12                 |
| 21          | Superpave Gyratory Compaction Molds and Gyratory Compactor - AASHTO T 312 (V) | 6                  |
| 22          | Sand Equivalent Test - AASHTO T 176 (V)                                       | 12                 |
| 23          | Vacuum System - AASHTO T 209 (V)  | 12                 |
| 32          | Timers  | 6                  |
| 45          | Mechanical Sieve Shaker (C)   | 12                 |
| 54m         | Marshall Stability / Flow Apparatus - AASHTO T245 (C)                         | 12                 |
| 58          | Marshall Molds, Manual Hammer, Breaking Heads, Pedestal - AASHTO T 245 (V)    | 12                 |

EXTERNAL CALIBRATION REQUIREMENTS

| VAOT Number | Verification (V) / Calibration (C) Item | Frequency (months) |
|-------------|---|--------------------|
| TBD         | Scales, Balances                        | 12                 |

For the purposes of this Subsection, calibrations are performed on equipment that can be adjusted into compliance. Verifications are completed on fixed condition equipment or equipment that requires outside calibration (typically by a manufacturer or calibration service). Laboratory records that include the date, service person, equipment calibrated or verified, procedure used for calibration and/or verification, and equipment condition shall be maintained in the laboratory. Equipment determined unsuitable for use will be marked "out of service". Tests performed on equipment marginally meeting specifications shall include a note on the results sheet indicating such condition.

Example calibration/verification procedures noted above are available from the Agency's Materials and Research Section. Alternate procedures approved in advance by the Materials and Research Engineer are allowable and anticipated.

106.04 PLANT INSPECTION. The Engineer may undertake the inspection of materials at the source.

In the event plant inspection is undertaken the following conditions shall be met:

- (a) The Engineer shall have the cooperation and assistance of the Contractor and the producer with whom the Contractor has contracted for materials.
- (b) The Engineer shall have full entry at all times to such parts of the plant as may concern the manufacture or production of the materials being furnished.
- (c) When required by the Contract, the Contractor shall arrange for an approved building or trailer with the necessary equipment for testing for the use of the Inspector; such building or trailer shall be located conveniently near the plant.
- (d) Adequate safety measures shall be provided and maintained.

The Agency reserves the right to retest all materials that have been tested and accepted at the source of supply prior to incorporation into the work after delivery and to reject all materials that do not meet the requirements of the Contract when retested.

106.05 STORAGE OF MATERIALS. Materials shall be stored so as to ensure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may be inspected prior to their use in the work; they shall meet the requirements of the Contract at the time of use. Stored materials shall be located so as to facilitate inspection. Upon approval, portions of the right-of-way not required for public travel may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefore shall be at the Contractor's expense. Private property shall not be used for storage purposes without written permission of the owner and/or lessee. All storage sites shall be restored to their original condition at the Contractor's expense; this shall not apply to the stripping and storing of topsoil, or to other materials salvaged from the work or specifically prescribed in the Contract.

106.06 HANDLING MATERIALS. All materials shall be handled so as to preserve their quality and fitness for the work.

106.07 UNACCEPTABLE MATERIALS. At the discretion of the Engineer, all materials not in conformance with the requirements of the Contract shall be considered unacceptable and all such materials, whether in place or not, shall be rejected and removed immediately from the site of the work unless otherwise instructed by the Engineer. Rejected materials that have been subsequently corrected shall not be used unless and until approval has been given.

106.08 EXPLOSIVE AND FLAMMABLE MATERIALS. The Contractor's attention is directed to the provisions of the Vermont Statutes Annotated as amended which (1) authorize the State Fire Marshal to make, publish, enforce, and from time to time to alter, amend, or repeal rules and regulations pertaining to fire prevention and public safety concerning the safekeeping, storage, use,

manufacture, sale, handling, transportation, or other disposition of blank cartridges, gun powder, dynamite, nitroglycerine, crude petroleum or any of its products including liquefied petroleum gas, explosives, flammable gases and flammable fluids, compounds or tablets, any other explosive, or any substance that may spontaneously or acting under the influence of any contiguous chemical or physical agent ignite, inflame, or generate inflammable or explosive vapors or gases to a dangerous extent, and (2) may prescribe the location, materials, and construction of buildings and other facilities to be used for storage of such products. Attention is further directed to the regulations applying to explosives while being transported by carriers in motor vehicles, railroad cars, or vessels in conformity with the regulations adopted by the US Department of Transportation, the US Coast Guard, or the Secretary of Transportation under the provisions of Title 5 VSA § 2001 and Subsection 107.11.

106.09 STOCKPILING OF MATERIALS.

- (a) Ordering Materials; Stockpiling Authority. The Contractor is urged to place orders for materials with producers and suppliers as early as practical so that delays may be kept to a minimum.

The Contractor may submit a written request to the Agency to pay for stockpiled material.

The Engineer may authorize payment for the Contractor's cost of materials, including freight.

The Agency may deny any and all requests to stockpile materials and to make stockpile payments.

Payment for stockpiling of materials will not be allowed for temporary materials.

- (b) Request and Procedure; Criteria. To request stockpiling, the Contractor shall submit the following for consideration by the Agency:

1. Identification of federal-aid project;
2. Listing of Work Package(s) to which the stockpiled materials are to be used in conjunction with;
3. Listing of material(s) by specific Contract specification number and quantity to be stockpiled;
4. Invoice for all materials, or a receipt for delivery;
5. Drafts of documents that show that ownership of the material(s), without encumbrances, will be in the name of the Contractor and will be for the benefit of the Agency;
6. Appropriate certifications and/or passing samples as required for the specific material(s);
7. Statement that the material shall be clearly marked so as to easily identify the project in which the material will be incorporated and shall be available for inspection by the Agency; and
8. The location where and condition(s) under which the material will be stockpiled.

The storage location and security of the stockpiled material(s) shall be the responsibility of the Contractor.

- (c) Raw Materials. In addition to the criteria set out above for other materials, raw material stockpiles shall be approved by the Engineer and meet the following additional criteria:

1. The various components of the finished product shall include all of the appropriate certifications, passing samples, passing tests, and any other documentation that may be required to certify that the materials are acceptable; and
2. Design plans related to the raw materials shall have been Released for Construction; and
3. Any other criteria the Engineer deems necessary to allow for payment.

- (d) Cap; Payment to Supplier; Charge Back; Minimum to Stockpile. Payment will be made for the invoiced amount. The quantity of stockpiled material shall not exceed what is required for completion of the Contract. The Design-Builder shall furnish the paid material invoice within twenty-eight (28) calendar days after the cutoff date for the estimate in which the stockpile amount is paid. If the Design-Builder fails to furnish the paid invoice within this time limit, the amount of the stockpile payment will be deducted from one or more subsequent payments. Under no circumstances shall stockpiling reimbursement be allowed for an item with a stockpiled value totaling less than \$25,000.

The stockpile credit amount shall be reduced once installation of the item begins, and the reduction shall correspond with the installation and payment of the Work Package for which the specific item is stockpiled.

- (e) Finished Product. Payment for stockpiled materials shall not relieve the Contractor from providing an acceptable finished product or from its responsibility for the condition of the materials as specified elsewhere in the Contract. Any defects, flaws, or poor craftsmanship shall be the responsibility of the Contractor and shall be corrected to the Agency's satisfaction at the Contractor's expense.
- (f) Material or Energy Shortage. In the event that unreasonable delays or changes in the work occur as a result of a material or energy shortage, the Contractor shall notify the Agency in writing. If, in the opinion of the Director of Program Development, the Contractor's argument has merit, alternate methods of construction, substitution of materials, or an extension of time may be authorized.

SECTION 107 - LEGAL RELATIONS AND RESPONSIBILITY  
TO THE PUBLIC

59. 107.01 LAWS TO BE OBSERVED.

- (a) General; Defense and Indemnification. The Contractor shall observe and comply with all Federal and State laws and local bylaws,

ordinances, and regulations in any manner affecting the conduct of the work and the action or operation of those engaged in the work, including all orders or decrees as exist at present and those which may be enacted later by bodies or tribunals having jurisdiction or authority over the work, and the Contractor shall defend, indemnify, and save harmless the State and all its officers, agents, and employees against any claim or liability arising from or based on the violation of any such law, bylaws, ordinances, regulations, order, or decree, whether by the Contractor in person, by the employees of the Contractor, or by a subcontractor or supplier.

- (b) Contract Contrary. If the Contractor discovers any provisions in the Contract that are contrary to or inconsistent with any law, ordinance, regulation, order, or decree, the Contractor shall immediately report it to the Engineer in writing.
- (c) U.S., VOSHA, and Environmental Protection Regulations. The Contractor's attention is directed to the various regulations promulgated and enforced by the United States and VOSHA and the environmental protection agencies.
- (d) Fair Employee Practices Act. The Contractor shall comply with all of the requirements of Title 21 VSA Chapter 5, subchapter 6, relating to fair employment practices to the extent applicable. A similar provision shall be included in any and all subcontracts.
- (e) Hazardous Wastes. The Contractor's attention is directed to regulations regarding the management of hazardous wastes such as waste crankcase and hydraulic oils, and waste paint generated by construction operations (ref: Agency of Natural Resources' Department of Environmental Conservation and Title 10 VSA Chapter 159).
- (f) Americans with Disabilities Act. The Contractor shall comply with the Americans with Disabilities Act of 1990 and shall assure that individuals with disabilities have equal access to the services, programs and employment activities/opportunities offered by the Contractor under this Contract.
- (g) Prompt Payment Act. The Contractor shall fully comply with the provisions of 9 V.S.A. Chapter 102, also referred to as Act No. 74 of 1991 or the Prompt Payment Act, as amended.
- (h) Subcontractor Payments; Reporting; Violations; Inclusion In Subcontracts. On all federal-aid and state funded contracts, the Contractor, during the life of the Contract and on a monthly basis, shall submit electronically, a listing of payments to subcontractors on the form specified by the State and made available at: <http://www.aot.state.vt.us/dbe/login.asp>. Electronic reports shall be filed with the Agency Office of Civil Rights by an authorized representative and received in the Agency Office of Civil Rights on or before the tenth working day after month end. Contractors without access to the internet shall obtain and submit manual reports to the Agency Office of Civil Rights. Manual reports shall be signed by an authorized representative, sent to the Agency Office of Civil Rights, and postmarked on or before the tenth working day after month end. There shall be no direct compensation allowed the Contractor for this work, but the cost thereof shall be included in the general cost of the work.

In accordance with 9 V.S.A. Section 4003, notwithstanding any contrary agreement, payments made to subcontractors after seven days from receipt of a corresponding progress payment by the State to the Contractor, or seven days after receipt of a subcontractor's invoice, whichever is later, violate this agreement.

Violations shall be reported to the Agency Office of Civil Rights for review. Failure to resolve disputes in a timely manner may result in a complaint made to the Agency Pre-qualification Committee. In this Committee's judgment, appropriate penalties may be involved for failure to comply with this specification. Penalties may include suspension, reduction or revocation of the Contractor's pre-qualification rating.

This clause shall be included in the prime Contractor's Contract made with all of its subcontractors.

60. 107.02 PERMITS, LICENSES, AND TAXES. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the lawful prosecution of the work.
61. 107.03 PATENTED DEVICES, MATERIAL, AND PROCESSES. If any design, device, material, or process covered by letters of patent or copyright is used by the Contractor, whether required or not, the Contractor shall provide for such use by suitable legal agreement with the patentee or owner; a copy of this agreement shall be filed with the Agency. The Contractor and the Contractor's surety shall defend, indemnify, and save harmless the State, any affected third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material, or process, or any trademark or copyright, and shall indemnify the State for any costs, expenses, and damages including reasonable attorney's fees which it may be obliged to pay by reason of any infringement at any time during the prosecution or after the completion of the work.
62. 107.04 FEDERAL-AID PROVISIONS. The Contractor acknowledges that pursuant to the provisions of Title 23 USC, and Acts amendatory thereto, as well as any and all other Federal legislation appropriating funds to the State, the Federal Government may pay a portion of the cost of this project. The above act of Congress provides that the construction work and labor on any Federal-Aid project in Vermont shall be done in accordance with its laws and under the direct supervision of the State of Vermont, Agency of Transportation, subject to the inspection and approval of the US Department of Transportation or appropriate Federal agency and in accordance with the rules and regulations made pursuant thereto. Therefore, the construction work will be subject to such inspection by the US Department of Transportation or appropriate Federal agency or its agent as deemed necessary to meet the above requirements. Such inspection will in no sense make the Federal Government a party to this Contract and will in no way interfere with the rights of either party hereunder.
63. 107.05 SANITARY PROVISIONS. The Contractor shall provide and maintain, in a neat and sanitary condition, such accommodations for the use of its employees as necessary to comply with the requirements and regulations of the State or local Boards of Health at no expense to the Agency.
64. 107.06 PLANT PEST CONTROL REQUIREMENTS. Soil and soil moving equipment are subject to plant quarantine regulations. In general, these regulations provide for cleaning soil from equipment before it is moved

from a project. Complete information may be secured from State or Federal plant pest control inspectors.

65. 107.07 PUBLIC CONVENIENCE AND SAFETY.

- (a) General. The Contractor shall conduct all work so as to ensure the least possible obstruction to traffic. The safety and convenience of the general public and the residents along the highway within the construction area and the protection of persons and property shall be provided for by the Contractor as specified in Subsection 104.04.
- (b) Dust Control. The Contractor shall use all necessary dust control on haul road(s) and maintenance yard(s) in the same manner as required for materials sources and disposal areas in Subsection 105.27. Dust control on haul road(s) and maintenance yard(s) shall be performed in accordance with Section 609. The Contractor shall perform all dust control directed by the Engineer on the haul road(s) and/or maintenance yard(s).

The Engineer will direct the use of all necessary dust control within the limits of the construction performed under the Contract. The necessary dust control shall be performed in accordance with the requirements of Section 609.

- (c) Stored Materials. Materials stored within the construction area shall be placed so as to cause a minimum obstruction to the traveling public and snow removal operations.
- (d) Fire Hydrants. Fire hydrants located within the construction area shall be kept accessible to fire apparatus at all times and no material or obstruction shall be placed within 4.5 m (15 feet) of any such hydrants.
- (e) Adjoining Ways. Sidewalks, gutters, drainage inlets, and portions of highways adjoining the roadway under construction shall be obstructed only when necessary. If a sidewalk is obstructed, temporary pedestrian access meeting the requirements of ADA and the MUTCD shall be provided around the obstructed area.
- (f) Lane Restrictions. When the total useable width of a traveled way will be decreased to 4.3 m (14 feet) or less for a period longer than one working day, the Contractor shall notify the Engineer of the date of the first day and the anticipated period of time such a lane restriction will be in effect. This notification shall be provided at least two weeks prior to the beginning of the lane restriction so that the Engineer may provide proper notification to the Oversized/Overweight Section of the Commercial Vehicle Enforcement Unit of the Department of Motor Vehicle and the Agency's Communications Section. When the date of the removal of the restriction becomes known, the Contractor shall notify the Engineer so that notification can be provided to these entities. Notwithstanding the above requirements, lane restrictions shall also be in accordance with other Contract Documents, including the Transportation Management Plan.

66. 107.08 TRAFFIC CONTROL DEVICES.

- (a) General. All approach signs shown on the Released for Construction Temporary Traffic Control Plans shall be installed prior to beginning



other work. Additional traffic control devices necessary for work on any portion of the project shall also be installed prior to beginning work on that portion. All traffic control devices shall conform to the latest version of the MUTCD. Use of metal drums as traffic control devices is prohibited.

The Contractor shall furnish, erect, and maintain all signs, barricades, lights, signals, and other traffic control devices necessary for the protection of the work and safety of the traveling public.

- (b) Existing Pavement Markings. Whenever existing pavement markings conflict with desired traffic patterns within a construction or detour area or otherwise create a potentially misleading, confusing, or hazardous condition for the traveling public, the markings shall be completely removed or obliterated by the Contractor to the satisfaction of the Engineer. Painting over the existing lines is not acceptable.
- (c) Warning Signs. The Contractor shall erect warning signs in advance of any location on the project where operations interfere with the use of the road by traffic and all locations where the new work crosses or coincides with an existing road.
- (d) Detour Signs. The Contractor shall provide and maintain throughout the project acceptable warning, direction, and detour signs at all closures and intersections; along the construction and detour routes, the Contractor shall provide and maintain acceptable warning, direction, and detour signs directing traffic around the closed portion or portions of the highway so that the temporary detour route(s) shall be indicated clearly throughout its (their) entire length(s).
- (e) Closed Highways/Sidewalks. Highways closed to traffic shall be protected by barricades and/or other approved barriers, which shall be reflectorized or illuminated.

When a section of an existing sidewalk is closed to pedestrians, suitable barricades and warning signs conforming to ADA and the MUTCD shall be installed. If channelizing devices are used to establish a temporary pedestrian route, those devices shall conform to the MUTCD.

- (f) Delineation. Delineation shall be required through the construction area as shown on the Released for Construction Temporary Traffic Control Plan or as directed by the Engineer.
- (g) Flashers. Flashers may be required by the Engineer for use on signs and barricades to call attention to special or hazardous conditions.
- (h) Failure to Install, Maintain, Remove. If the Contractor fails to satisfactorily install, maintain or remove traffic control devices, the Engineer may have such installations made, maintained, or removed, and the cost thereof shall be deducted from the monies due the Contractor.

67. 107.09 RESPONSIBILITY FOR USE OF FLAGGERS AND UNIFORMED TRAFFIC OFFICERS. In accordance with 23 CFR 630; as conditions warrant, the Contractor shall employ flaggers at any location on the project where equipment or

construction operations will interfere with the movement or safety of the traveling public. This includes operations where equipment enters, leaves or crosses normal traffic lanes being used or set aside for the traveling public and locations where heavy equipment is operating adjacent to areas where traffic is moving. Flaggers may not be required at locations manned by uniformed traffic officers assigned for the protection of the traveling public. Attention is directed to the provisions of Section 108 as they may apply to the use of flaggers. Where needed to assure safe ingress and egress for activities associated with the construction of the project, the Engineer may require the use of flaggers at locations off of the project site.

When uniformed traffic officers are used, marked law enforcement vehicles displaying law enforcement signal lamps shall accompany each uniformed traffic officer in or near the highway, indicating their presence.

The dress, equipment, and procedures of all flaggers and uniformed traffic officers shall conform to the requirements in the MUTCD and Section 630 of the Standard Specifications.

68. 107.10 RAILWAY-HIGHWAY PROVISIONS. If the Contractor is required or elects to haul materials across the tracks of a railway other than on a public highway, the Contractor shall make arrangements with the railway for a new private crossing or for the use of an existing private crossing. All work to be performed within a railroad right-of-way by the Contractor in the construction of railway-highway separation structures or at grade crossings shall be done in accordance with the Contract. The Contractor shall use all care and precaution in order to avoid crashes, damage, or unnecessary delay or interference with the railway company's trains and other property. The Contractor shall carry Public Liability and Property Damage Insurance as stipulated elsewhere in these Specifications or other Contract Documents.

69. 107.11 USE OF EXPLOSIVES.

- (a) General. The Contractor shall use the utmost care to protect life and property and, whenever directed by the Engineer, shall reduce the number and size of explosive charges. Blasting mats shall be used when required by regulation or deemed necessary. The Contractor shall notify each person, company, corporation, or public utility that owns, leases, or occupies property or structures near the site of the work of plans to use explosives; notice shall be given sufficiently in advance to enable people to take such steps to protect their property or structure from injury as they may deem necessary. Provision of notice shall not relieve the Contractor of responsibility for any damage resulting from the Contractor's blasting operations. All persons within the danger zone of blasting operations shall be warned, a warning whistle shall be sounded, and the zone cleared just prior to blasting. A sufficient number of flaggers shall be stationed outside the danger zone to stop all approaching traffic during blasting operations. Explosives shall be used only during daylight hours and shall be handled only by competent, trained workers; particular care shall be taken to ensure that no unexploded charges remain in the work area unattended and when constructions operations cease for the day. All explosives shall be stored securely, all storage locations shall be clearly marked "DANGEROUS-EXPLOSIVES," and all storage locations shall be supervised and controlled by a competent, trained person at all times. All explosives and highly flammable materials shall be stored

and used in strict conformity with all Federal, State, and local laws, rules, and regulations. Attention is directed to VOSHA *Safety and Health Standards for Construction*, Subpart U, Blasting and the Use of Explosives.

- (b) Liability. Each of the insurance policies required for a project shall include coverage for injury to persons and injury or destruction of any property arising out of the storage and use of explosives.
- (c) Insurance. The Contractor acknowledges full responsibility and assumes full liability for any and all damage or injury to persons or property caused either directly or indirectly by the Contractor's or a subcontractor's use of explosives. The liability of the Contractor shall apply equally to damages or injury to persons or property whether said injury or damage occurs within or outside of the right-of-way.
- (d) Blasting Cap Danger. The Contractor and/or the Contractor's agents shall take all precautions necessary to prevent premature explosions of electric blasting caps individually or when they are connected into a circuit.

The Contractor and/or the Contractor's agents acknowledge and are hereby advised of the potential hazard of a premature explosion of electric blasting caps due to propagation of radio frequency energy by transmitters of radio and the related radio services such as television and radar. Mobile and fixed radio, cellular telephone, radar, television, and related transmitters are in general use in the State of Vermont, including police departments, fire departments, political subdivisions, utility companies, commercial carriers, private and public enterprises, and individuals.

- (e) Warning Signs. Prior to blasting operations the Contractor shall install warning signs in conformance with the MUTCD. Warning signs shall be located in prominent positions at least 370 m (1200 feet) from the point of blasting and visible to any person approaching the blasting point.
- (f) Documentation of Structure Condition. It shall be the responsibility of the Contractor to document the existing condition of all structures that have potential for damage. This documentation shall be in the form of a video or pictures, with sufficient description, and shall be supplied to the Engineer prior to any blasting on the project.
- (g) Blast Surveys. The Contractor shall monitor all blasts and provide a report to the Engineer that shall indicate the Peak Particle Velocity (PPV) of the blast. The PPV sensitivity as reported shall range from less than 0.5 mm/s (0.02 in/s) to more than 125 mm/s (5.0 in/s). The Engineer reserves the right to request more than one instrument to monitor the blasting if there is a need for monitoring in more than one direction from the blasting area.

70. 107.12 PROTECTION AND RESTORATION OF PROPERTY.

- (a) General. The Contractor shall:

- (1) Not enter upon private property for any purpose without obtaining written permission;
  - (2) Be responsible for the preservation of all public and private property along and adjacent to the work;
  - (3) Use every precaution necessary to prevent damage or injury to public and private property;
  - (4) Protect from disturbance or damage all land monuments and property markers until an authorized agent has witnessed or otherwise referenced their locations, monuments, and property markers;
  - (5) Not move any land monuments and property markers until directed by the Engineer; and
  - (6) Protect all trees, shrubs, and other plants not marked by the Engineer for removal from damage by construction operations.
- (b) Protection of Existing Infrastructure. The Contractor shall ensure that any portions of the existing roadway and existing structures which are to be retained for public travel are left in as good condition as when the Contractor commenced work. The Contractor shall not move or use equipment on any pavement or structure in a manner that may or does cause damage.
- (c) Contractor's Responsibility. The Contractor shall be responsible for all claims involving damage or injury to, or destruction of, property of any type resulting from any act, omission, neglect, or misconduct of the Contractor's manner or method of executing the work, due to the Contractor's non-execution of said work, or due to defective work or materials. The Contractor's responsibility shall not be released until the work has been completed and accepted and the applicable statute of limitations has expired.
- (d) Restoration of Damaged Property. When any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work or in consequence of the non-execution thereof on the part of the Contractor, such property shall be restored at the Contractor's expense to a condition similar or equal to that existing before such damage or injury was done or the Contractor shall make good such damage or injury in an acceptable manner.
- (e) Cleaning Traffic Signals and Street Lighting. When the Contractor's operations compromise the functionality of existing traffic signals and/or street lighting equipment, the Engineer may require the Contractor to clean said equipment prior to project completion. Cleaning of traffic signals shall include all vehicle and pedestrian signal face lenses (inside and outside). Further, the inside of the controller cabinet shall be vacuumed and any vent filter shall be replaced; cleaning of streetlights shall include both the lens (inside and outside) and the reflector. The cleaning of electrical equipment shall be done by a traffic signal/electrical contractor. Any equipment that is damaged in the cleaning process shall be repaired or replaced at the Contractor's expense.
- (f) Ground Vibration Limits. The maximum Peak Particle Velocity (PPV) of ground vibration in any of the three mutually perpendicular

components of particle velocity for the following structure types shall be limited as follows:

| <u>Type of Structure</u>              | <u>PPV in mm/s (in/sec)</u>          |   |
|---------------------------------------|--------------------------------------|---|
|                                       | <u>Frequencies &lt;<br/>40 Hertz</u> | <u>Frequencies &gt;<br/>or = 40 Hertz</u> |
| Modern Homes (drywall interior)       | 19 (0.75)                            | 50 (2.0)                                  |
| Older Homes (plaster on wood or lath) | 13 (0.50)                            | 50 (2.0)                                  |
| Non-Residential Structures            |                                      |   |
| Underground Utilities                 |                                      |   |

The Agency reserves the right to lower the PPV limit in areas where there may be structures or elements with a higher sensitivity to ground vibration. Adherence to this specification does not waive the Contractor's responsibility for damage as specified in this Subsection and in Subsection 107.16.

71. 107.13 PROTECTION AND RESTORATION OF UTILITIES AND SERVICES.

- (a) General. The Contractor shall take proper precaution during construction to avoid damage to public and private services. These services include, but are not limited to gas, water, sewer and drainage pipes, springs, wells, septic tanks, cesspools, telephone, telegraph, television, and other communication and electrical services. Services may be located on or adjacent to the project, above, on, or under the ground.
- (b) Dig-Safe. The Contractor shall comply with the requirements of Dig-Safe, Title 30 V.S.A. Chapter 86, Sections 7001 - 7008.
- (c) Notice of Work. At commencement or resumption of construction, the Contractor shall notify the owners, operators, occupants, or lessees of all the public or private services of any work to be done on, over, under, adjacent to, or in proximity to said utilities during the construction of the project. Further, the Contractor shall again notify the aforesaid parties seven (7) to fourteen (14) calendar days in advance of starting such work to enable them to take steps as they may deem necessary to protect their property or structures from damage. Provision of notice shall not relieve the Contractor of its responsibility for any damages resulting from the Contractor's work.
- (d) Owner Access. Owners, employees, or agents of public or private services located within the project limits shall be allowed free and full access with the tools, materials, and equipment necessary to install, operate, maintain, place, replace, relocate, and remove service facilities. No compensation will be paid to the Contractor for any inconvenience caused by working with these parties or around or with their services.
- (e) Service Relocation. The exact location of any service facility relocated within the project limits shall be as shown on the utility relocation plans Released for Construction by the Engineer.
- (f) Cooperation. The Contractor shall cooperate with the owners of any of the aforementioned services in order that the service removal and/or relocation operation will progress in a reasonable manner,

that duplication or temporary relocation work may be reduced to a minimum, and that services rendered by the concerned parties will not be unnecessarily interrupted.

- (g) Service Interruption. If in connection with the work interruption in service occurs, the Contractor shall promptly notify the owner or the owner's authorized representative and cooperate with the owner to promptly restore service. In no case shall interruption to water or sewer service be allowed to exist outside of normal working hours without the substitution of acceptable alternate service.
- (h) Fire Hydrants. No work shall be undertaken around fire hydrants until provisions for continued service have been approved by the local fire authority.
- (i) Responsibility for Damage. The Contractor shall be responsible for all damages done to services from the beginning of construction to the satisfactory completion of the project, including all damages to water supplies and sewage systems, including but not limited to damage to springs and wells, septic tanks, cesspools, and underground pipes, whether located within or outside the project right-of-way or whether or not shown on the Plans, except as otherwise provided in the Contract.
- (j) Water; Investigation of Claims. The Agency will receive and investigate all claims relating to damage to springs, wells, and water supply systems. The Contractor will be notified of the results of the investigation. If it is determined that the damage is the responsibility of the Contractor, the Contractor shall be responsible for immediately repairing and restoring the facility to its original condition, in a manner acceptable to the Engineer, at the Contractor's own expense.
- (k) Restoration of Service by Agency. If the Contractor fails to restore a service or to make good on a damage or injury to service(s), the Engineer may proceed to repair, rebuild, or otherwise restore the service as deemed necessary and the cost thereof will be deducted from any monies due, or which may become due, the Contractor under the Contract.

72. 107.14 PROTECTION OF HISTORICAL AND ARCHAEOLOGICAL SITES. When the Contractor's excavation operations encounter sites or artifacts of historical or archaeological significance not identified in the Contract documents and/or during the Contractor's site investigations, the operations shall be immediately discontinued. The Engineer will contact archaeological authorities and give them 48 hours to determine the appropriate action to be taken. When directed by the Engineer, the Contractor shall excavate the site in a manner that will preserve the artifacts encountered and/or remove them for delivery to the custody of proper state authorities; such excavation will be considered and paid for as Extra Work.

73. 107.15 FOREST PROTECTION.

- (a) General. When working within or adjacent to forests or other plant growth, the Contractor shall satisfactorily burn or otherwise dispose of all valueless trees and logs, stumps, roots, brush, weeds, grass, and other objectionable material. Disposal of such

material shall be in conformity with the laws, rules, and regulations of the State of Vermont pertaining thereto and other authority having jurisdiction governing the protection of forests and in carrying out work within forests. When working within or adjacent to National Forest Lands, the Contractor shall comply with the requirements set forth in the Forest Service Special Use Permit included in the Contract. Before a fire is kindled on or in the vicinity of any project, the Contractor shall obtain the necessary permits from the State Agency of Natural Resources and the local fire prevention officials. Copies of permits shall be available on the project. Fires must either be thoroughly wet down when construction operations are suspended for the day or the remains shall be attended until work begins again. Night burning will not be allowed.

- (b) Work In Forest Areas. The Contractor shall observe all sanitary laws, rules, and regulations with respect to the performance of work in forest areas. The Contractor shall keep forest areas in orderly condition, obtain permits for the construction and maintenance of all construction camps, stores, warehouses, residences, latrines, cesspools, septic tanks, and other structures in accordance with the requirements of the Forest Supervisor.
- (c) Forest Fires. The Contractor and all subcontractors shall take appropriate action to prevent forest fires. If a fire is out of control on or near the project, the Contractor and all subcontractors shall do everything within their power to suppress the fire, shall immediately notify the Town Fire Warden or other known forest officials of the location and extent of the fire and shall cooperate with forest officials to suppress the fire once they have assumed control of the firefighting operation.
- (d) Fires Caused By Contractor's Operation; Costs. The Contractor shall reimburse the Federal government, State, and political subdivisions for all expenses of suppressing a forest fire caused by its operations and shall be responsible to landowners for any and all damage caused by a fire.

74. 107.16 RESPONSIBILITY FOR DAMAGE CLAIMS.

- (a) General. The Contractor shall defend, indemnify and save harmless the municipality(ies), the State, the Agency, and railroad(s) and all of their officers, agents, and employees from all suits, actions, or claims of any character, name, and description brought for or on account of any injuries or damages received or sustained by any person, persons, or property that arise out of, relate to, or are in any manner connected with the Contractor's work or the supervision of the Contractor's work on the project; or by or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or by or on account of any act of omission, neglect, or misconduct of the Contractor; or by or on account of any claims or amounts recovered for any infringement of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the Workers Compensation Act, or any other law, bylaw, ordinance, order, or decree. The State shall notify the Contractor in the event of any such claim or suit, and the Contractor shall immediately retain counsel and otherwise provide a complete defense against the entire claim or suit.

After a final judgment or settlement the Contractor may request recoupment of specific defense costs and may file suit in Washington Superior Court requesting recoupment. The Contractor shall be entitled to recoup costs only upon a showing that such costs were entirely unrelated to the defense of any claim arising from an act or omission of the Contractor.

The Contractor shall indemnify the State and its officers and employees in the event that the State, its officers or employees become legally obligated to pay any damages or losses arising from any act or omission of the Contractor.

- (b) Right to Retention of Funds. So much of the money due the Contractor under and by virtue of the Contract as shall be considered necessary by the Agency for such purpose may be retained for the use of the State. If no money is due, the Contractor's surety shall be held until such suit or suits, action or actions, or claim or claims for injuries or damages shall have been resolved and suitable evidence to that effect furnished by the Agency.
- (c) Submission of Damage Claims. With regard to each and every damage claim, the Contractor shall:
  - (1) Provide the claimant with a damage claim form for the submission of damage claims to the Contractor and Agency;
  - (2) Pay, settle, or otherwise resolve the claim;
  - (3) Submit the claim to the insurance carrier, with a copy to the Agency;
  - (4) Treat all claimants with respect.

75. 107.17 OPENING SECTIONS OF PROJECT TO TRAFFIC.

- (a) General. Opening of a section of a project to traffic prior to substantial completion of the entire Contract may be desirable in some instances. Discussions concerning such an opening shall involve, but are not limited to, the Regional Construction Engineer, Project Manager, District Transportation Administrator, and, when appropriate, local municipal officials. Such an opening shall be made in accordance with the Contractor's Transportation Management Plan. Such an opening shall not constitute acceptance of the work or a part thereof or a waiver of any provisions of the Contract.
- (b) Delayed Completion of Project. If the Contractor delays completion of shoulders, drainage structures, or other features of the work, the Engineer will notify the Contractor in writing and establish a reasonable period of time in which the work shall be completed. If the Contractor fails to complete the work by the time specified, the Engineer may order all or a portion of the project opened to traffic at no additional cost to the Agency. On sections that are ordered to be opened, the Contractor shall conduct the remainder of construction operations so as to cause the least obstruction and disruption to the traveling public, including vehicular and pedestrian traffic, adjacent landowners, and commercial businesses. The Contractor shall not receive any additional compensation due to the added cost caused by opening such section(s) to traffic.



- (c) Compensation for Work on Opened Sections. Except as provided for in this Subsection, notwithstanding any other provision of the Contract Documents, the Contractor shall receive no additional compensation for work on a section of the project that has been opened to traffic as described herein.

76. 107.18 CONTRACTOR'S RESPONSIBILITY FOR WORK.

- (a) General. Until acceptance of the project by the Engineer the Contractor shall be responsible therefore and shall take every precaution against injury or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work before acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God, of a public enemy, or governmental authorities. For purposes of this paragraph the term work shall exclude Contractor owned, rented, or leased materials, equipment, and incidentals.
- (b) Suspension of Work. When work is suspended for any reason, the Contractor shall be responsible for the project and shall take precautions to prevent damage to the project, provide for normal drainage, and erect any necessary temporary structures, signs, or other facilities solely at the Contractor's expense. During a period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established plantings, seedings, and soddings furnished under the Contract and take adequate precautions to protect new tree growth and other important vegetative growth against injury.
- (c) Winter Maintenance. The performance by the State, a subdivision thereof, or other authorized agent of any snowplowing, salting, and/or sanding shall not relieve the Contractor of its responsibility as outlined herein or elsewhere in the Contract.

77. 107.19 NO PERSONAL LIABILITY OF PUBLIC OFFICIALS. It being understood that in all such matters relative to the Contract that they act solely as agents and representatives of the State, neither the Secretary, Deputy Secretary, the Director of Program Development, Engineer, or their authorized representatives shall be liable, either personally or as officials of the State, for their actions pursuant to authority granted to them by the Contract.

78. 107.20 NO WAIVER OF LEGAL RIGHTS.

- (a) General. Upon completion of the work, the Agency will expeditiously make final inspection and notify the Contractor of acceptance. Acceptance of the project, however, will not preclude or prevent the Agency from correcting any certificate made before or after completion of the work; and the Agency will not be precluded or prevented from recovering from the Contractor, the Contractor's surety, or both any overpayment it may have made by failure on the part of the Contractor to fulfill the Contractor's obligations under the Contract. A waiver on the part of the Agency of any breach of

any part of the Contract shall not be held to be a waiver of any other or subsequent breach.

- (b) Latent Defects, Fraud, and Gross Mistakes. Without prejudice to the terms of the Contract, the Contractor shall be liable to the Agency for latent defects, fraud, and such gross errors, omissions, or mistakes as may amount to fraud, and as regards the Agency's rights under any warranty or guaranty.

79. 107.21 FURNISHING RIGHT-OF-WAY. The State has acquired all necessary Right-of-Way and Land Rights necessary to construct the Base Technical Concept shown in the RFP documents. Any additional rights-of-way and/or additional rights to use land outside of the right-of-way as shown on the Plans which the Contractor desires for its own convenience shall be obtained and paid for by the Contractor. All right-of-way acquisition shall be performed in accordance with the Uniform Act pursuant to 42 U.S.C. § 4601 (1987).

80. 107.22 BUY AMERICA PROVISIONS.

- (a) General. All steel products permanently incorporated into Federal-Aid projects shall be products that have been entirely manufactured within the United States. All manufacturing processes of the steel or iron material in a product (i.e., smelting and any subsequent process which alters the steel material's physical form or shape or changes its chemical composition) must occur within the United States to be considered of domestic origin. This includes processes such as rolling, extending, machining, bending, grinding, and drilling.
- (b) Use of Foreign Materials. This requirement does not prevent a minimal use of foreign materials, provided the cost of foreign materials used does not exceed 0.1 percent of the total Contract price or \$2,500, whichever is greater. The cost of foreign steel or iron is defined as its value delivered to the project. The Contractor shall notify the Engineer if it intends to use any foreign materials on the project.
- (c) Coatings on Steel/Iron. In accordance with 23 CFR 635.410, iron has been added to the materials now subject to the Buy America requirements, and the action of applying a coating to a covered material (i.e., steel and iron) is now deemed a manufacturing process subject to Buy America. Coating includes epoxy coating, galvanizing, painting, and any other coating that protects or enhances the value of a material subject to requirements of Buy America. Buy America requirements of 23 CFR 635.410 are applicable to all Federal-Aid highway construction projects (NHS and non-NHS).

81. 107.23 DEFENSE OF LAWSUITS - CHALLENGE TO JURISDICTION AND WAIVER OF IMMUNITY. When defending any claim that may arise under the Contract, the Contractor shall not raise or impose any defense involving the jurisdiction of the tribunal before which said claim is pending, the immunity of the State of Vermont, governmental nature of the State, or the provision of any statutes respecting suits against the said State of Vermont without obtaining the express advance permission of the Vermont Attorney General's Office.

82. 107.24 INTEREST. Notwithstanding any statutory or other provisions to the contrary, interest on monies owed pursuant to the Contract shall be paid as follows:

- (a) Claims for Adjustment or Dispute - Pre-Decision or Judgment. Interest shall be allowed the Contractor on a decision or judgment for money in a claim for adjustment or dispute. Pre-decision or judgment interest shall be calculated for twenty-one (21) days after the date the money would have been paid in a bi-weekly or final estimate, or the date of the claim, whichever is later, but for the failure of the Agency to make the payment to the date of decision or judgment, at a simple rate equal to the weekly average 1-year constant maturity Treasury yield, as published by the Board of Governors of the Federal Reserve System, for the calendar week preceding the date of the decision or judgment
- (b) Claims for Adjustment or Dispute - Post-Decision or Judgment. Interest shall be allowed the Contractor on a decision or judgment for money in a claim for adjustment or dispute. Post-decision or judgment interest shall be calculated from the date of decision or judgment to the date of payment at a simple rate equal to the weekly average 1-year constant maturity Treasury yield, as published by the Board of Governors of the Federal Reserve System, for the calendar week preceding the date of the decision or judgment.

#### SECTION 108 - PROSECUTION AND PROGRESS

83. 108.01 SUBLETTING OR ASSIGNMENT OF CONTRACT.

- (a) General. The Contractor shall not sublet, assign, sell, transfer, or otherwise dispose of the Contract or any portion thereof, or of its right, title, or interest therein to any individual, firm, corporation, or other entity without the written consent of the Engineer. The Contractor must file with the Agency copies of all executed subcontracts and other documents. An approved subcontractor shall not in turn sublet or assign any of the work pertaining to the subcontract without the Contractor obtaining further permission from the Agency. In no event shall Agency approval release the Contractor from responsibility and liability under the Contract and bonds.
- (b) Performance of the Contract Work. The Contractor shall perform Contract work with its own organization amounting to at least 30 percent of the total Contract work amount. The Contractor's own organization includes only workers employed and paid directly by the Contractor and equipment owned, leased, or rented by it from a non-debarred individual or entity, with or without operators. The term "own organization" does not include employees or equipment of a subcontractor, assignee, agent, or supplier of the Contractor. When determining whether the Contractor is in compliance with this 30 percent requirement, the following shall apply:
  - (1) The cost of materials and manufactured products to be purchased or produced under the Contract shall be included in the amount upon which the 30 percent requirement is computed.
  - (2) The percentage of subcontracted work shall be based on the subcontracted dollar amount.

- (3) When a firm sells materials to a Contractor and performs the work of incorporating the materials into the project, these actions must be considered in combination and as constituting a single subcontract.
- (c) Performance Requirements. The Contractor and its subcontractor(s) shall, in the staffing and administration of the Contract, comply with the following performance requirements:
  - (1) Commercially Useful Function. The Contractor and subcontractor(s) must each perform a "commercially useful function." This means that the Contractor/subcontractor is responsible for the execution of a distinct element of the work of a Contract and carries out its responsibilities by actually performing, managing, and supervising the work involved. The Contractor/subcontractor must have the latitude to independently:
    - a. Select contracts to be bid;
    - b. Determine prices to be quoted;
    - c. Select material suppliers;
    - d. Hire, fire, supervise, and pay employees; and
    - e. Direct or cause the direction of the management and policies of the firm.

The Contractor/subcontractor may not broker work for another firm or act as a bidding conduit.

- (2) Contractor to Furnish Competent Representative; Safety Officer; Others. To ensure that any subcontracted work is performed in accordance with the Contract requirements, the Contractor shall be required to furnish:
  - a. A competent, reliable English-speaking representative employed by the Contractor who has full authority to direct performance of the work in accordance with the Contract requirements and who is responsible for all construction operations on the project regardless of who performs the work.
  - b. A competent, reliable English-speaking employee designated as the safety officer who is authorized to receive orders and to issue binding directions concerning safety to all persons except Agency representatives associated with the project, whether employed by the Contractor, subcontractors, or material suppliers.
  - b. Such other individual(s) from the Contractor's organization as the Agency's Construction Engineer determines is (are) necessary to ensure the performance of the Contract, e.g., supervisory, managerial and engineering personnel.
- (3) Employees on Payroll. The Contractor/subcontractor is not permitted to place on the payroll the employees of another firm for the purpose of avoiding Federal or State regulations or the provisions of the Contract.

84. 108.02 CONTRACT NOTICE TO PROCEED. The Contractor shall not commence Project Work until Contract bonds have been filed, the Contract Documents have been signed on the part of the State, and the Regional Construction Engineer has given the Contractor written notice to proceed.

The "Notice to Proceed" will stipulate the date on which the Contractor may begin Project Work and from which date Contract time will be charged.

85. 108.03 PROSECUTION AND PROGRESS.

(a) General. The Contractor is expected to progress the work in a manner that allocates adequate resources to complete all aspects of the work within the time allotted. The Contractor is responsible for the scheduling of all Contract work, which shall include, but not be limited to subcontracted work, complete and acceptable submissions, work component fabrications, and delivery of materials. The schedule shall include allowance for time for all aspects of the work including sufficient time for VTrans to perform their functions as indicated in the Contract, including but not limited to QA inspection and testing, VTrans review of Design-Builder submissions, and review of Working Drawings.

(b) Baseline Project Schedule. In accordance with Part 2 of the RFP, as part of the Administrative Submittals, the Contractor shall submit to the Engineer for approval a CPM progress schedule (Baseline Project Schedule).

The schedule shall define and sequence activities so as to accurately describe the project and to meet Contract requirements for scope of work, phasing, accommodations for traffic, and interim, milestone, and project completion dates. Use work days to create the schedule, beginning with the date of the Notice to Proceed.

(1) The schedule shall include the following:

- a. Activities that describe the essential features of the work, activities that might delay Contract completion, and which activities are on the critical path;
- b. The planned start and completion dates for each activity and the duration of each activity stated in work days (field activities of more than 15 work days in duration shall be broken into two or more activities distinguished by location or some other logical feature); this estimated figure shall include considerations for permit limitations, seasonal limitations, and any other anticipated delays.
- c. Finish-to-Start relationships among activities, without leads or lags unless justified in the narrative, and approved by the Engineer;
- d. Distinct columns showing Predecessors, Successors, Duration, Actual Start, and Actual Finish for each Activity;
- e. Project suspension or work inactivity that is three (3) days or longer;

- f. An indication of how the schedule accommodates adverse weather days for each month;
  - g. Dates related to the procurement of materials, equipment, and articles of special manufacture;
  - h. Dates related to the submission of Working Drawings, plans, and other data specified for review or approval by the Agency;
  - i. Key milestone dates specified in the Contract including but not limited to; Notice to Proceed, Authorization to Design and Construct, Interim Completion, Permit Restriction Dates, and Contract Completion Date. These shall be the only constraints in the schedule logic;
  - j. Activities related to Agency inspections, and activities related to specified activities by the Agency, and third parties.
- (2) Schedule Submission Requirements. Provide the following items with each schedule submission:
  - a. An electronic copy in MS Project format with run date and version of the schedule;
  - b. A PDF illustrated in color, depicting no more than 50 activities on each 280 by 430 mm (11 by 17 in.) sheet, and with each sheet including title, project name and number, match data for diagram correlation, and a key;
  - c. A four-week look-ahead narrative to provide a more detailed plan of upcoming work highlighting the near term priorities. Indicate the anticipated workdays per week, number of shifts per day, number of hours per shift, crew sizes, and assumed resources. If the project requires a road closure, identify any changes in anticipated resources, or work schedule during the closure period;
- (3) The Critical Path Method (CPM) shall be used to format the schedule. The schedule shall be prepared and submitted with a scheduling software format that is editable with Microsoft Project.
- (c) Schedule Updates. The schedule shall be updated on a weekly basis. Include the following with each update:
  - (1) Actual start dates of each activity started;
  - (2) Actual finish dates of each activity finished, or remaining durations of activities started but not yet completed;
  - (3) Narrative report describing progress during the month, shifts in the critical activities from the previous update, sources of delay, potential problem areas, work planned for the next update period, and changes made to the schedule. Changes include additions, deletions, or revisions to activities due to the issuance of a Contract revision, changes to an activity duration, changes to relationships between activities, or changes to the planned sequence of work or the method and manner of its performance;

- (4) The Original schedule shall be shown as a Baseline.

The updated schedule shall be submitted in accordance with subparts 108.03(b)(1) & (2).

- (d) Float. Any float in the schedule is to be credited to the project only.
- (d) Failure to Submit Schedule. Failure to submit the schedule in accordance with parts 108.03(b) or 108.03(c) shall be grounds for suspension of the scheduled payments, as identified in Subsection 109.08, until a satisfactory schedule meeting the requirements of the applicable section of this specification is received by the Engineer.
- (e) Performance of the Work. The work shall be performed from as many points, in as many parts, at times, in a manner, and with sufficient materials, equipment, and labor so as to ensure its completion within the time(s) set forth in the Contract.
- (f) Resumption of Work After Discontinuance With Consent. Should the performance of the work be discontinued by the Contractor for any reason, the Contractor shall notify the Engineer at least 24 hours before resuming operations.

86. 108.04 LIMITATIONS OF OPERATIONS. The Contractor shall conduct the work at all times in a manner and sequence that will ensure the least interference with traffic. The Contractor shall have due regard to the location of detours and to the provisions for handling traffic. The Contractor shall not commence work to the prejudice or detriment of work previously started. The Engineer may require the Contractor to complete an area on which work is in progress before work is commenced on other area(s) if the opening of the area in progress is essential to public convenience.

87. 108.05 CHARACTER OF WORKERS, METHODS AND EQUIPMENT.

- (a) General. The Contractor shall at all times employ sufficient labor and equipment to perform the several classes of work to full completion in the manner(s) and time(s) required by the Contract Documents.
- (b) Workers' Skill and Experience. All workers shall have sufficient skill and experience to properly perform the work assigned to them. Workers engaged in specialty or skilled work shall have sufficient skill, experience and experience with equipment required to perform such work properly and satisfactorily.
- (c) Electrical Work. All electrical work shall be performed by or under the supervision of a licensed electrician (master or journeyman). Electrical work shall be defined as any work which involves making connections to electrical components or splices in wiring that are, or will be, carrying 100 V or more. "Under the supervision of" means that the licensed electrician employed on the project shall be physically present on the project and must be actively supervising the work.
- (d) Removal of Workers from Project. Any person employed by the Contractor or a subcontractor who in the opinion of the Engineer

does not perform work in a proper and skillful manner or is intemperate or disorderly shall, at the written order of the Engineer, be removed forthwith by the Contractor or subcontractor employing such person and shall not be employed again in any portion of the work without the approval of the Engineer.

- (e) Failure to Remove Worker from Project. If the Contractor fails to remove a person or persons as required above, or fails to furnish suitable and sufficient personnel for the proper prosecution of the work, the Engineer may withhold all payments which are or may become due and/or may suspend the work by written notice until the Contractor complies with the order.
- (f) Equipment Sufficiency. All equipment used to perform the work shall be of sufficient size and mechanical condition to meet requirements of the work and to produce work of satisfactory quality. Equipment used on the project shall not cause injury to the roadway, adjacent property, or other highways.
- (g) Methods and Equipment Not Prescribed. When the methods and equipment to be used by the Contractor are not prescribed in the Contract, the Contractor is free to use any methods or equipment that it demonstrates to the satisfaction of the Engineer will accomplish the work in conformity with the requirements of the Contract, and provided they pose no safety risk to the workers, inspection staff, traveling public, or general public.

88. 108.06 WAGES AND CONDITIONS OF EMPLOYMENT.

- (a) General. The Contractor and all subcontractors shall comply with the provisions and requirements of all Federal and State labor laws and with the wage requirements set forth in detail in the Contract. In case of conflicts between wage determinations made by the US Department of Labor and the minimum wage established by statute, the larger of the two amounts shall be the minimum wage for that classification.
- (1) Fair Labor Standards Act - The Fair Labor Standards Act (FLSA) of 1938, as amended, 29 USC 201.
  - a. General. No law requires Federal or State agencies to insert in their contracts a clause to ensure compliance by the Contractor with the FLSA. However, the FLSA most likely applies to work under a construction Contract with the Federal Government or that is financed with the aid of the Federal Government. The FLSA requires payment of a minimum hourly rate as well as overtime pay for work in excess of 40 hours in each workweek. Moreover the overtime provisions of the FLSA and of the Eight-Hour Law are not mutually exclusive. Therefore, a Contractor's employees covered by the FLSA are most likely also covered by the overtime provisions of other, applicable laws.

The FLSA, sometimes known as the "Wage-and-Hour-Law," applies to individual workers who are engaged in commerce or in the production of goods for commerce as defined in the FLSA. If a worker carries materials or moves equipment across state lines, unloads or guards materials or equipment arriving from other states, or performs other functions in commerce in the



course of performing work, that worker is covered under the FLSA. Also, if the job is one to repair, reconstruct, enlarge, or improve an existing instrumentality of commerce such as a highway, bridge, or road, the worker is likewise covered under the Act while working on the job, including municipal streets if they are available to and are regularly used by interstate traffic.

New construction is covered by the FLSA when the project(s) is(are) part of and directly related to the functioning of an existing instrumentality of commerce. Coverage is therefore extended to construction workers on highways in the "Interstate System" or on other roads built to serve as part of a network carrying interstate traffic. In this regard, workers engaged in work preparatory to actual construction such as surveying, clearing, or grading are also covered.

- b. Minors. Under the FLSA, the minimum age for general employment in the construction industry is 16 years. The minimum age is 18 years for employment in occupations declared to be hazardous by the US Secretary of Labor. Included in this category are the occupations of motor-vehicle driver and helper. Children 14 and 15 years old may be employed for a limited number of hours and under certain conditions in office work; they may not be employed in any manner at covered construction sites.
- c. Contacts for More Information. The above is general information concerning the applicability of the FLSA to the highway construction industry. Contractors and subcontractors must obtain more detailed information from the Wage and Hour and Public Contracts Divisions, United States Department of Labor, John F. Kennedy Federal Building, Government Center, Boston, Massachusetts 02203-2211.

(2) Contract Work Hours and Safety Standards Act.

- a. General. The Contract Work Hours and Safety Standards Act (Work Hours Act) requires Federal construction contractors and subcontractors to pay time and one-half after 40 hours a week; work under the Federal-Aid Highway Act (USC Title 23, Section 101, *et. seq.*) and all other construction financially assisted in whole or part by the Federal Government is covered by the Work Hours Act. The Work Hours Act applies to all contracts for work financed in whole or in part by loans or grants by the United States or instrumentalities thereof under any "Federal Statute" providing wage standards for the type of work covered. See Part IV, Subparts 7, 8, and 9 of the "Required Contract Provisions Federal-Aid Construction Contracts."
- b. Computation of Overtime; No Defense. Overtime shall be computed on the basic rate of pay. It is not a defense that laborers and mechanics accepted or agreed to accept less than the required rate of wages or voluntarily made refunds.

(3) Davis-Bacon Act. Where the Contract includes Davis - Bacon wage rate requirements, the following also applies with respect to construction activities.

- a. General. The wage rate determination of the US Secretary of Labor which has been incorporated in the proposal may not contain all job classifications necessary for the work contemplated under the project. The Contractor is independently responsible for ascertaining area practice with respect to the necessity, or lack thereof, for the use of any job classifications in the prosecution of the work contemplated by the project; no inference concerning prevailing area practices relative to their use may be drawn from the omission of these job classifications. Further, the omission of a job classification shall not be construed as establishing governmental liability for increased labor cost.
  - b. Missing Job Classification(s)/Wage Rate(s). The Contractor shall submit to the Agency any requests for missing job classifications and proposed wage rates.
  - c. Vermont Labor Laws. The Contractor's attention is directed to the provisions and requirements of the Vermont Workers Compensation Act and to Vermont statutes regulating employment of minors.
89. 108.07 LABOR AND RENTAL PREFERENCE. In accordance with Vermont Statutes Annotated, Title 19 Section 17, the Contractor shall give preference to Vermont labor and trucks owned in Vermont. This requirement shall not apply to any highway project, or any part thereof, financed with Federal funds.
90. 108.08 MEETING PERSONNEL REQUIREMENTS. Contractors are encouraged to use the services of the local offices of the State Department of Employment and Training to meet their personnel requirements. Recruitment of workers in all occupations and skills is conducted by the State Employment and Training Services, initially from the immediate labor market areas, and when workers with the required skills are not available locally, through the nationwide workforce clearance system of the US Employment Service.
91. 108.09 TEMPORARY SUSPENSION OF THE WORK.
- (a) General. The work may be suspended by the Engineer, wholly or in part, for such period or periods as necessary on account of:
    - (1) Unsuitable weather conditions.
    - (2) Failure on the part of the Contractor to carry out instruction or an order given, to perform satisfactory work, or to perform one or more provisions of the Contract.
    - (3) Any other conditions which, in the judgment of the Engineer, make work impractical, dangerous, harmful to the environment, or in violation of a permit or other authorization for the project.
  - (b) Authority of Agency Safety Officer. In the absence of the Engineer, the Agency Safety Officer, or person acting in that role, shall have authority to suspend work when s/he determines that the suspension of work is warranted for a safety violation on the job site. The period of time work is suspended due to a serious safety

violation will not be justification for an extension of time under Subsection 108.11 or for additional compensation.

- (c) Authority of Agency Hazardous Materials and Waste Coordinator. In the absence of the Engineer, the Agency Hazardous Materials and Waste Coordinator, or person acting in that role, shall have authority to suspend work when s/he determines that the suspension of work is warranted for an environmental violation on the job site. The period of time work is suspended due to a serious environmental violation will not be justification for an extension of time under Subsection 108.11 or for additional compensation.
- (d) Seasonal Closure Procedure. From December 1<sup>st</sup> to April 15<sup>th</sup>, exclusive, no construction work of any kind shall be done except by written permission from the Regional Construction Engineer, and only under such condition as specified therein.

Permission will only be granted for work which will result in a direct benefit to the State or the traveling public. Items which may be considered as a benefit include but are not limited to shorter Contract duration, a cost savings, increased safety for the traveling public, and an ability to ensure the quality of work. The Contractor shall request permission in writing, detailing what Contract items may be affected, a schedule of work, and the benefits to the State or traveling public.

- (e) Contractor Suspension of Work. The Contractor shall not suspend the work without permission of the Engineer.
- (f) Contract Applicable. If the work is suspended for any reason, all appropriate requirements of the Contract shall continue.

92. 108.10 SUSPENSIONS OF WORK ORDERED BY THE ENGINEER.

- (a) Additional Compensation/Time Request; Time Limit. If the performance of all or any portion of the work is suspended by the Engineer for an unreasonable period of time not originally anticipated, customary, or inherent to the construction industry, and the Contractor believes that additional compensation and/or Contract time is due as a result of the suspension, the Contractor shall submit to the Engineer in writing a request for adjustment within seven calendar days of receipt of the notice to resume work, and not thereafter. The request shall set forth the reasons and support for the adjustment requested. No Contract adjustment will be allowed unless the Contractor has submitted the request for adjustment within the time prescribed.
- (b) Evaluation of Request. Upon receipt, the Engineer will evaluate the Contractor's request. If the Engineer agrees that the cost and/or time required for the performance of the Contract has increased as a result of the suspension and the suspension was caused by conditions beyond the control of and not the fault of the Contractor, its suppliers, or subcontractors at any approved tier, and not caused by weather, the Engineer will make an adjustment (excluding profit) and modify the Contract accordingly. The Engineer will notify the Contractor whether or not an adjustment of the Contract is warranted. To the extent that performance would have been suspended by any other cause or an adjustment is provided

for or excluded under some other term or condition of the Contract, no Contract adjustment will be allowed under this Subsection.

93. 108.11 DETERMINATION OF EXTENSION OF CONTRACT TIME FOR COMPLETION.

- (a) General; Request for Extension of Contract Completion Date. When a definite date or a fixed number of days for completion is specified in the proposal and Contract, and when the Contractor fails to substantially complete the work within the Contract time specified due to unforeseen conditions beyond the control and without fault or negligence of the Contractor, the Contractor will be credited additional contract completion time on a full day basis as provided in Subsection 108.11(b). The Finals Engineer will submit to the Contractor a "Request for Extension of Time Form" containing a preliminary review of extension of time in accordance with Subsection 108.11(b). If the Contractor concurs with the preliminary review, the Contractor shall sign and return the form to the Finals Engineer within 60 calendar days of the date of presentation (the "60 day period"). If the Contractor disputes the preliminary review, the Contractor shall notify the Finals Engineer within the 60 day period and provide supportive documentation regarding the dispute. Upon receipt of a dispute, the Finals Engineer will research, consult with the Resident Engineer and the Construction Engineer, and provide a response to the Contractor. The Contractor may appeal this decision as provided in Subsection 105.20. Notwithstanding Subsections 105.02 and 105.20, failure to notify the Finals Engineer of a dispute within the 60 day period shall constitute concurrence with the preliminary review and be deemed a waiver of the Contractor's right to appeal, in which case the extension of time will be processed without the Contractor's signature.

No extension of time will be required when a Substantial Completion Date is established prior to the Contract Completion Date, as modified by applicable change orders.

- (b) Determination of Contract Completion Date Extension. Whenever the work is suspended through no fault of the Contractor, a completion date extension will be determined upon consideration of the following:
- (1) Delay by the Agency in awarding the Contract and/or in issuance of the Contract Notice to Proceed.
  - (2) Federal or State laws passed subsequent to the date of the Contract adversely affecting progress of the work.
  - (3) Acts of God, including but not limited to unusually severe storms of extended duration or impact which could not generally be anticipated by the Contractor, either during the bidding process or during construction, and catastrophic weather events such as floods, droughts, fires, hurricanes, tornadoes, earthquakes, or landslides.
  - (4) This section left intentionally blank.
  - (5) Differing Site Conditions pursuant to Subsection 104.08.
  - (6) This section left intentionally blank.

Special Provisions for:

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- (7) Extra Work ordered by the Engineer pursuant to Subsection 104.03.
- (8) This section left intentionally blank.
- (9) Court orders, including but not limited to temporary restraining orders, preliminary and permanent injunctions, or judgments that are not attributable to the Contractor.
- (10) Industry-wide labor unrest.
- (11) Industry-wide material or supply shortages not reasonably anticipated by the Contractor at the time the Contract was entered.
- (12) If satisfactory completion of the Contract with any authorized extension and increases requires the performance of work in greater quantities than those set forth in the proposal, the Contract time allowed for performance of the work will be increased in the same ratio that the total cost of the work actually performed bears to the total cost in the proposal. However, when additional time is added to the Contract by change order/supplemental agreement, the number of days added will be deducted from the number of days calculated in the method above. Also, if more days are added by change order/supplemental agreement than would have been by the previously mentioned method, the Contractor will not have the excess days deducted. Additional time may be allowed for unusual circumstances when cost alone is not a determining factor in time required to perform the additional work. Any change in the final Contract time shall be computed to the nearest full day.
- (13) Industry-wide material or supply shortages not reasonably anticipated by the Contractor at the time the Contract was entered. Delays caused by a shortage of materials, but only when the Contractor furnishes to the Engineer documentary proof that a diligent effort has been made to obtain the materials from all known sources and the inability to obtain the materials when originally planned did in fact cause a delay in final completion of the entire work, and the delay could not be avoided by revising the sequence of the Contractor's operations. The Contractor shall notify the Engineer in writing of the causes of delay caused by material shortages no later than 15 calendar days from the beginning of any such delay and not thereafter.
- (14) Any other conditions which in the opinion of the Director of Program Development warrants consideration for an extension of time.

94. 108.12 FAILURE TO COMPLETE WORK ON TIME.

- (a) Time Essential Element. Time is an essential element of the Contract. The Contractor shall plan its progress schedule and vigorously press the progress of the work in order to complete the Contract on or before the Contract Completion Date set forth in the Contract.

- (b) Manner, Sequence, or Schedule Required. Whenever the Special Provisions of the Contract call for any portion or portions of the work to be performed in any particular manner or for any portion or portions of the work to be completed pursuant to a certain sequence or schedule prior to the date of completion of the entire Contract, the Contractor shall punctually comply with the related instructions, dates, and periods of time.
- (c) Liquidated Damages; General; Days Charged. For each working day on which roadways remain unavailable or impacted, due to construction activities, to the traveling public beyond the dates allowed by the contract or any work remains incomplete after the Substantial and Final Completion dates specified in the Contract for completion of the work involved, there shall be deducted from any monies due the Contractor the amount identified by the Liquidated Damages, unless otherwise specified in the Contract. The deduction is not a penalty, but is liquidated damages to defray the cost to the Agency to administer of the Contract including, but not limited to, the cost of engineering, inspection, supervision, cost to the traveling public, obstruction of traffic, and interference with business. Due account shall be provided for any adjustment of the Contract time for completion of the work under the provisions of Subsection 108.11.

Liquidated damages may be applied cumulatively as appropriate.

South Burlington IM CULV(24)

Substantial Completion: The daily charge for Project liquidated damages is \$3300.00 for each working day for which the contractor fails to meet substantial completion.

The daily charge for Project liquidated damages for each working day of delay beyond the Contract Completion Date shall be \$1400.00.

Georgia IM CULV(25)

Substantial Completion: The daily charge for Project liquidated damages is \$600.00 for each working day for which the contractor fails to meet substantial completion.

The daily charge for Project liquidated damages for each working day of delay beyond the Contract Completion Date shall be \$1400.00.

Should the Contractor elect to work on Saturdays, Sundays, or Holidays, or days from December 1st to April 15th, exclusive, after the Contract completion date, the Contractor will be charged liquidated damages for such days worked.

- (d) No Waiver. Permitting the Contractor to continue to finish the work or any part of the work after the time fixed for its completion or after the date to which the time for completion may have been extended shall not operate as a waiver on the part of the Agency of any of its rights under the Contract.
- (e) Liability for Liquidated Damages. The Contractor covenants and agrees that should the amount of monies due or that may become due

the Contractor be less than the amount of ascertained liquidated damages, the Contractor and the Contractor's surety shall be liable to the State for the deficiency.

95. 108.13 TERMINATION OF CONTRACT.

- (a) General; Notice. Upon written notice from the Engineer or other proof satisfactory to the Secretary, the Secretary will give notice in writing to the Contractor and the Contractor's surety of delay, neglect, or default if the Contractor:
  - (1) fails to begin the work under the Contract within the time specified in the "Contract Notice to Proceed;"
  - (2) in the opinion of the Engineer, fails to perform the work with sufficient workers and equipment or with sufficient materials to ensure the prompt completion of said work;
  - (3) in the opinion of the Engineer, performs the work unsuitably or neglects or refuses to remove materials or to redo or replace work rejected as defective and unsuitable;
  - (4) discontinues the prosecution of the work without authorization of the Engineer;
  - (5) fails to resume work that has been discontinued within a reasonable time after notice to do so;
  - (6) becomes insolvent, is declared bankrupt, or commits any act of bankruptcy or insolvency;
  - (1) allows any final judgment to stand against the Contractor unsatisfied for a period of ten calendar days;
  - (8) makes an assignment for the benefit of creditors; or
  - (9) in the opinion of the Engineer, fails, for any cause whatsoever, to carry on the work in an acceptable and timely manner.
- (b) Failure of Contractor to Proceed; Termination. If the Contractor or the Contractor's surety does not proceed in accordance with the notice within a period of ten calendar days after notice, the Agency may, without violating the Contract, terminate the Contract by taking performance of the work out of the hands of the Contractor. The Agency may appropriate and use any or all materials and equipment on the project as are suitable and acceptable and may enter into an agreement for the completion of the Contract, according to the terms and provisions thereof or use such other methods as, in the discretion of the Engineer, will be required for the completion of the Contract in an acceptable manner and in the best interest of the Agency.
- (c) Agency's Costs. All costs and charges incurred by the Agency, together with the costs of completing the work under contract, shall be deducted from any monies due or which may become due the Contractor. If the expense incurred by the Agency is less than the sum which would have been payable under the Contract had it been completed by the Contractor, the Contractor shall be entitled to receive the difference; if the expense exceeds the sum which would

have been payable under the Contract, the Contractor and the Contractor's surety shall be liable and shall pay to the Agency the amount of the excess.

96. 108.14 TERMINATION OF CONTRACT FOR CONVENIENCE.

- (a) General. The Agency may, by written order to the Contractor, terminate the Contract or any portion thereof when such termination would be in the best interest of the Agency.

Any such termination shall be effected by delivery to the Contractor an Order of Termination specifying the termination is for the convenience of the Agency, the extent to which performance of work under the Contract is terminated, and the effective date of the termination.

In the event such termination occurs, without fault and for reasons beyond the control of the Contractor, all completed stages of work as of the date of termination will be paid for in accordance with the schedule of payment stipulated in other Contract documents. Payment for partially completed work will be made either at a percentage of completed state of work or by force account methods provided elsewhere in the Contract.

Upon request the Contractor shall make all Contract-related records available to the Agency.

- (b) Contractor Obligations. After receipt of the Order of Termination and except as otherwise directed by the Engineer, the Contractor shall immediately proceed to:
- (1) To the extent specified in the Order of Termination, stop work under the Contract on the date specified.
  - (2) Place no further orders or subcontracts for materials, services, and/or facilities except as may be necessary for completion of such portion(s) of the work under the Contract as is (are) not terminated.
  - (3) Terminate and cancel all orders or subcontracts for materials, services, and/or facilities except as may be necessary for completion of such portion(s) of the work under the Contract as is (are) not terminated.
  - (4) Submit to the Engineer a material inventory list, certified as to quantity and quality of materials in its possession or in transit to the project.
  - (5) Transfer to the Agency all completed or partially completed plans, drawings, information, and other property which, if the Contract had been completed, would be required to be furnished to the Agency.
  - (6) Take other action as may be necessary or as directed by the Engineer for the protection and preservation of the property related to the Contract which is in the possession of the Contractor and in which the Agency has or may acquire any interest.
- (c) Claim by Contractor. After receipt of the Order of Termination from the Agency, the Contractor shall submit any claim for



additional damages or costs not covered herein or elsewhere in the Contract within 60 days of the effective termination date, and not thereafter.

Should the Contractor fail to submit a claim within the 60 day period, the Agency may, at its sole discretion, based on information available to it, determine what, if any, compensation is due the Contractor and pay the Contractor the determined amount.

- (d) Materials. At the option of the Agency, acceptable materials included in the material inventory in subpart (b)(4) above that have been obtained by the Contractor for the work but which have not been incorporated into the work may be purchased from the Contractor at actual cost delivered to a location prescribed by the Engineer or otherwise disposed of as mutually agreed.

Payment for materials included in the material inventory chosen to be purchased by the Agency will be made at actual cost delivered to the project or storage site designated by the Engineer, including transportation charges, to which 10 percent overhead and profit will be added.

- (e) Idle Equipment. Idle equipment time claimed by the Contractor will be paid as follows:

- (1) Contractor Owned Equipment. For the portion of any claim relating to idle equipment time for equipment owned by the Contractor, the Contractor will be entitled to recover equipment rates based on the Contractor's internal ownership costs. Recovery for idle equipment time shall not be based on published rental rates.

- (2) Rented Or Leased Equipment. For the portion of any claim relating to idle equipment time for equipment rented or leased by the Contractor, the Contractor will be entitled to recover the lesser of the actual rental costs or fair market rental costs, and the amount shall not exceed 30 days rental.

- (3) Limitations On Recovery For Idle Equipment. Claims for idle equipment time, whether for Contractor owned equipment or leased/rented equipment, following termination of the Contract pursuant to this Subsection are limited to a maximum of 30 days and may not include any operating expenses.

- (f) Negotiation; No Anticipated Profit. Negotiation to settle a timely claim shall be for the sole purpose of reaching a settlement equitable to both the Contractor and the Agency. Settlement shall be based on actual costs incurred by the Contractor plus overhead and profit as specified in Subsection 109.06. Consequential damages, loss of overhead, loss of overhead contribution of any kind, and/or loss of anticipated profits on work not performed shall not be included in the Contractor's claim and will not be considered, allowed, or included as part of any settlement.

- (g) Records. The Contractor shall make available to the Agency all cost records relevant to a determination of an equitable settlement.

- (h) Contractual Responsibilities Continue. Termination of the Contract, or portion thereof, shall not relieve the Contractor of its contractual responsibilities for work completed and shall not

relieve the Contractor's Surety of its obligation for and concerning any just claim arising out of the work performed.

97. 108.15 TERMINATION OF CONTRACTOR'S RESPONSIBILITY.

- (a) Completion and Acceptance. Whenever the project(s) provided for by the Contract has(have) been completely performed by the Contractor, all parts of the work have been approved and accepted by the Engineer, and all Contract Documents complied with, the Contractor will then be released from further obligations except as set forth in the bonds provided, and the Agency will provide the Contractor with a Completion and Acceptance Memorandum.
- (b) Limited Completion at Separate Location(s) and Acceptance. If the Contract includes work at more than one location as separate projects or as separate locations on a single project, the Agency may accept the work at any location when the work at that location is completely finished and all responsible parties agree to acceptance in the same manner as a normal final inspection. If a portion of the Contract is accepted by the Engineer, and all Contract Documents related thereto are complied with, the Contractor shall remove all construction warning signs from that portion and the Contractor will then be released from further obligations as to that portion except as set forth in the bonds provided.

If substantial completion of the work is accomplished, but additional work is required to achieve final acceptance, the Agency may accept the work under the Contract with exceptions and/or reservations.

SECTION 109 - MEASUREMENT AND PAYMENT

98. 109.01 MEASUREMENT OF QUANTITIES.

- (a) General. All work completed under the Contract will be measured by the Engineer according to SI or U.S. Customary units, as required by the Contract Documents.

The measurement and determination of the number of units of each specification item will be made as specified in this Section and as are specifically described under the "Method of Measurement" subsection for each item.

- (b) Area. Unless otherwise specified in the Contract area computations will be made horizontally, and no deductions will be made for individual fixtures having an area of 1 m<sup>2</sup> (10 square feet) or less; measurements for area computations will be the neat dimensions shown on the Plans.
- (c) Structures. Structures will be measured according to neat lines shown on the Plans in accordance with the method of measurement stated in the Contract.
- (d) Volumes. Volumes of excavation and borrow pits will be calculated from cross-sections and the use of average end area formulae or by another approved method. Volumes of other work, e.g. Cement Masonry or Removal of Concrete or Masonry, will be calculated by using

arithmetical formulae. Where the volume is bounded by varying dimensions and there is no simple volumetric formula applicable, frequent cross-sections will be taken and the volume computed from average end area formulae. Other methods of measurement for small quantities may be authorized when approved in writing by the Engineer.

- (e) Length Measurement. All items measured by the meter (linear foot) will be measured parallel to the base or foundation upon which the item is placed, unless otherwise shown on the Plans.
- (f) Metric Ton; Ton. The term "metric ton" is used to indicate a mass of 1000 kg. The term "ton" means the English short ton consisting of 2000 pounds. All materials that are measured, or proportioned by mass (weight), shall be done so on accurate, approved scales by competent, qualified personnel.
- (g) Bituminous Materials Measurements.
  - (1) General. Bituminous materials will be measured by the liter (gallon) or kilogram [hundredweight (CWT)]. Volumes of bituminous materials will be measured at 15°C (60° F) or will be corrected to the volume at 15°C (60° F) using ASTM D 1250 for asphalt or ASTM D 633 for tar.
  - (2) Shipping of Bituminous Materials; Correction. When liquid bituminous materials are shipped by truck or transport, net certified mass (weight) or volume subject to correction for loss or foaming may be used for computing quantities.
- (h) Cement. Cement will be measured by the kilogram [hundredweight (CWT)].
- (i) Timber. Timber will be measured by the cubic meter [thousand feet board measure (MFBM)] actually incorporated in the work. Measurement will be based on nominal widths and thicknesses and the in place length of each piece.

99. 109.02 THIS SECTION LEFT INTENTIONALLY BLANK.

100. 109.03 SCOPE OF PAYMENT.

- (a) General. The Contractor shall receive and accept compensation in accordance with the payment schedule for dollar values of completed and accepted stages of work contained in other Contract documents:
- (b) Payment; Obligations of Contractor. The payment of any current or final estimate shall not prejudice or affect the obligation of the Contractor under the Contract, at its own cost and expense, to repair, correct, renew, or replace any defects or imperfections in the project and its appurtenances or the strength of or quality of materials used on the project; payment of an estimate, including a final estimate, shall not relieve the Contractor from the payment of any and all damages due or attributed to defects or imperfections.
- (c) Damage Claims and Liabilities; Payment by Agency. Relative to damage, labor and materials, and other claims against the Contractor

or project, no monies payable under the Contract or any part thereof shall become due and payable if the Agency so elects until the Contractor satisfies the Agency that the Contractor has fully settled or paid all damage, labor, or materials claims and all liabilities incurred in connection with the work; if it so elects, the Agency may pay any or all claims or liabilities wholly or in part and deduct the amount or amounts so paid.

- (d) Written Evidence of Releases. If it so elects, the Agency may require the Contractor to furnish written evidence of release from all claims and obligations connected with the work.

101. 109.04 THIS SECTION LEFT INTENTIONALLY BLANK.

102. 109.05 THIS SECTION LEFT INTENTIONALLY BLANK.

103. 109.06 EXTRA AND FORCE ACCOUNT WORK. Extra work ordered and accepted as specified in Subsection 104.03 will be paid for on a unit price or lump sum basis under a Supplemental Agreement. The agreement will be made before the work is started. When the Engineer deems it impractical to handle any Extra Work ordered on a unit price or lump sum basis, a Supplemental Agreement will be made and the work will be ordered done and paid for on a force account basis as specified below.

Any additional costs for Public Liability Insurance and Property Damage Insurance that are required in the Contract will be allowed and reimbursed at the actual cost to the Contractor.

- (a) Labor. For all machine or equipment operators, other workers, and supervisors in direct charge of the specific operation, the Contractor shall receive the actual wages agreed upon before beginning the work and were paid to the workers performing the work, to which shall be added an amount equal to 10 percent for profit. If the Contractor elects to use employee(s) more skilled than required to perform the extra work, the Agency reserves the right to allow compensation for said employee(s) to be capped at 125% of the applicable Davis-Bacon wage rate of the base skill level required to perform the work.

Workers Compensation Insurance, Unemployment Compensation Insurance, and Social Security charges on labor items as paid by the Contractor will be allowed. Other employee insurances (health, disability, e.g.) being paid by the Contractor just prior to the work being ordered will also be allowed, provided the Contractor submits an applicable notarized insurance rate schedule from its insurance agent. The Contractor shall submit an Agency form indicating all applicable insurances and overhead items for each employee involved in the extra work.

The Contractor will be allowed an additional 10% of the actual wages as compensation for administration charges and any other additional costs. Additional cost or charge for the Superintendent shall not be allowed.

- (b) Materials. The Contractor shall receive the actual cost including freight charges (both as submitted on original receipted bills) for all materials furnished and used. Ten percent shall be added thereto for overhead, profit and any other costs incurred in supplying the materials. Vermont sales tax shall not be included.

- (c) Equipment. The Contractor will be reimbursed as described below. Equipment that is used shall be specifically described by year, manufacturer, model number, and any other information required to identify the appropriate hourly rate in the Rental Rate Blue Book published by Equipment Watch ("Blue Book"). In the event the Contractor elects to use equipment of a higher rental value than equipment suitable for the work, payment will be made at the rate applicable to suitable equipment.
- (1) Contractor Owned Equipment.
- a. Ownership Costs. The Contractor will be reimbursed for its ownership costs for self-owned equipment at the rates agreed to before the work begins. These rates shall be on an hourly basis and shall not exceed the monthly ownership rates listed in the current Blue Book divided by 176. The rates will be adjusted for depreciation as computed and published in the Blue Book rate adjustment tables, but will not be adjusted as recommended on the Blue Book regional adjustment maps. The rates for ownership costs will be total reimbursement to the Contractor for all non-operating costs of the equipment, including depreciation, insurance, taxes, interest, storage, overhead, repairs, and profit. The maximum duration for reimbursement in a day shall not exceed eight hours unless the equipment actually is operated for more than eight hours on a particular day, in which case the rate shall be paid for all hours the equipment actually worked on that day.
- b. Operating Costs. The rates for operating costs include fuel, lubricants, other operating expendables, and preventative and field maintenance. The Contractor will be reimbursed the amount derived as the product of the number of hours of actual use multiplied by the Blue Book estimated operating cost per hour. Operating costs do not apply to equipment idle time. Operating costs do not include the operators' wages.
- Except as otherwise provided, the rates to be used for computation shall be those in effect at the time the force account work is performed as reflected in the applicable publication of the Blue Book.
- c. In the event that an ownership cost rate and/or an operating cost rate is not established in the Blue Book for a particular piece of equipment, the Engineer shall establish a rate(s) for that piece of equipment consistent with its costs and expected life. The Contractor shall make no charge for small tools that are considered as having a replacement value of less than \$500.
- (2) Rented Equipment. In the event the Contractor does not own a specific type of equipment and must rent, the Contractor will be reimbursed the actual cost for the equipment, as submitted by invoice, for the time that the equipment is used to accomplish the work. Vermont sales tax shall not be included.

The Agency reserves the right to limit the hourly rate to the maximum amount allowed by Blue Book in the event that the prime

contractor is a subsidiary of, or has a close affiliation to, the firm supplying the rented equipment.

- (3) Maximum Amount Payable. The maximum amount of reimbursement for the ownership cost of Contractor owned equipment or the rental cost of rented equipment is limited to the original purchase price of the equipment.
- (4) Equipment Downtime. No rental cost or operating cost will be paid for downtime for either rented equipment or Contractor owned equipment.
- (5) Transportation Costs. The Contractor will be paid for the reasonable documented cost of transporting both Contractor owned and rented equipment to the work location and back to its original location or a new location if the cost is less.
- (d) Subcontracted Work: The Contractor shall receive the actual cost, as submitted on original receipted bills, for all extra and force account work subcontracted to others. Ten percent shall be added thereto for overhead, profit and any other costs incurred to perform the subcontracted work. However, the Agency reserves the right to use the force account procedures as depicted previously in this subsection in the event that the cost of reimbursable subcontracted work is deemed excessive.

The compensation as herein provided shall be received by the Contractor as payment in full for Extra Work done on a force account basis. The Contractor's representative and the Engineer shall compare records of Extra Work on a force account basis at the end of each day. Copies of these records shall be made on Agency forms provided for this purpose and shall be signed by both the Engineer and Contractor's representative. All requests for compensation for Extra Work done on a force account basis, including original receipted bills to verify cost and freight charges for all materials, shall be submitted to the Agency as soon as possible; however, if the required request, invoices, and other documentation are not filed before 90 days have lapsed following final acceptance of the project, the costs associated with such Extra and force account work shall not be reimbursable.

104. 109.07 THIS SECTION LEFT INTENTIONALLY BLANK.

105. 109.08 PARTIAL AND FINAL PAYMENTS.

- (a) General. Partial payments, computed upon the basis set forth in the Contract, will be made by the Engineer.
- (b) Tax Compliance. If the Contractor is found to not be in good standing with respect to, or in full compliance with a plan to pay, any and all taxes due the State as required in Title 32 VSA Section 3113, money otherwise owed to the Contractor will be withheld from one or more biweekly estimates and the final estimate.
- (c) Claims and Withholdings. For the protection of the State, creditors and, other claimants of the Contractor, payment for all or part of one or more biweekly estimates and/or the final payment as determined by the final estimate may be held for the use of the State, if the Agency so elects, until the Contractor has fully

settled for or paid for all materials and equipment used in or upon the work and labor done in connection therewith and fully settled for or paid for all damage claims or liabilities incurred in connection with said work. Upon satisfactory settlement of all such accounts, the final estimate will be paid to the Contractor.

- (d) Final Payment. At the discretion of the Finals Engineer, the Contractor may be presented with close-out documents consisting of the Final Estimate for signature and a "Status of Claims" form. Failure by the Contractor to sign the Final Estimate and "Status of Claims" form within 20 days will result in closure of the Contract, provided that there are no claims on file with the Agency.
- (e) Retainage. The Agency shall not withhold retainage on the Contract; the Contractor shall not withhold retainage on any subcontract; and subcontractors shall not withhold any retainage on any of their subcontracts.

#### SECTION 520 - MEMBRANE WATERPROOFING, SPRAY APPLIED

- 106. 520.01 DESCRIPTION. This work shall consist of furnishing and installing a spray applied membrane waterproofing system. The system shall incorporate a primer, the waterproofing membrane, tack coat, and any required aggregate.
- 107. 520.02 MATERIALS. The materials shall consist of an approved spray applied membrane waterproofing system listed on the Approved Products List on file with the Agency's Materials and Research Section.
- 108. 520.03 SUBMITTALS. The following information shall be provided by the Contractor to the Engineer prior to application of the membrane system:
  - (a) Material Safety Data Sheets (MSDS) and Material Detail Sheets prepared by the membrane manufacturer, provided a minimum of seven (7) days prior to the scheduled commencement of work.
  - (b) Written certification from the manufacturer regarding the Applicator's qualifications and references for a minimum of three (3) spray applied membrane projects completed by the Applicator within the last five (5) years, provided a minimum of seven (7) days prior to the application of any system component. The certification shall apply only to the named individual(s) performing the application.
- 109. 520.04 WEATHER LIMITATIONS. Waterproofing shall not be done in rainy weather or when the temperature is below 5°C (40°F) without the authorization of the Engineer.
- 110. 520.05 SURFACE PREPARATION. Concrete surfaces that are to receive the membrane waterproofing shall meet SSPC SP13/NACE No. 6 Surface Preparation of Concrete. Metal surfaces shall meet SSPC SP10/NACE No. 2 Near White Blast Cleaning.
- 111. 520.06 CONSTRUCTION DETAILS.
  - (a) General. All work performed shall be in accordance with the manufacturer's recommendations.

The manufacturer shall have a competent technical representative with necessary equipment to perform the quality control testing at the job site during all phases of preparation and installation. The technical representative will be responsible for performing all quality control testing required during membrane application (as described below). The technical representative will present all quality-control testing equipment to the Engineer to verify calibration dates and demonstrate their competency to perform quality control testing.

Personnel exposed to primers and membranes shall be protected in accordance with the MSDS.

All components of the membrane system shall be stored in accordance with the Material Detail Sheets.

All installation shall be performed in accordance with the Material Detail Sheets and manufacturer's recommendations.

Where traffic will be driving directly on the membrane surface, an aggregate wearing surface shall be adhered to the top membrane coat. Unless otherwise specified, the aggregate shall be broadcast at  $1.22 - 2.44 \text{ kg/m}^2$  ( $0.25 - 0.50 \text{ lb/ft}^2$ ) to achieve adequate uniform coverage.

Where bituminous concrete pavement will be applied to the membrane surface, a tack coat compatible with the membrane system shall be used between the membrane and the bituminous concrete pavement. The surface preparation and tack coat shall be applied per the manufacturer's recommendations.

(b) Quality Control Testing.

- (1) Substrate Moisture Content and Temperature. The surface moisture content and surface temperature shall be measured prior to applying the primer and membrane. The moisture content and temperature shall be within the limits indicated on the Material Detail Sheets. One test shall be performed for every 165 square meters (200 square yards) of deck area or three tests per bridge deck, whichever is greater.
- (2) Primer Adhesion. After the substrate has been prepared to the satisfaction of the Engineer, the adhesion of the primer to the substrate shall be tested in accordance with ASTM D 4541. Tests shall be conducted after the primer has sufficiently cured as determined by the technical representative. One test shall be performed for every 165 square meters (200 square yards) of deck area or three tests per bridge deck, whichever is greater. The Engineer may require additional test(s) where deficient adhesion is suspected. A minimum of 1 MPa (150 psi) adhesion strength to Portland cement concrete is required. The primer shall consist of one coat with an overall coverage rate of  $3.0-4.3 \text{ m}^2/\text{l}$  ( $125-175 \text{ ft}^2/\text{gal}$ ) unless otherwise recommended in the manufacturer's written instructions.



- (3) Membrane Thickness. The wet-film thickness of each course of membrane shall be measured using a standard comb-type thickness gauge, or the dry-film thickness of each course of membrane shall be measured in accordance with SSPC-PA2. Alternative methods for measuring thickness shall be submitted to the Engineer for approval. The measured thickness of each course of the membrane and the entire thickness of the finished membrane shall be greater than or equal to the depth documented in the Crack Bridging Test (ASTM C 836).
- (4) Membrane Pin Holes. Test for pin holes in the cured membrane system over the entire application area in accordance with ASTM D 4787. The test shall be conducted at voltages recommended by the manufacturer to prevent damage to the membrane.
- (5) Membrane Adhesion. The adhesion of the membrane system to the substrate shall be tested in accordance with ASTM D 4541. Tests shall be conducted after the membrane has sufficiently cured as determined by the technical representative. One test shall be performed for every 165 square meters (200 square yards) of deck area or three tests per bridge deck, whichever is greater. The Engineer may require additional test where deficient adhesion is suspected. A minimum of 1 MPa (150 psi) adhesion strength to Portland cement concrete is required.

The Contractor shall repair and/or correct any deficiencies in the membrane system and substrate noted during quality-control testing as recommended by the manufacturer's representative to the satisfaction of Engineer at no additional cost to the State.

112. 520.06 PROTECTION OF EXPOSED SURFACES. The Contractor shall exercise care in the application of the waterproofing materials to prevent surfaces not receiving treatment from being spattered or marred. Particular reference is made to the face of curbs, copings, finished surfaces, substructure exposed surfaces, and outside faces of the bridge. Any material that spatters on these surfaces shall be removed and the surfaces cleaned to the satisfaction of the Engineer.
113. 520.07 METHOD OF MEASUREMENT. The quantity of Membrane Waterproofing, Spray Applied to be measured will be the number of square meters (square yards) used in the complete and accepted work. Measurement will be based on the horizontal distance between the face of the curbs, plus vertical surfaces as shown on the Plans, and the horizontal length of the membrane installed.

#### SECTION 652 - EROSION PREVENTION & SEDIMENT CONTROL PLAN

114. SECTION 652 - EROSION PREVENTION & SEDIMENT CONTROL PLAN, is hereby made a new Section of the Specifications as follows:
115. 652.01 DESCRIPTION. This work shall consist of designing, furnishing, and submitting for acceptance modifications to the Contract Erosion Prevention & Sediment Control Plan (hereinto known as the EPSC Plan), becoming a co-permittee with the Agency of Transportation, State of Vermont on associated permits, monitoring the EPSC Plan using an On-Site

Plan Coordinator, and maintaining the erosion prevention and sediment control measures to ensure the effectiveness of the EPSC Plan.

116. 652.02 MATERIALS. Materials required for the field work maintenance of the EPSC Plan shall meet all requirements of the appropriate Section of the VAOT Standard Specifications for Construction.

Materials including manuals, checklists, forms, and other supporting documentation necessary to meet the requirements of these provisions and maintain compliance with associated permits shall be made available to the Engineer by the Contractor and maintained on site by the Contractor. Supporting documents associated with the requirements of General Permit 3-9020 are available upon request to ANR or from the ANR Stormwater web page. The *VTrans Erosion Prevention and Sediment Control Plan Contractor Checklist* and *Low Risk Site Inspection Form* are available from the VTrans Construction Environmental Engineer.

117. 652.03 QUALIFICATIONS. Modifications to the EPSC Plan shall be prepared and signed by a Licensed Professional Civil Engineer registered in the State of Vermont or a qualified professional in erosion prevention and sediment control, certified by CPESC, Inc. or equivalent, hereinafter called the "Preparer."

118. 652.04 EROSION PREVENTION & SEDIMENT CONTROL PLAN. The EPSC Plan, developed using a combination of structural, non-structural, and vegetative practices to adequately prevent erosion and control sedimentation, and meeting the requirements of the *VTrans Erosion Prevention & Sediment Control Plan Designer Checklist (Non-Jurisdictional and Low Risk)* or the *Vermont Standards & Specifications for Erosion Prevention & Sediment Control* based on area of disturbance and risk, has been included in the Contract Documents.

The Contractor shall use the EPSC Plan included in the Contract and, at the onset of construction as well as throughout the duration of the project, modify it to describe changing conditions and illustrate how the criteria of the determined risk will be upheld. For Non-Jurisdictional and Low Risk projects, the Contractor shall use the *VTrans Erosion Prevention and Sediment Control Plan Contractor Checklist*. For Moderate Risk projects, the Contractor shall modify the Contract EPSC Plan in accordance with the General Permit 3-9020 Parts 4 through 6. If a modification to the EPSC Plan at a Low or Moderate Risk project alters any criteria of the determined risk, an updated Risk Evaluation shall be prepared.

The Contractor may use the Agency's EPSC Plan sheet(s) as a basis for necessary modifications; however, if necessary to convey the sequential nature and phases of construction activities and associated erosion prevention and sediment control measures, several plan sheets showing successive site conditions are recommended.

All work shown in the EPSC Plan shall be included in the Contractor's CPM Progress Schedule, as required by Subsection 108.03.

119. 652.05 SUBMITTALS. Three sets of the modified EPSC Plan as well as the updated Risk Evaluation, stamped and signed by the Preparer, shall be submitted to the Construction Engineer as Construction Drawings in accordance with Section 105. Submittals shall occur after award of the Contract but not later than the Pre-Construction Conference to allow time

for review by the Agency. An Acceptance Memo or comments will be provided to the Contractor within 10 working days.

The Contractor shall respond to comments as soon as possible, but not more than 10 days after the date of VTrans initial correspondence. Agency review time for response to comments will be completed within an additional 10 working days. Modifications or additions to the EPSC Plan will not be considered as an acceptable delay of the work under Subsection 108.11.

All subsequent modifications to the EPSC Plan and updates to the Risk Evaluation will be reviewed and forwarded to the ANR by the Agency as appropriate.

Construction activities for EPSC Plan modifications that do not require authorization from the ANR shall commence only after the EPSC Plan has been accepted by the Agency. Construction activities for EPSC Plan modifications that do require authorization from the ANR shall commence only after that authorization has been granted.

120. 652.06 MONITORING EROSION PREVENTION & SEDIMENT CONTROL PLAN. The Contractor shall designate a person (On-Site Plan Coordinator) who is directly responsible for the on-site implementation of the EPSC Plan. This person shall generally be on-site on a daily basis during active construction and have the authority to halt construction activities if necessary. The On-Site Plan Coordinator shall have demonstrated experience in construction practices as they relate to erosion prevention and sediment control as well as a general understanding of State and Federal environmental regulations and permits pertaining to the National Pollutant Discharge Elimination System Construction Program. The On-Site Plan Coordinator shall be proficient at reading and interpreting engineering and EPSC plans. Preference will be given to a Licensed Professional Civil Engineer registered in the State of Vermont or a qualified professional in erosion prevention and sediment control, certified by CPESC, Inc. or equivalent. The qualifications of the On-Site Plan Coordinator shall be included in the EPSC Plan. The Engineer, if not satisfied with the performance of this individual, may at any time request a replacement.

During active construction and periods of inactivity, the On-Site Plan Coordinator shall be responsible for inspections and reporting.

- (a) Active Construction. Inspections shall occur once every seven calendar days and within 24 hours of the end of a storm event that results in a discharge of stormwater from the site. During the winter construction season (October 15<sup>th</sup> to April 15<sup>th</sup>, inclusive), inspections at all sites shall occur daily.

For Non-Jurisdictional and Low Risk projects, inspections shall be conducted using the Agency's *EPSC Plan Inspection Report (Non-Jurisdictional and Low Risk Projects)*.

For Moderate Risk projects, inspections shall be conducted using the *General Permit 3-9020 Inspection Report for Moderate Risk Projects* referenced in the Permit and available upon award of the Contract.

Immediate action shall be taken to correct the discharges of sediment, including halting or reducing construction activities as

necessary, until the discharge and/or the condition is fully corrected. Corrective actions shall be recorded on the monitoring reports and shown on the EPSC Plan. Each report shall be signed by the On-Site Plan Coordinator.

- (b) Inactive Construction. Periods such as shutdown during the winter season shall require inspection and reporting of erosion prevention and sediment control measures. The Contractor shall contact the Engineer prior to conducting any inspections. The inspections shall be conducted at least once every 30 days and within 24 hours of any storm or significant snow melt event that may cause stormwater runoff to leave the construction site. The Contractor shall provide, within 24 hours, the necessary personnel, equipment, and materials to repair or correct any deficiencies identified during inspection. All deficiencies and corrective measures taken shall be documented on the reports.

Copies of all reports shall be submitted to the Engineer within 24 hours of inspection or when corrective measures were taken. Copies of all reports shall be kept on site in the Contractor's project files.

121. 652.07 MAINTENANCE OF EROSION PREVENTION & SEDIMENT CONTROL PLAN. This work shall consist of providing all labor and equipment necessary for field maintenance of erosion prevention and sediment control items in the Contract, and providing materials and labor necessary for installing, monitoring, maintaining and, where necessary, removing additional measures needed to correct deficiencies that develop during construction that lessen the performance of the EPSC Plan. Erosion prevention and sediment control measures shall be maintained by the Contractor and removed when authorized by the Engineer. The Contractor shall establish vegetation in all areas disturbed during removal of the erosion prevention and sediment control measures.

Any maintenance required due to the failure of the Contractor to follow the EPSC Plan in its accepted form shall be performed at no additional cost to the Agency.

#### SECTION 900 - SPECIAL PROVISION ITEMS

##### BRIDGE RAILING, F-SHAPE CONCRETE

122. DESCRIPTION. This work shall consist of furnishing and erecting cast-in-place concrete bridge railing (F-shape concrete) in accordance with the Plans and as directed by the Engineer.

The work under this Section shall be performed in accordance with these provisions, the Plans, and Sections 501 and 525 of the Standard Specifications, with the exception that the provisions of Subsection 525.03 do not apply.

123. MATERIALS. Concrete shall meet the requirements of this Section for High Performance Concrete, Low Shrinkage.

Reinforcing steel shall meet the requirements of Section 507.

124. CLASSIFICATION AND PROPORTIONING. Proportioning of High Performance Concrete, Low Shrinkage shall meet the following requirements:

| HPC Class  | Req.***<br>Cem. Mat.<br>(lbs./cy) | Maximum<br>Water-<br>Cem. Mat.<br>Ratio | Max.*<br>Slump<br>(in.) | Air<br>Content<br>(%) | Coarse<br>Aggregate<br>Gradation<br>Table | 28-Day**<br>Comp.<br>Strength<br>(psi) | 28-Day**<br>Modulus of<br>Rupture<br>(psi) |
|--|-----------------------------------|---|-------------------------|-----------------------|---|--|--|
| Low<br>Shrinkage   | 611                               | 0.44                                    | 7                       | 7.0 ±<br>1.5          | 704.02B                                   | 3500                                   | 600  |
| *A maximum slump of 8 inches is allowed after the addition of admixtures.<br>** The listed 28-day compressive strength or modulus of rupture will serve as the basis of designing or approving the concrete mix.<br>***See additional (English unit) tables located in Subsection 501.03 for required cementitious materials (use HP Class B). |                                   |   |                         |                       |   |  |  |

125. SHRINKAGE COMPENSATING ADMIXTURE. A shrinkage compensating admixture shall be added during the initial concrete mixing phase or as recommended by the chemical manufacturer product representative. The shrinkage compensating admixture shall be one of the products listed below. The final dosage rate will be determined by the product representative and the concrete producer. The dosage rate volume is computed into the final water/cementitious ratio.

Manufacturer: Sika Construction Product Division

Product name: - Sika Control 40

Tel.: 1-800-933-7452

Website: <http://www.sikaconstruction.com/tds-cpd-SikaControl40-us.pdf>

Manufacturer: The Euclid Chemical Company

Product name: Eucon SRA

Tel.: 1-800-321-7628

Website:

[http://www.euclidchemical.com/fileshare/ProductFiles/techdata/eucon\\_sra.pdf](http://www.euclidchemical.com/fileshare/ProductFiles/techdata/eucon_sra.pdf)

Manufacturer: BASF (Master Builders)

Product name: Tetraguard AS20

Tel.: 1-800-628-9900

Website: <http://www.basf-admixtures.com/NR/rdonlyres/84C7EC12-F527-44FD-A8B9-3A007609FF76/0/TETRAGUARD AS20 DS307.pdf>

Manufacturer: Grace Construction Products

Product name: Eclipse Plus

Tel.: 1-877-423-6491

Website: <http://www.na.graceconstruction.com/concrete/download/EC-13B 2.pdf>

126. FABRICATION. Fabrication tolerances for all cast-in-place concrete bridge railing, regardless of the method of construction, shall conform to the following finished tolerances:

|  |                                  |
|--|----------------------------------|
| Bar Reinforcement Cover  | -0, +13 mm (½ inch)              |
| Width (Top)  | -0, +6 mm (¼ inch)               |
| Width (Bottom)   | -0, +13 mm (½ inch)              |
| Surface Straightness   | 13 mm in 6 m (½ inch in 20 feet) |
| (Deviation from theoretical centerline)                        |                                  |
| Vertical Alignment   | 13 mm in 6 m (½ inch in 20 feet) |
| (Deviation from a line parallel to the theoretical grade line) |                                  |

The barrier shape indicated on the Plans shall not be altered.  
Precast concrete barrier units shall not be used for permanent concrete bridge railing.

Slip forming of the barrier will not be allowed.

127. CURING CONCRETE. The Contractor and all other project personnel shall take particular care when performing any construction or other operations during the railing curing period in order that the bridge deck is not struck, shaken, or vibrated. After the curing period is completed, all parties shall take care to avoid damaging the railing during the remainder of project construction.

After 24 hours the bond between the concrete rail and the forms shall be broken. Weeper hoses shall be installed so that the water can flow across all faces of the concrete rail for the entire required curing period.

If the forms are removed before ten curing days have passed, the concrete shall be cured by means of a white curing compound. Curing compound shall be sprayed on the concrete surface immediately following form removal and hand finishing operations. The compound shall be applied by means of pressure spraying or distributing equipment at the rate directed by the Engineer, but not less than 0.06 gallons per square yard of surface or a dosage rate as specified by the curing compound manufacturer, whichever is greater.

The equipment for applying the compound shall be such that the compound is applied as a fine spray with no surface damage to the concrete. The equipment shall also provide adequate agitation of the compound during application, and shall be approved by the Engineer before work is started.

At the request of the Engineer, the Contractor shall devise a demonstration of the equipment and spray coverage over an area of no less than 32 square feet that will not be incorporated into the accepted work. Should the method of applying the compound produce a non-uniform film, or should the spraying equipment fail and duplicate equipment not be immediately available, the application of curing compound shall be discontinued immediately and the curing shall be accomplished by another method acceptable to the Engineer.

The Contractor shall submit a contingency curing plan at the deck pre-pour meeting for review and approval. The Engineer will have 7 days to review the plan. The Contractor shall stockpile sufficient approved coverings for protection of the concrete in the event of rain, non-uniform film application, or breakdown of spray equipment.

128. METHOD OF MEASUREMENT. The quantity of Special Provision (Bridge Railing, F-Shape Concrete) to be measured will be the number of meters (linear feet) of railing constructed in the complete and accepted work. Measurement will be made along the face of rail from end to end of barrier as detailed on the Plans. No deductions or additions will be made for joints.

DRILLED SHAFTS

129. DESCRIPTION. This work shall consist of mobilizing and furnishing all materials, equipment, labor, and services necessary to construct production drilled shafts in accordance with these provisions, the Plans, and as directed by the Engineer.

130. GENERAL REQUIREMENTS. The lengths of the drilled shafts shown on the Plans have been estimated from the available subsurface information. The Contractor is expected to furnish the proposed drilled shafts as per Plan requirements with the understanding that the actual length required based on actual conditions encountered during construction may differ from the estimated length shown in the Plans.

This work shall be conducted in strict conformance with all applicable environmental regulations and permits. The Contractor/subcontractor performing this work must be prequalified in accordance with PREQUALIFICATION of this Section.

The drilled shaft Contractor is responsible for all aspects of construction of drilled shafts. This includes excavation, reinforcing steel, and concrete placement.

Prior to submitting a bid for the drilled shaft construction, it is strongly encouraged that the drilled shaft Contractor (hereafter "Contractor" for the purposes of this Section) visits the site where drilled shafts will be used on this project.

131. DEFINITIONS.

CASING METHOD - A method of shaft construction, consisting of advancing and cleaning a cased hole, placing the reinforcing cage, and placing concrete in the shaft while extracting temporary casing.

CASING (SHELL) - A steel casing used to construct the drilled shaft. The casing can help advance the hole and supports the sides of the hole.

DRILLED SHAFT - A cylindrical structural column transmitting loads to soil and/or rock. The drilled shaft is constructed in a hole with a circular cross section. The hole is filled with concrete and may be reinforced with steel.

DRY CONSTRUCTION METHOD - A method of shaft construction consisting of drilling the shaft, removing water and material from the excavation, placing the reinforcing cage, and placing concrete in the shaft in a relatively dry condition.

OBSTRUCTIONS - Obstructions may include man-made and/or man-placed materials and natural materials, such as boulders, that require the use of special procedures and/or tools by the Contractor when the hole cannot be advanced using conventional augers, drilling buckets, and/or underreaming tools or reverse circulation drilling (if this is used as the primary drilling method). Such special procedures/tools may include but are not limited to chisels, boulder breakers, core barrels, air tools, hand excavation, temporary casing, and increasing hole diameter. Surface and subsurface obstructions at drilled shaft locations shall be removed by the Contractor. Drilling tools that are lost in the excavation shall

not be considered obstructions and shall be promptly removed by the Contractor without compensation.

Surface rip-rap and boulders shall not be considered an obstruction. When suspected obstructions are encountered, the Contractor shall notify the Engineer and recommend a course of action to advance the drill hole in an expedient manner. The Engineer shall determine if an obstruction has been encountered.

SLURRY - A mixture of water and bentonite, or water and polymers, which provides hydrostatic pressure that supports the sides and bottom of the hole, lubricates and cools the drill tools, and aids clean out. Slurry cannot be made from native materials, or material from the excavation.

SURFACE CASING - Temporary casing installed to prevent sloughing of the surrounding soil near the surface of the shaft excavation.

TEMPORARY CASING - A casing that serves its function during construction of the drilled shafts. It serves no permanent structural function, and shall be removed in the final condition.

PERMANENT CASING - A casing that will be left in place after construction. The permanent casing will be used to protect the upper portions of the drilled shaft.

WET CONSTRUCTION METHOD - A method of shaft construction consisting of using water or slurry to maintain stability of the hole while advancing the excavation to the final depth, placing the reinforcing cage, and placing concrete in the shaft.

132. MATERIALS.

- (a) Drilled Shaft Concrete. Concrete for drilled shafts shall meet the requirements of Section 501 for HP Class SCC, with the exception that the 56 day permeability test is not required.

The proposed aggregate gradations for drilled shaft concrete may differ from those specified in Subsections 704.01 and 704.02, but shall meet the requirements of ASTM C 33 or AASHTO M6/M80. Maximum aggregate size is 12.5 mm (1/2").

- (b) Reinforcing Steel. Reinforcing steel shall conform to Section 507. Centralizers used to provide the required sidewall and bottom clearance for the reinforcement shall be constructed of an approved non-corrosive material that is compatible with and as durable as the shaft concrete. The Engineer shall approve the type of centralizers prior to use.

- (c) Steel Casing for Drilled Shafts. Steel casing shall meet the requirements of ASTM A252 Grade 2. Casings shall have inside diameters not less than the indicated shaft sizes. However, the Contractor may increase the size of the casing by 150 mm (6") (larger increases require approval of the Engineer) to facilitate construction operations, at no additional cost to the Agency. Casings shall have a 16 mm (5/8 inch) minimum wall thickness and have sufficient strength to withstand handling stresses, concrete pressures, and surrounding earth or fluid pressures. It is the Contractor's responsibility to determine the final wall thickness necessary to meet these requirements. No appurtenances,



reinforcement, or holes shall be added to the casing without the approval of the Engineer.

- (d) Mineral Slurry. Provide mineral (bentonite) slurry that will remain in suspension, and with sufficient viscosity and gel characteristics to transport excavated material to a suitable screening system. Provide slurry with the percentage and specific gravity of the material used to make the suspension sufficient to maintain the stability of the excavation and allow proper concrete placement.

The acceptable ranges of values for mineral slurry are as follows:

RANGE OF VALUES FOR MINERAL SLURRY (at 20 °C, 68 °F)

| Property (Units)  | Test*  | Requirement    |
|---|--|----------------|
| Density (kg/m <sup>3</sup> )                                    | Mud Weight (Density)<br>API 13B-1, Section 1   | 1030 to 1153** |
| Viscosity (sec/qt)  | Marsh Funnel and Cup<br>APT 13b-1, Section 2.2 | 28 to 50       |
| pH  | Glass Electrode, pH<br>Meter or pH Paper       | 8 to 11        |
| Sand Content (%)<br>immediately prior<br>to placing<br>concrete | Sand Content Test API<br>13B-1, Section 5      | 4.0 max        |

\* These tests shall be performed in accordance with the American Petroleum Institutes RP 13B-1, Recommended Practice for Field Testing Water Based Drilling Fluids.

\*\*Unit weights stated are exclusive of weighting agents that may be proposed by the Contractor with the agreement of the slurry manufacturer's representative and the Agency.

De-sand the slurry in order that the sand content does not exceed 4 percent (by volume) measured 300 mm (1 foot) from bottom of shaft prior to concrete placement. All referenced tests shall be conducted by the Contractor with results presented to the Engineer. All necessary equipment and materials shall be provided by the Contractor.

- (e) Polymer Slurry. Provide polymer slurry with sufficient viscosity and gel characteristics to hold the hole open and to transport excavated material to a suitable screening system. Polymer slurry (vinyl (dry) or natural polymers) shall be made from Partially-Hydrolyzed Polyacrylamide Polymer (PHPA) (emulsified). The polymer slurry product must be approved for use by the Agency.

Slurry properties at the time of mixing and at the time of concreting must be in conformance with the written recommendations of the manufacturer. The use of a blended mineral-polymer slurry is not permitted.

The acceptable range of values for polymer slurry is as follows:

RANGE OF VALUES FOR POLYMER SLURRY (at 20 °C, 68 °F)

| Property (Units)  | Test*  | Requirement |
|---|--|-------------|
| Density (kg/m <sup>3</sup> )                                    | Mud Weight (Density)<br>API 13B-1, Section 1   | 1025 max    |
| Viscosity (sec/qt)  | Marsh Funnel and Cup<br>APT 13b-1, Section 2.2 | 32 to 135   |
| pH  | Glass Electrode, pH<br>Meter or pH Paper       | 8 to 11.5   |
| Sand Content (%)<br>immediately prior<br>to placing<br>concrete | Sand Content Test API<br>13B-1, Section 5      | 1.0 max     |

\* These tests shall be performed in accordance with the American Petroleum Institutes RP 13B-1 Recommended Practices for Field Testing Water Based Drilling Fluids.

De-sand the polymer slurry in order that the sand content is less than 1 percent (by volume) prior to concrete placement. All referenced tests shall be conducted by the Contractor with results presented to the Engineer. All necessary equipment and materials shall be provided by the Contractor.

- (f) Access Tubes for Cross-Hole Sonic Log Testing. Access tubes for Cross-Hole Sonic Log (CSL) testing shall be steel pipe of 3.7 mm (0.145 inch) minimum wall thickness and at least 38 mm (1½ inches) inside diameter. The access tubes shall have a round, regular inside diameter free of defects and obstructions, including all pipe joints, in order to permit the free, unobstructed passage of 33 mm (1.3 inches) maximum diameter source and receiver probes used for the CSL tests.

The access tubes shall be watertight and free from corrosion with clean internal and external faces to ensure good bond between the concrete and the access tubes. The access tubes shall be fitted with watertight caps on the bottom and the top.

- (g) Grout. The access tubes for CSL tests shall be grouted after the completion of the test. The grout for filling the access tubes at the completion of the CSL tests shall conform to Subsection 707.03.
- (h) Water. Provide water conforming to the requirements of Section 745, except with a pH conforming to the slurry requirements listed above.

133. PREQUALIFICATION. The Contractor shall submit proof and details of the following:

- (a) Three projects in the past five years where the Contractor or subcontractor performing the work has successfully installed drilled shafts of similar diameter and length as required for this project, and a minimum of one project requiring similar on-site topographical and geotechnical conditions to those described in the Plans.
- (b) The on-site Superintendent shall have a minimum of two years experience in supervising construction of drilled shaft foundations

of similar size (diameter and depth) and difficulty to those shown on the Plans, and in similar geotechnical conditions. The work experience shall be direct supervisory responsibility for the on-site drilled shaft construction operations. Project management level positions indirectly supervising on-site drilled shaft construction operations shall not be considered to be acceptable for this experience requirement.

- (c) The drill operators having had a minimum of one year of experience installing drilled shafts with similar diameters and lengths, and in similar conditions. Include details describing the equipment and methods used, difficulties encountered and how they were overcome, and the results of any testing performed. For each project cited, include the name and telephone number of someone who can be contacted as a reference.

The Contractor shall submit this information to the Engineer for review, evaluation, and approval prior to submitting detailed information as required under SUBMITTALS AND PRECONSTRUCTION REQUIREMENTS of this Section. The Engineer will render a decision within 10 working days after receipt of the submission. The Contractor or subcontractor will not be permitted to install drilled shafts without this approval.

The Engineer may suspend the drilled shaft construction if the Contractor substitutes unapproved field personnel without prior approval by the Engineer. The Contractor shall be fully liable for the additional costs resulting from the suspension of work and no adjustments in contract time resulting from such suspension of work will be allowed.

134. SUBMITTALS AND PRECONSTRUCTION REQUIREMENTS.

- (a) Submittals. All approvals are subject to satisfactory field performance. Approval of a submittal does not relieve the Contractor and/or subcontractor of their responsibilities to satisfactorily complete the work detailed in the Contract Documents. If the approved submittal procedures do not produce satisfactory field performance, the Contractor will be responsible for submitting revised procedures. No further drilled shaft work will be allowed until the revised procedures have been approved.

The Contractor shall submit a Drilled Shaft Installation Plan (hereafter "plan" for the purposes of this Section) to the Engineer for review and approval prior to commencing the work. The plan shall document the proposed procedures and equipment for installing drilled shafts. The Engineer will render a decision within 15 working days from the date of receipt of all required information. The submittal shall include, but not be limited to, the following information:

- (1) A list, description, and capacities of proposed equipment and procedures for drilled shaft installation, including drawings showing consecutive steps of drilled shaft installation and drawings with measurements showing that the proposed equipment can perform the specified work. Included in the drawings shall be sketches that show the areas that are planned to be used for staging, layout drawings showing the proposed sequence of drilled shaft installation, and detailed drawings of all over-water equipment for drilled shaft installation. The information shall describe the type of

equipment to be used, including drill rig, cranes, drilling tools, final cleaning equipment, de-sanding equipment, slurry pumps, bailing buckets, sampling equipment, tremies or concrete pumps, and casing, including casing dimensions, material and splice details, etc. As appropriate, the narrative shall describe equipment suitability to the anticipated site and subsurface conditions. The narrative shall include a project history of the drilling equipment demonstrating the successful use of the equipment on shafts of equal or greater size in similar subsurface conditions. Provide a detailed description of procedures for temporary and permanent casing installation and removal as applicable.

- (2) Details of shaft excavation methods, including removal of sediment from the shaft bottom. Details of proposed methods to clean the shaft after initial excavation. Details of proposed methods to check shaft bottom cleanliness. Procedures for control, removal, and disposal of spoils. Where casing is proposed or required, casing dimensions and detailed procedures for permanent casing installation and temporary casing installation and removal shall be provided.
- (3) Details of the method(s) to be used to ensure drilled shaft hole stability (i.e. prevention of caving, bottom heave, etc., using temporary casing, slurry, or other means) during excavation and concrete placement. The details shall include a review of method suitability to the anticipated site and subsurface geotechnical conditions.
- (4) Shaft excavation methods, and verification methods of final shaft dimensions and verticality. Include details of proposed corrective measures to be implemented as necessary.
- (5) Methods of removal and disposal of contaminated concrete.
- (6) Details of steel reinforcement lifting, splicing, insertion, and securing, including support and centralization methods.
- (7) Details of concrete batching and/or delivery to the site, how concrete acceptance samples will be collected, proposed location for concrete acceptance testing, and concrete placement including proposed operational procedures for concrete pump or tremie. Include details of initial placement, raising tremie pipe(s) during placement, and overfilling of the shaft concrete, the method to accurately monitor the volume of concrete being placed at all times during the pour, and provisions to prepare the completed shaft top at its final shaft top elevation.
- (8) Approved concrete mix design in accordance with MATERIALS of this Section.
- (9) Slurry Technical Assistance. If slurry is used to construct the shafts, the Contractor shall provide, or arrange for, technical assistance from the slurry manufacturer as specified in this Specification. The submittal shall include the following:

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- a. The name and current phone number of the slurry manufacturer's technical representative assigned to the project.
  - b. The name(s) of the Contractor's personnel assigned to the project and trained by the slurry manufacturer's technical representative in the proper use of the slurry. The submittal shall include a signed training certification letter from the slurry manufacturer for each individual, including the date of the training.
- (10) Detailed procedures for mixing, using, maintaining, and disposing of the slurry shall be provided. A detailed mix design (including all additives and their specific purpose in the slurry mix), and a discussion of its suitability to the anticipated subsurface geotechnical conditions, shall also be provided for the proposed slurry.
  - (11) The submittal shall include a detailed plan for quality control of the selected slurry, including tests to be performed, test methods to be used, and minimum and/or maximum property requirements which must be met to ensure that the slurry functions as intended, considering the anticipated subsurface conditions and shaft construction methods, in accordance with the slurry manufacturer's recommendations and these Specifications.
  - (12) Description and details of the slurry sampling tool to be used. Provide a tool capable of taking a slurry sample at a specific depth, without being contaminated by slurry from another depth.
  - (13) If slurry is to be used, an alternate procedure to be used which will secure the shaft in the event of slurry loss or loss of slurry stabilization properties.
  - (14) Description of the type of feet to be used to support the reinforcing steel cage in the drilled shaft.
  - (15) Emergency construction joint procedure, to be used when concrete placement for the drilled shaft is unexpectedly interrupted.
  - (16) Description of equipment and method to be used for drilled shaft inspection. The Inspector will use these methods and equipment to inspect the drilled shafts. The inspection program must be thorough enough to assure the Engineer that each drilled shaft meets the requirements of these provisions.
  - (17) Method for reinsertion of a tremie pipe, if required.
  - (18) Details of equipment and procedures for obstruction removal, including the types of chisels and grabs.
  - (19) Method used to fill or eliminate all voids below the top of shaft between the plan shaft diameter and excavated shaft diameter, or between the shaft casing and surrounding soil,

where permanent casing is specified.

The Engineer will evaluate the plan for conformance with the Contract Documents. Any part of the plan that is unacceptable will be rejected and the Contractor shall submit changes agreed upon for reevaluation. The Engineer will notify the Contractor within seven working days after receipt of proposed changes of their acceptance or rejection. All approvals given by the Engineer shall be subject to trial and satisfactory performance in the field.

Actual drilled shaft location data shall be submitted to the Engineer within one working day after a drilled shaft is installed. The Contractor shall provide the Engineer's on-site representative with written tabulations of the following information:

- (1) Drilled shaft location.
- (2) Elevation of top of drilled shaft measured to the nearest 12 mm (1/2 inch).
- (3) Deviation from design plan location measured to the nearest 6 mm (1/4 inch).
- (4) Plumbness (deviation from vertical) as determined along the entire length of the shaft where required.

Within ten calendar days after the completion of installation of all drilled shafts, and before removing the drilled shaft installation equipment from the site, the Contractor shall provide the Engineer with a plan showing the as-installed location of all drilled shafts installed to the tolerances specified in the Contract Documents.

- (b) Drilled Shaft Pre-Construction Meeting. A meeting shall be held after the approval of the submittal detailing the installation procedure, but prior to commencing construction of the drilled shafts. The purpose of the meeting will be to review all aspects of the drilled shaft construction and testing and to facilitate coordination between all parties involved.

Individuals attending the meeting representing the Agency shall include the Engineer, the Project Manager, the Design Engineer, the Structural Concrete Engineer, the Soils and Foundation Engineer, and the Geologist.

Individuals attending the meeting representing the Contractor and subcontractor shall include the project Superintendent and all foremen in charge of excavating the shaft, placing casing and slurry, placing reinforcing steel, and placing the concrete. A representative from the concrete producer shall also attend the meeting. If slurry is to be used, the slurry manufacturer shall be available by phone for technical assistance during this meeting. All parties shall be notified a minimum of 7 days in advance of the meeting date.

- (c) Production Shaft Installation Sequencing and Scheduling.

- (1) Drilling, installation of reinforcing steel, and concreting shall be scheduled so that each drilled shaft is poured

immediately after drilling is complete, the shaft is inspected and accepted by the Engineer, and reinforcing steel placed and accepted.

- (2) The Contractor will not be permitted to schedule a concrete pour until it is demonstrated that the Contractor can achieve the required bottom of hole cleanliness to the satisfaction of the Engineer.
- (3) Vibration or excessive wheel loads will not be allowed within the immediate vicinity of any drilled shaft. Maintain a stable shaft excavation at all times.

135. CONSTRUCTION TOLERANCES. In-place tolerances for drilled shafts shall be as follows:

- (a) The top of shaft shall not vary horizontally from the location shown on the Plans by more than 75 mm (3 inches).
- (b) The allowable tolerance from the required verticality is 2%. This tolerance applies for the total length of shaft.
- (c) The top of shaft elevation shall be within 25 mm (1 inch) above or 75 mm (3 inches) below the elevation shown in the Plans.
- (d) Reinforcing steel projection elevation tolerance, after all shaft concrete has been placed, is  $\pm 50$  mm ( $\pm 2$  inches) from the projection elevation shown in the Plans.
- (e) Tolerances for the diameter are as follows: The minimum diameter of the drilled shaft is not more than 25 mm (1 inch) less than the diameter shown on the Plans. The maximum shaft diameter is the diameter shown on the Plans plus 150 mm (6 inches).

Drilled shaft excavations and completed shafts not constructed within the required tolerances are unacceptable. The Contractor shall submit written correction procedures to the Engineer for approval prior to correcting the deficiencies. The Contractor is responsible for correcting all unacceptable shaft excavations and completed shafts to the satisfaction of the Engineer at no cost to the Agency and without extension of the Contract Completion Date.

136. CONSTRUCTION REQUIREMENTS.

- (a) Furnishing Equipment for Drilled Shaft Construction. The type and size of the equipment for constructing drilled shafts shall be approved by the Engineer prior to being moved onto the project. When directed by the Engineer, unsatisfactory equipment shall be removed from the project and replaced with satisfactory equipment.
- (b) Drilling and Excavation. The Contractor shall perform the excavations required for the shafts, through whatever materials are encountered, to the dimensions and elevations shown in the Plans or otherwise required by the Contract Documents. The Contractor shall extend the drilled shaft base elevations when the Engineer determines that the material encountered during the excavation is unsuitable and/or differs from that anticipated in the design of the drilled shaft. The Contractor's methods and equipment shall be suitable for the intended purpose and materials encountered.

The Contractor shall excavate the holes and dispose of all excavated material for drilled shafts using the same requirements, methods, procedures, and equipment approved by the Engineer. The Contractor shall not alter equipment and/or methods without written permission from the Engineer.

Pre-excavation, utilizing appropriate sediment and turbidity controls when in/near waters of the State, may be needed to advance past shallow obstructions before installing casing.

- (c) Slurry. The drilled shafts may be advanced using a controlled slurry or water to maintain the excavation. A temporary surface casing shall be used above the top of shaft elevation extending above the adjacent water level. The fluid level inside the hole shall be maintained above the adjacent water level at all times during installation and cleaning out.

Pre-mix the slurry, and allow adequate time for hydration prior to introduction into the shaft excavation. Provide adequate slurry tanks when specified or required by the Engineer. Do not mix slurry in the hole for the drilled shaft. Slurry pits will not be allowed without written permission from the Engineer.

Provide adequate de-sanding equipment where required for slurry operations. Take appropriate steps to prevent slurry from setting up in the shaft excavation, such as agitation, circulation, and adjusting the properties of the slurry. Do not let bentonitic slurry sit unagitated for more than four (4) hours.

If the unagitated bentonitic slurry is in the hole for more than four (4) hours, or if caking develops, scrape the sides to remove the filter cake before proceeding with the excavation.

The properties of the pre-mixed slurry must be checked as slurry is introduced and periodically thereafter, including a final check of a bottom sample just prior to concreting to see that the density and sand content are within the limits for proper slurry displacement during concreting. Perform control tests on the slurry to determine density, viscosity, and pH before and during shaft excavation to establish a consistent working pattern.

Let the slurry sit for 30 minutes prior to placing the reinforcing steel cage and shaft concrete, to allow the excess sand to settle out. Remove any sand and spoil that has accumulated on the bottom.

Immediately prior to placing shaft concrete, take slurry samples from the bottom and 3 meters (10 feet) from the bottom of the drilled shaft excavation using an approved slurry sampling tool. Remove any heavily contaminated slurry and spoil that has accumulated at the bottom of the shaft. Ensure the slurry is within the specification requirements immediately before concrete placement. If it is not, clean the hole and flush it with fresh slurry until subsequent tests reveal that the slurry is within the tolerances specified in these provisions.

- (1) Slurry Technical Assistance. If slurry is used, the slurry manufacturer's technical representative shall:



- a. Provide technical assistance for the use of the slurry.
  - b. Be at the site prior to introduction of the slurry into a drilled hole.
  - c. Remain at the site during the construction and completion of a minimum of one shaft to adjust the slurry mix to the specific site conditions.
- (d) Rock Socketing. If shafts are intended to be socketed into rock per the Plans, minimum rock socket lengths shall be as shown on the Plans. The top of rock socket elevation shown on the Plans has been estimated based on test borings and survey. The actual top of rock socket may vary in the field. The top of rock sound enough to begin the socket shall be identified by the Engineer based on the existing borings and observations during shaft drilling. Weathered or highly fractured rock, as determined by the Engineer, shall not be considered sufficient for the top of rock socket. The rock socket shall begin beneath any weathered or highly fractured rock encountered, and may be lower than determined by the Engineer's interpretation of existing borings. The Engineer shall be the sole judge as to when the top of rock sound enough to begin the socket has been encountered in the field. The design rock socket length shown on the Plans shall begin at or below the depth determined by the Engineer.
- (e) Drilled Shaft Excavation Log. The Contractor shall maintain an excavation log during drilled shaft excavation. The log shall contain information such as the description and approximate top and bottom elevation of each soil or rock material encountered during shaft excavation, and any obstruction encountered. The type of tools used for the excavation shall be shown on the log. All changes in the type of tools used for excavation shall be shown on the log. The Engineer will monitor these operations and the logs will be used as a basis of measurement for payment. The Contractor shall resolve all discrepancies on the log noted by the Engineer at the end of each work day. Two copies of a legible, final log shall be furnished to the Engineer within 24 hours after a shaft excavation is completed and accepted.
- (f) Excavation Inspection. The Contractor shall provide equipment for checking the dimensions and alignment of each shaft excavation (moving drilling equipment against the sidewalls, weighted tapes, or other means approved by the Engineer). Electronic measuring equipment may be used, but is not required. The Contractor shall determine the dimensions and alignment under the direction of the Engineer. The Contractor shall measure the final shaft depth after cleaning. Unless otherwise stated in the Plans, a minimum of 50 percent of the base of each shaft shall have less than 25 mm (1 inch) of sediment. Debris at any place on the base of the shaft shall not exceed 50 mm (2 inches). The Engineer shall determine shaft cleanliness by visual inspection for dry shafts or other methods deemed appropriate by the Engineer for wet shafts.
- (g) Access Tubes for Cross-Hole Sonic Log Testing. All completed drilled shafts shall be tested with the nondestructive testing (NDT) method by the Engineer. Cross-Hole Sonic Logging (CSL) will occur after a minimum of 1 day (24 hours) of curing time has elapsed to allow the concrete to harden sufficiently. The Engineer may specify a longer minimum time if special retarders, mix designs, or other

factors result in slower-setting concrete. All CSL testing shall be completed within 5 working days of concrete placement.

The Contractor shall install access tubes for CSL testing in all drilled shafts to permit access for the CSL test probes. One tube per 305 mm (1.0 foot) of shaft diameter, rounding up to the nearest whole number of tubes, (i.e., 8 tubes for a 2.4 meter (8 foot) diameter shaft) shall be installed.

The Contractor shall securely attach the access tubes to the interior of the reinforcement cage for the shaft. The access tubes shall be equally spaced around the shaft, inside the spiral or hoop reinforcement and midway between adjacent vertical reinforcement. The access tubes shall be placed 50 mm (2 inches) clear of the vertical reinforcement. If these minimums cannot be met due to close spacing of the vertical reinforcement, then the access tubes shall be bundled with the vertical reinforcement.

The access tubes shall be installed in straight alignment and as near to parallel to the vertical axis of the reinforcement cage as possible. The tubes shall be secured, such that the tubes stay in position during reinforcement cage and concrete placement. The tubes shall extend from 150 mm (6 inches) above the shaft bottoms to a minimum of 600 mm (2 feet) above the top of the shaft. Under no circumstance shall the tubes be allowed to rest on the bottom of the drilled shaft excavation. Splice joints in the access tubes, if required to achieve full-length access tubes, shall be watertight. The Contractor shall clear the access tubes of all debris and extraneous materials prior to installing the access tubes. Care shall be taken to prevent damaging the access tubes during reinforcement cage installation and concrete placement operations.

The access tubes shall be filled with potable water prior to concrete placement. After filling with water, the top watertight caps shall be reinstalled.

Care shall be exercised in the removal of caps or plugs from the pipes after installation so as not to apply excess torque, hammering, or other stresses which could break the bond between the tubes and the concrete.

Upon completion of CSL testing and acceptance of the shaft by the Engineer, all water shall be removed from the access pipes and any other drilled holes. The pipes and holes shall then be completely filled with an approved grout having strength properties equivalent to or better than those of the drilled shaft concrete. The pipes in a particular shaft shall not be filled with grout until all testing is completed and the shaft has been accepted by the Engineer.

- (h) Reinforcing Steel. Completely assemble the reinforcing steel cage, including longitudinal bars, ties, cage stiffener bars, access tubes, centralizers, bottom supports, and other necessary appurtenances. Ties shall be installed at every intersection between vertical and horizontal (or spiral) reinforcing.

Place and center the reinforcing steel cage in the hole prior to placing concrete in the shaft. Install centralizers at the bottom

and along the axial length of the steel reinforcing at sufficient spacing to maintain proper concrete cover. The longitudinal spacing shall not exceed 3 meters (10 feet). A minimum of four centralizers shall be placed at each longitudinal spacing and shall be spaced no greater than 1.2 meters (4 feet) and equally spaced around the shaft circumference. The bottom of the cage shall be maintained at the proper distance above the base.

Check the elevation of the top of the reinforcing steel cage before and after placing the shaft concrete to ensure that no displacement of reinforcing bars has occurred. If the reinforcing steel cage is not maintained within the specified tolerances, make corrections to the satisfaction of the Engineer. Do not construct additional shafts until the procedure has been modified, to the satisfaction of the Engineer.

- (i) Placing Concrete. Concrete placement shall commence immediately after completion of excavation by the Contractor and inspection by the Engineer. Immediately prior to commencing concrete placement, the shaft excavation and the properties of the slurry (if used) shall conform to these provisions. Concrete placement shall continue in one operation to the top of the shaft, or as shown in the Plans.

Concrete for drilled shafts shall be designed and placed in such a manner that it can be pumped, or flow by gravity through a tremie to the bottom of the excavation; flow easily through the rebar cage without vibration (so that the concrete is not inadvertently mixed with drilling fluid, groundwater, soil, or rock); displace drilling slurry or water while rising in the borehole and in the annular space between the cage and the borehole wall; and not segregate or become leached of cement paste in the process. Simultaneously, the concrete shall have the appropriate strength, stiffness, and durability after it has cured.

If water is not present, the concrete shall be deposited through the center of the reinforcement cage by a method which prevents segregation of aggregates and splashing of concrete on the reinforcement cage. The concrete shall be placed such that the fall is vertical down the center of the shaft without hitting the sides, the steel reinforcing bars, or the reinforcement cage bracing.

When placing concrete underwater, the Contractor shall use a concrete pump or tremie. A tremie shall have a hopper at the top that empties into a watertight tube at least 300 mm (12 inches) in diameter. If a pump is used, a watertight tube shall be used with a minimum diameter of 100 mm (4 inches). The discharge end of the tube on the tremie or concrete pump shall include a device to seal out water while the tube is first filled with concrete. An inflatable ball will not be permitted. The device shall keep its shape and float without danger of deflation, such as a styrofoam plug.

Throughout the underwater concrete placement operation, the discharge end of the tube shall remain submerged in the concrete at least 1.5 meters (5 feet) and the tube shall be continuous until the work is completed, resulting in a seamless, uniform shaft. If at any time during the concrete pour the pump line orifice is

removed from the fluid concrete and discharges above the rising concrete level, a measurement will be made to determine the elevation and the shaft will be considered defective. The Contractor shall take appropriate and immediate action to correct the deficiency.

An example of such an action would be to recharge the pump line using a new plug, submerge the orifice below the contaminated concrete level and resume pumping, to displace the contaminated concrete. Another example would be to remove the reinforcing steel cage and concrete, complete any necessary sidewall removal directed by the Engineer, replace the reinforcing steel cage, and replace the concrete for the shaft. The Contractor shall perform the corrective action at no additional cost to the Agency.

During concrete placement, the concrete level in the drilled shaft shall be continually monitored by the Contractor and the Engineer. The difference in the concrete level between the inside of the reinforcing cage and outside of the reinforcing cage shall be no greater than 300 mm (1 foot). The reinforcing steel cage shall be installed before concrete is placed.

The Contractor's construction operations in the vicinity of a drilled shaft excavation with freshly placed concrete and curing concrete are subject to the following restrictions:

- (1) The Contractor shall not drive piling or advance drilled shaft casing in a 30 meter (100 foot) radius of a drilled shaft within 72 hours after the conclusion of placing concrete.
- (2) During the time period between six hours before concrete placement operations and seven days after completing concrete placement operations, the Contractor shall not place and advance a casing, or perform drilling within four shaft diameters of the centerline of the shaft.

This restriction may be waived if one of the following conditions is satisfied:

- a. The compressive strength of the concrete in the shaft has reached 20 MPa (3000 psi). The Contractor shall obtain and test concrete test cylinders for this early concrete strength measurement in accordance with these provisions.
  - b. The Contractor has implemented a shaft vibration monitoring plan approved by the Engineer.
- (j) Shaft Construction Timing. Every effort shall be made by the Contractor in planning, coordinating, and carrying out the work to minimize the time between the start of excavation for the drilled shaft and completion of shaft concrete placement. Each step in the process of initially drilling into uncased load bearing zones, satisfactorily cleaning the shaft bottom, placing reinforcing steel, and completing concrete placement shall be coordinated to avoid delays during or between each work step. In general, the Contractor shall organize work efforts such that the time between final cleaning of the bearing zones and completion of concrete placement is less than twenty-four (24) continuous hours. No more

than eight (8) continuous hours shall be permitted between the final cleaning of the excavation and the placement of concrete up to a height of 3 meters (10 feet) above the bearing zone.

For cases where eight (8) or more continuous hours elapse between final cleaning into uncased bearing zones and commencement of concrete placement, the Contractor shall clean the shaft and the reinforcing steel already placed using methods approved by the Engineer to the satisfaction of the Engineer. After cleaning, concrete placement shall be immediately commenced.

(k) Shaft Top Preparation. The top-most concrete placed in the shaft shall be considered waste concrete and shall be either:

- (1) pushed upward and ejected completely out of the top of the casing and wasted as final concrete is placed;
- (2) pumped upward to a level a minimum of 600 mm (24 inches) clear distance above the Plan shaft top level and allowed to cure in place for removal later; or
- (3) placed a minimum of 600 mm (24 inches) above the Plan shaft top level via tremie, the casing dewatered prior to initial concrete set and waste concrete removed in the dry by methods approved by the Engineer.

Waste concrete shall be considered to be the top 600 mm (24 inches) of initial concrete placed, plus the height of any additional volume of waste concrete deposited in the shaft where concrete placement was halted and restarted, plus any additional amount necessary to produce full strength, non-segregated concrete at the Plan shaft top level.

Where waste concrete alternative (1) above is selected, waste concrete shall be allowed to evenly overflow the full top circumference of the casing, and may not channel or bleed off by notches or holes cut in the casing top. Any fresh concrete in the casing at a level above the Plan shaft top level after ejecting all waste concrete may be dipped or pumped out to the Plan top elevation while still plastic by methods and equipment approved by the Engineer, or allowed to cure in place for removal later.

Where waste concrete alternative (3) above is selected, the Contractor shall submit calculations demonstrating that the concrete in the shaft at the time of dewatering provides a minimum Factor of Safety against uplift of 1.25.

Final shaft top preparation may commence only once the drilled shaft concrete obtains an average unconfined compressive strength of 17 MPa (2500 psi) or, in lieu of concrete strength testing, beginning seven (7) full days after completion of concrete placement. Final top preparation steps shall consist of:

- (1) cutting off any extra casing above the top of casing elevation;
- (2) cutting off any cured over pour concrete to the Plan shaft top elevation by approved methods;

- (3) dressing the final shaft top surface;
  - (4) verification by the Engineer that the exposed concrete consists of full strength concrete with a typical, non-segregated mortar and aggregate distribution;
  - (5) approved non-destructive strength testing by the Contractor where required by the Engineer to verify that concrete has full design strength; and
  - (6) removal of additional concrete below the Plan shaft top level as necessary to reach full-strength, non-segregated concrete.
- (1) Temporary Casing Removal. The Contractor shall completely remove all temporary casings, except as noted. The Contractor may leave some or all of the temporary casing in place provided all the following conditions are satisfied:
- (1) The Contractor shall submit the following information in writing to the Engineer:
    - a. A complete description of the portion of the temporary casing to remain.
    - b. The specific reason(s) for leaving the portion of the temporary casing in place.
    - c. Calculations conforming to the requirements of Section 105, using the design specification and design criteria specified in the Plans, indicating that leaving the temporary casing in place is compatible with the structure as designed in the Plans.
  - (2) The Contractor shall have received the Engineer's written approval of the submitted request to leave the temporary casing in place. Any additional costs incurred as a result of leaving the temporary casing in place shall be borne by the Contractor. Additional costs may include, but are not limited to, increased shaft lengths, additional reinforcing steel, and any additional obstruction removal.
  - (3) The entire length of the drilled shaft shall be in intimate contact with the adjacent surrounding soils at the completion of drilled shaft installation. If intimate contact is not achieved, as determined by the Engineer, due to temporary casing removal, temporary casing remaining in place, or for other reasons related to the means and methods of the Contractor, the annular space around the drilled shaft shall be grouted by the Contractor, to the satisfaction of the Engineer, at no expense to the Agency.

The Agency reserves the right to reject any and all proposals.

- (m) Contractor's Records. The Contractor shall keep a record, independent of that which may be kept by the Engineer, of all pertinent data relative to the installation of the drilled shaft. This record shall be available for the Engineer's inspection until the completion of the project, and a copy shall be transmitted to

the Engineer within three days of the completion of each shaft. This record is to include for each shaft:

- (1) Shaft location and dates of installation.
  - (2) Slurry data.
  - (3) Total length of each shaft.
  - (4) Plumbness of shaft.
  - (5) Placement and condition of reinforcing cage.
  - (6) The time, method, and duration of the concrete placement.
  - (7) A log of the ambient and concrete temperatures at the time of placement.
  - (8) The quantity of concrete versus depth of filled shaft.
- (n) Cross-Hole Sonic Log Testing. Cross-Hole Sonic Logging (CSL) testing and analysis on all completed drilled shafts on this project shall be conducted unless directed otherwise by the Engineer. The testing and analysis shall be performed by an independent testing organization retained by the Agency.

The testing shall be performed after the shaft concrete has cured for a minimum of 24 hours. Additional curing time prior to testing may be required if the shaft concrete contains admixtures, such as set retarding admixture or water reducing admixture. The additional curing time prior to testing required under these circumstances shall not be grounds for additional compensation or an extension of time.

After placing the shaft concrete and before beginning CSL testing of a shaft, the Contractor shall inspect the access tubes. Each access tube that the test probe cannot pass through shall be replaced, at the Contractor's expense, with a 50 mm (2 inch) diameter hole cored through the concrete for the entire length of the shaft. Unless directed otherwise by the Engineer, cored holes shall be located approximately 150 mm (6 inches) inside the reinforcement and shall not damage the shaft reinforcement. Descriptions of inclusions and voids in cored holes shall be logged and a copy of the log shall be submitted to the Engineer. Findings from cored holes shall be preserved, identified as to location, and made available for inspection by the Engineer.

The Engineer will determine final acceptance of each shaft, based on the CSL test results and analysis for the tested shafts, and will provide a response to the Contractor within five working days after the completion of the CSL testing.

The Contractor shall not commence concrete operations in subsequent shaft excavations until the CSL tests have been accepted on the previously completed shaft and the Engineer has given approval. This requirement may be waived at the discretion of the Engineer.

- (o) Acceptance of Drilled Shafts. A comparison of the computed volume of the excavation (theoretical) with the volume of concrete placed

(actual) shall be made. A plot of depth versus volume shall be computed. The Contractor shall provide cooperation and whatever assistance necessary to accurately monitor the volume of concrete placed at all times during the pour. The Engineer will determine final acceptance of each shaft and will provide a response to the Contractor within five working days after the completion of the CSL testing.

Unacceptable drilled shafts are drilled shafts that are rejected by the Engineer due to damage, failure to advance through obstructions, mislocation, misalignment, failure to install the drilled shaft to the proper bearing stratum, or the results of the CSL testing indicate defects. Rejection of a shaft based on the shaft integrity testing shall require conclusive evidence that a defect exists in the shaft which will result in inadequate or unsafe performance under service loads. If the CSL records are complex or inconclusive, the Engineer may require additional testing to confirm the location of the defect.

For all shafts determined to be unacceptable, the Contractor shall submit a remedial action plan to the Engineer for approval. If the remedial action plan requires any modifications to the dimensions of the shafts detailed in the Plans, they shall be supported by calculations and working drawings. All remedial correction procedures and designs shall be prepared by a registered professional engineer licensed in the State of Vermont and submitted to the Engineer for approval. The Contractor shall not begin repair operations until receiving the Engineer's approval of the remedial action plan.

If the Engineer determines that the concrete placed is structurally inadequate, that shaft will be rejected. The placement of concrete shall be suspended until the Contractor submits to the Engineer written changes to the methods of shaft construction needed to prevent future structurally inadequate shafts, and receives the Engineer's written approval of the submittal.

At the Engineer's direction, a core hole (standard Nx rock core) shall be drilled in any questionable quality shaft (as determined from CSL testing and analysis or by observation of the Engineer) to explore the shaft condition.

Prior to beginning coring, the Contractor shall submit to the Engineer the method and equipment used to drill and remove cores from shaft concrete. The Engineer shall issue written approval before the coring work can be started. The coring method and equipment shall provide for complete core recovery and shall minimize abrasion and erosion of the core.

If a defect is confirmed, the Contractor shall pay for all coring costs. If no defect is encountered, the Agency will pay for all coring costs as Extra Work and, if the shaft construction is on the critical path of the Contractor's schedule, compensation for the delay will be granted by an appropriate time extension.

Materials and work necessary, including engineering analysis and redesign, to effect corrections for shaft defects shall be furnished to the Engineer's satisfaction at no additional cost to the Agency.



All access tubes and cored holes shall be dewatered and filled with grout after tests are completed and the shaft is accepted. The access tubes and cored holes shall be filled using grout tubes that extend to the bottom of the tube or hole or into the grout already placed.

137. METHOD OF MEASUREMENT. The quantities of Special Provision (Drilled Shaft in Earth) and Special Provision (Drilled Shaft in Rock) of the size specified to be measured will be the number of meters (linear feet) of drilled shaft placed in the complete and accepted work (except where measurement is made for Special Provision (Drilled Shaft Obstruction Drilling and Removal) as specified below) measured to the nearest 30 mm (0.1 foot) from the Plan top of concrete shaft elevation to the bottom of shaft. Measurement will be taken at the cross-sectional center of the shaft.

The quantity of Special Provision (Drilled Shaft Obstruction Drilling and Removal) to be measured will be the number of meters (linear feet) performed in the complete and accepted work, over the depth range in which obstructions are encountered, measured to the nearest 30 mm (0.1 feet) as determined by the Engineer. No measurement for Special Provision (Drilled Shaft in Earth) will be made within the limits of Special Provision (Drilled Shaft Obstruction Drilling and Removal).

HIGH PERFORMANCE STEEL, PLATE GIRDER, GRADE HPS 70W

138. DESCRIPTION. This work shall consist of furnishing, erecting, and when specified, coating fabricated high performance structural steel components.

The work under this Section shall be performed in accordance with these provisions, the Plans, and Section 506 of the Standard Specifications.

139. MATERIALS. Material shall be unpainted, high-strength low-alloy steel conforming to AASHTO M 270/M 270 and ASTM A 709/A 709M. ASTM A 709/A 709M supplementary Requirement S83, "Non Fracture Critical Material Toughness Testing and Marking" will apply, and must be specified with the mill order.

140. WELDING. Only submerged arc welding and shielded metal arc welding will be permitted. Consumable handling requirements shall be in accordance with AWS D1.5.

(a) Filler Metals.

- (1) Unless otherwise noted on the Plans, filler metals for all fillet welds shall be in conformance with AWS D1.5, Table 4.1.
- (2) Filler metals for single pass fillet welds need not meet the requirements for exposed bare applications of Section 4.1.4 of AWS D1.5-95, as long as they comply with Section 4.1.5.

141. METHOD OF MEASUREMENT. The quantity of Special Provision (High Performance Steel, Plate Girder, Grade HPS 70W) to be measured will be the number of kilograms (pounds) used in the complete and accepted work, as computed in accordance with Subsection 506.24(a).

MECHANICALLY STABILIZED EARTH (MSE) RETAINING WALL

142. DESCRIPTION. This work shall consist of designing, detailing, fabricating, furnishing, erecting, and monitoring mechanically stabilized earth retaining walls constructed in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown on the Plans or as directed by the Engineer.

The mechanically stabilized earth retaining wall system shall consist of placement and compaction of select granular backfill, a non-structural leveling pad, precast concrete face panels, and membrane and soil reinforcement elements mechanically connected to each facing panel. The soil reinforcement shall have sufficient strength, length, and frictional resistance as required by the design as specified herein.

143. GENERAL REQUIREMENTS. All appurtenances behind, in front of, under, mounted upon, or passing through the wall such as drainage structures, utilities, or other appurtenances shown on the Plans shall be accounted for in the stability design of the wall.

The mechanically stabilized earth retaining wall design shall follow the dimensions of the wall envelope shown on the Plans. The design shall locate the leveling pad at or below the minimum wall embedment. Where a coping or barrier is utilized, the wall face panel shall extend up into the coping or barrier the minimum distance specified on the Plans. The top of the face panels may be level or sloped to meet the top of the wall. Cast-in-place concrete will not be acceptable replacement for panel areas, except for minor grouting of pipe penetrations and leveling required for coping.

Where walls or wall sections intersect with an angle of 130° or less, a special vertical corner element panel shall cover the joint of the panels that abut the corner, and allow for independent movement along the abutting panels.

The face panels and wall system shall be designed to accommodate the appropriate magnitude of differential settlement. The spacing between adjacent panels shall be designed to be 19 mm. When shown on the Plans, slip joints to accommodate excessive differential settlement shall be included.

144. DESIGN REQUIREMENTS. The design by the wall system supplier shall consider the internal stability of the wall mass and shall be performed in accordance with the appropriate sections of the most recent edition of the AASHTO *LRFD Bridge Design Specifications*.

The mechanically stabilized earth retaining wall system shall be designed for a design life of 75 years using the corrosion rates given in the AASHTO *LRFD Bridge Design Specifications* for non-aggressive soil.

- (a) Backfill. The friction angle of the select granular backfill used in the reinforced fill zone for the internal stability of the wall shall be assumed to be 34°, unless determined otherwise by tests. When a friction angle greater than 34° is proposed, the friction angle shall be determined by the standard direct shear test, AASHTO T 236, utilizing a sample of the material compacted to 95 percent of AASHTO T 99, Methods C or D (with oversize correction per AASHTO

T 224), at the optimum moisture content. Before construction begins, the select granular backfill material selected shall be subject to approval by the Engineer. Compliance with the test requirements shall be the responsibility of the Contractor. The wall supplier shall be furnished a copy of the test results for the backfill prior to construction.

- (b) Connections. All connections shall be positive, structural connections subject to the same loss rates and tension requirements as the primary soil reinforcement for mechanically stabilized earth retaining walls.

145. SUBMITTALS. The Contractor shall submit two (2) copies of the design computations and five (5) sets of panel Fabrication Drawings and wall construction drawings for approval prior to beginning of construction.

- (a) Working Drawings and design calculations shall be submitted to the Engineer for review and approval a minimum of four (4) weeks before work is to begin and shall include the following:
  - (1) Complete design calculations substantiating that the proposed design satisfies the design parameters specified in the Contract Documents.
  - (2) Details of revisions or additions to drainage systems or other facilities required to accommodate the wall system.
  - (3) An elevation view of the wall, which shall include the elevation at the top of the wall at all horizontal and vertical break points and at least every 15 m along the face of the wall, all steps in the leveling pads, the designation as to the type of panel, the length of soil reinforcing elements, the distance along the face of the wall to where changes in length of the soil reinforcing elements occur, and an indication of the final ground line and maximum calculated bearing pressures.
  - (4) A typical cross-section or cross-section showing the elevation relationship between ground conditions and proposed grades, including existing ground elevations that have been verified by the Contractor for each location involving construction wholly or partially in original ground.
  - (5) General notes pertaining to design criteria and wall construction.
  - (6) A listing of the summary of quantities on the elevation sheet for each wall.
  - (7) The details for diverting soil reinforcements around obstructions such as piles, catch basins, and other utilities.
  - (8) The details for connection between the concrete panel and the soil reinforcements.
  - (9) Other information required in the Contract Documents or requested by the Engineer.

- (b) Panel Fabrication Drawings shall show all dimensions necessary to construct the element, all reinforcing steel in the element, the location of soil reinforcing connection devices embedded in the panels, and an indication of the architectural treatment.
- (c) The Contractor shall submit, for review and approval by the Engineer prior to construction, wall design calculations, signed and sealed by a Professional Engineer registered in the State of Vermont and directly employed by the wall system supplier. The Contractor shall not start work on any earth retaining system for which Working Drawings are required until the Engineer has approved such drawings.

Approval of the Contractor's Working Drawings shall not relieve the Contractor of any responsibility under the Contract for the successful completion of the work.

146. MATERIALS. The Contractor shall make arrangements to purchase from the wall system supplier the materials covered herein, including concrete panels, reinforcing strips, attachment devices, fasteners, joint materials, and all necessary incidentals. The Contractor, or the supplier as the Contractor's agent, shall furnish the Engineer a certificate of compliance certifying that the applicable materials comply with these provisions. Materials not conforming to these provisions shall not be used without the written consent of the Engineer.

- (a) Concrete Facing Panels. Concrete facing panels shall meet the requirements of Section 540.

- (1) Reinforcing Steel. Reinforcing steel used in the concrete facing panels and panel copings shall be epoxy coated in accordance with Sections 507 and 713.
- (2) Casting. The panels shall be cast face down in level forms supported on a flat working surface. Guides shall be used to locate and support attachment devices set in the back face of the panel.

The concrete in each panel unit shall be placed without interruption.

- (3) Concrete Finish. The panel surfaces shall be free of open pockets of aggregate and surface distortions in excess of 6 mm.

- (b) Soil Reinforcing and Attachment Devices. All reinforcing and attachment devices shall be carefully inspected to ensure they are true size and free from defects that may impair their strength and durability.

- (1) Reinforcing Mesh Elements. Reinforcing mesh elements shall be shop fabricated from cold drawn steel rod conforming to the minimum requirements of AASHTO M 32M/M 32 and shall be welded at the junctions between longitudinal and transverse wires in accordance with AASHTO M 55M/M 55. Galvanizing shall be applied after mesh fabrication and shall conform to the minimum requirements of AASHTO M 111M/M 111. The galvanizing thickness shall be determined and specified based on the design life requirements of the structure.

- (2) Loop Embeds. Loop embeds shall be fabricated from cold drawn steel rod conforming to AASHTO M 32M/M 32. Loop embeds shall be welded in accordance with AASHTO M 55M/M 55. Loop embeds shall be galvanized in accordance with AASHTO M 232M/M 232.
  - (3) Reinforcing Strips. Reinforcing strips shall be hot rolled from bars to the required shape and dimensions. Their physical and mechanical properties shall conform to ASTM A 572/A 572M Grade 450 or equal. Galvanizing shall conform to the minimum requirements of AASHTO M 111M/M 111. The galvanizing thickness shall be determined and specified based on the design life requirements of the structure.
  - (4) Tie Strips. Tie strips shall be shop fabricated from hot rolled steel conforming to the minimum requirements of ASTM A 570, Grade 50 or equivalent. Galvanizing shall conform to AASHTO M 111M/M 111 or AASHTO M 232M/M 232. The minimum coating thickness shall be 0.610 kg/m<sup>2</sup>.
  - (5) Fasteners. Fasteners shall consist of galvanized hexagonal cap screw bolts and nuts conforming to the requirements of AASHTO M 164M (M 164) or equivalent. Fasteners shall be galvanized in accordance with AASHTO M 232M/M 232.
- (c) Joint Materials. Joint materials shall be installed to the dimension and thickness indicated in the Plans.
- (1) Bearing Pads. Bearing pads shall be preformed EDPM rubber pads conforming to ASTM D 2000 M2AA 807 and having a durometer hardness equal to 80±5.
  - (2) Joint Cover. Horizontal and vertical joints between panels shall be covered by a geotextile. The geotextile may be either a non-woven needle punched polyester geotextile or a woven monofilament polypropylene geotextile meeting the requirements of Section 720 for Geotextile Under Stone Fill. The wall supplier shall approve adhesive used to hold the geotextile filter fiber material to the rear of the facing panels prior to backfill placement.
- (d) Select Granular Backfill. Select granular backfill material used in the mechanically stabilized earth structure shall be reasonably free from organic and otherwise deleterious materials, and shall conform to the following gradation limits as determined in accordance with AASHTO T 27:

| <u>SIEVE SIZE</u> | <u>PERCENT PASSING</u> |
|-------------------|------------------------|
| 101.6 mm          | 100                    |
| 75 mm             | 75 - 100               |
| 0.425 mm          | 0-60                   |
| 75 µm             | 0 - 12                 |

In addition, the backfill shall conform to the following requirements:

- (1) Plasticity Index. The Plasticity Index (P.I.), as determined by AASHTO T 90, shall not exceed six.

- (2) Soundness. The material shall be substantially free of shale or other soft particles with poor durability characteristics. The material shall have a sodium sulfate soundness loss of less than 8 percent after five (5) cycles, as determined by AASHTO T 104.
- (3) Electrochemical Requirements. The backfill material shall conform to the following requirements:

| <u>PROPERTY</u>                | <u>REQUIREMENT</u>      | <u>TEST METHOD</u> |
|--------------------------------|-------------------------|--------------------|
| Resistivity at 100% saturation | Minimum 3000 ohm-cm     | AASHTO T288        |
| pH                             | Acceptable Range 5 - 10 | AASHTO T289        |
| Sulfates                       | Maximum 200 ppm         | AASHTO T290        |
| Chlorides                      | Maximum 100 ppm         | AASHTO T291        |
| Organic Content                | <1%                     | AASHTO T267        |

Backfill not conforming to these provisions shall not be used without the written consent of both the Engineer and the wall supplier.

- (4) Uniformity Coefficient. Backfill material shall have a minimum uniformity coefficient,  $C_u$ , of 2.

#### 147. CONSTRUCTION REQUIREMENTS.

- (a) Manufacturer's Representative. The Contractor shall make the necessary arrangements with the wall supplier to have a technical representative on the project to supervise the initial placement of the mechanically stabilized earth retaining wall system. The technical representative shall also be required to be on-site any time during wall installation as requested by the Engineer. The representative shall be available for a minimum of 20 work days.
- (b) Wall Excavation. Common excavation shall be in accordance with the requirements of specifications for embankment excavation and in reasonable close conformity with the limits shown on the Plans.
- (c) Foundation Preparation. The foundation for the structure shall be graded level for a width equal to or exceeding the length of the soil reinforcements, or as shown on the Plans. The Contractor shall proof roll the foundation using a minimum 4500 kg, self-propelled vibratory roller to compact soils disturbed by excavation. Areas exhibiting excess weaving or soft, unsuitable soils should be excavated and replaced with compacted granular fill. Wet foundation soils should be proof rolled without vibration. Any foundation soils found to be unsuitable shall be removed and replaced as directed by the Engineer.

At each panel foundation level, an unreinforced concrete leveling pad shall be provided as shown on the Plans. The leveling pad shall have nominal dimensions of 150 mm thickness and 300 mm width, and shall be cast using minimum 13.8 MPa 28 day compressive strength concrete. The leveling pad shall be cast to the design elevations

as shown on the Plans. Allowable elevation tolerances are +3 mm and -6 mm from the design elevation. Prior to placement of the leveling pad, the Agency's Geotechnical Engineer or designated representative shall inspect the foundation soils to evaluate the suitability of the bearing soils.

Leveling pads shall be allowed to cure a minimum of 24 hours before wall panels are erected on them.

- (d) Wall Erection. Precast concrete panels shall be placed vertically with the aid of a light crane. For erection, panels shall be handled by means of lifting devices set into the upper edge of the panels. Panels shall be placed in successive horizontal lifts in the sequence shown on the Plans as backfill placement proceeds.

As the backfill material is placed behind the panels, the panels shall be maintained in a vertical position by means of temporary wooden wedges placed in the joint at the junction of the two adjacent panels on the external side of the wall. External bracing is required for the initial lift. Vertical tolerance (plumbness) and horizontal alignment tolerances shall not exceed 20 mm. The allowable offset in any panel joint shall be 20 mm. The overall vertical tolerance of the wall (plumbness from top to bottom) shall not exceed 13 mm per 3 m of wall height.

- (e) Placement of Reinforcements. Prior to the first layer of reinforcements, backfill shall be placed and compacted in accordance with part (f) of this Subsection.

Soil reinforcements shall be placed normal to the face of the wall, unless otherwise shown on the Plans or directed by the Engineer.

If skewing of the soil reinforcements is required due to obstructions in the reinforced fill, or in other cases justified by calculation, the maximum skew angle shall not exceed 15 degrees from the normal position, except in case of acute corners where redundant reinforcements are used, or in other cases justified by calculation.

- (f) Backfill Placement. Backfill placement shall closely follow erection of each course of panels. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the facing panels. Any wall materials which become damaged or disturbed during backfill placement shall be corrected or removed and replaced at the Contractor's expense, as directed by the Engineer.

No backfill shall be placed until test results from a qualified independent testing laboratory have been submitted for the proposed material. Test results shall demonstrate conformance with the backfill friction angle requirements included in these provisions (if friction angle greater than 34° is being proposed) and meet the requirements for Select Granular Backfill.

Backfill shall be compacted to 95 percent of the maximum density as determined in accordance with AASHTO T 99, Method C or D (with oversize correction).

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift.

The optimum moisture content shall be determined in accordance with AASHTO T 99, Method C or D (with oversize correction).

The frequency of sampling of Select Granular Backfill material, necessary to assure gradation control throughout construction, shall be as directed by the Engineer. If 30 percent or more of the Select Granular Backfill material is greater than 19 mm in size, AASHTO T 99 is not applicable. For such material, the acceptance criterion for control of compaction shall be either a minimum of 70 percent of the relative density of the material, as determined by ASTM D 4253 and D 4254 or a method specification (based on a test compaction section) which defines the type of equipment, lift thickness, number of passes of the specified equipment, and placement moisture content.

The maximum lift thickness after compaction shall not exceed 250 mm, regardless of the vertical spacing between the reinforced soil layers. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density. Prior to placement of the soil reinforcements, the backfill elevation, after compaction, shall be 50 mm above the attachment device elevation from a point approximately 300 mm behind the back face of the panels to the free end of the soil reinforcements, unless otherwise shown on the Plans.

Compaction within 1 m of the back face of the panels shall be achieved by a minimum of three (3) passes of a lightweight mechanical tamper, roller or vibratory system. The specified lift thickness shall be adjusted as warranted by the type of compaction equipment actually used, but no soil density tests need be taken within this area. Care shall be exercised in the compaction process to avoid misalignment of the panels or damage to the attachment devices. Heavy compaction equipment shall not be used to compact backfill within 1 m of the wall face.

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to direct runoff of rainwater away from the wall face. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

- (g) Horizontal and Vertical Control. Immediately following the erection of the mechanically stabilized earth retaining wall system, the Contractor shall establish horizontal and vertical survey points at three locations across the top and at mid-elevation on the wall to monitor future movements. These points shall be tied into a minimum of two control markers that are sufficiently removed from the wall so as not to be influenced by wall movement. The control shall be located to allow additional measurements to be made after all construction is complete. A plan with the locations of all survey points and ties, along with distances and elevations recorded to the nearest 0.001 m, shall be provided to the Engineer



within 48 hours of the completion of the mechanically stabilized earth retaining wall system.

148. METHOD OF MEASUREMENT. The quantity of Special Provision (Mechanically Stabilized Earth Retaining Wall) to be measured will be the number of square meters (square feet) of wall surface area in the complete and accepted work, measured as the sum of the areas of panels actually erected in the wall.

QC/QA CLEANING AND PAINTING STRUCTURAL COMPONENTS

149. DESCRIPTION. This work shall consist of the preparation of all designated metal surfaces by the method(s) specified in the Contract Documents. This work also includes the coating of those designated surfaces with the paint system(s) and grease coating specified in the Contract Documents.

150. MATERIALS. The Contractor shall provide a three-coat paint system, and where required by the Contract Documents, a grease rustproofing compound. The paint system shall consist of an organic zinc rich primer or hot dipped galvanizing, an epoxy intermediate coat, and an aliphatic urethane finish coat. For new galvanized steel members, the galvanized surface shall be considered the prime coat and the organic zinc rich primer shall not be applied. The coating system and rustproofing compound shall meet the requirements of the following Subsections:

Approved Structural Coating Systems.....708.03  
Grease Rustproofing Compound.....708.04

Components from one paint system shall not be intermixed with components from another system.

Shop applied systems may have isolated areas where the coatings were damaged during shipping or erection and will have areas around faying surfaces that may need field applied primer, intermediate, and top coatings. Thus, any coating system that is used in the shop shall be acceptable for the field conditions that are expected to be encountered.

The Contractor shall provide the Engineer with one copy each of all "product data sheets" published by the coating manufacturer for each and every coating applied, thinner, and/or sealer, to be retained with the project records.

Each coat shall be a contrasting color. The finish coat color shall conform to Federal Color Standard 595 as specified in Subsection 708.03.

151. DEFINITIONS.

(a) Shop Application. Applications in an enclosed environment, such as a fabrication plant, shop, or enclosed area, where vapors, spray, temperature, and humidity can be controlled.

(b) Field Application. All applications which cannot be considered shop applications.

152. SUBMITTALS. The Contractor shall submit to the Engineer, in accordance with Subsection 105.03 for Construction Drawings, the following

information for completing the work. Complete submittals shall be provided a minimum of 21 days prior to the anticipated start of the work.

- (a) Contractor/Personnel Qualifications. Evidence of Contractor qualifications and the names and qualifications/experience/training of the personnel managing and implementing the Quality Control Program and conducting the quality control tests. At a minimum this should include the Quality Control Manager and the Quality Control Inspector.
- (b) Quality Control (QC) Program. The QC Program shall identify the following:
  - (1) Instrumentation that will be used.
  - (2) Schedule of required measurements and observations.
  - (3) Procedures for correcting unacceptable work.
  - (4) Procedures for improving surface preparation and painting quality as a result of quality control findings.

The QC Program shall be signed by the Quality Control Manager.

- (c) Inspection Access Plan. The Inspection Access Plan is for use by Contractor QC personnel for ongoing inspections and by the Engineer during Quality Assurance (QA) observations. The plan shall include the design of any necessary scaffolding or staging required for QC/QA inspections. All staging and scaffolding shall be designed by a qualified Licensed Professional Engineer.
- (d) Surface Preparation/Painting Plan for Existing Steel. The Surface Preparation/Painting Plan for existing steel shall include the specified methods of surface preparation and type(s) of equipment to be utilized for water washing, hand/power tool cleaning, removal of rust, mill scale, paint or foreign matter, abrasive blast or water jetting, and remediation of chloride. If detergents, additives, or inhibitors are incorporated into the water used for any coating work operations, the plan shall include the names of the materials and Material Safety Data Sheets (MSDS).

The plan shall identify the solvents proposed for solvent cleaning together with MSDS.

The plan shall also include the methods of coating application, including any required strip coats and all equipment to be utilized.

If the Contractor proposes to heat or dehumidify the containment, the methods and equipment proposed for use shall be included in the plan for the Engineer's consideration.

- (e) Surface Preparation/Painting Plan for Galvanized Steel. The Surface Preparation/Painting Plan for galvanized steel shall include the specified methods of surface preparation of galvanized steel for painting and shall comply with the requirements of ASTM D 6386. Painting of the galvanized steel with the epoxy intermediate coat may be done in the shop or in the field. Surface preparation for painting to be done in the shop shall meet the requirements of Section 5 of ASTM D 6386 and surface preparation

for painting to be done in the field shall meet the requirements of Section 6 of ASTM D 6386. All aliphatic urethane finish coat painting shall be applied in the field. The plan shall include the type of equipment and materials used for surface smoothing, surface cleaning, and surface preparation of the galvanized steel. The plan shall also include provisions for repairing damage to the galvanized surface in case of damage.

- (f) Paint Manufacturer Certifications and Letters. All required certifications shall be submitted in accordance with Subsection 700.02.

When a penetrating sealer is used, the Contractor shall provide the manufacturer's Type A Certification of compliance. The certification shall also indicate the compatibility of the sealer with the specified paint system.

When rust inhibitors are used, the Contractor shall provide a Type A Certification from the coating manufacturer indicating that the inhibitor is compatible with, and will not adversely affect the performance of, the coating system.

If the use of a chemical soluble salt remover is proposed by the Contractor, a Type A Certification shall be provided from the coating manufacturer indicating that the material will not adversely affect the performance of the coating system.

The paint manufacturer's application and thinning instructions, MSDS, and product data sheets shall be provided, with specific attention drawn to storage temperatures and the temperatures of the material, surface, and ambient air at the time of application. A letter or written instructions from the coating manufacturer shall be provided indicating the length of time that each coat must be protected from cold or inclement weather (e.g., exposure to rain) during the drying/curing period.

- (g) Abrasives. Abrasives to be used for abrasive blast cleaning, including MSDS: For expendable abrasives, the Contractor shall provide certification from the abrasive supplier that the abrasive meets the requirements of SSPC-AB1. For steel grit abrasives, the certification shall indicate that the abrasive meets the requirements of SSPC-AB3.
- (h) Protective Coverings. Plan for containing or controlling surface preparation and paint debris (abrasive media, droplets, spills, overspray, etc.): Any tarpaulins or protective coverings proposed for use shall be fire retardant. See CONTAINMENT AND DISPOSAL OF LEAD PAINT CLEANING RESIDUES of Section 900, when applicable under the Contract, for submittal requirements involving the containment used to remove lead paint.
- (i) Progress Schedule. A Progress Schedule shall be submitted and shall identify all major work items and associated hold points (e.g. installation of rigging/containment, surface preparation, and coating application). The Contractor shall provide updated progress schedules as requested by the Engineer.

When the Engineer accepts the submittals, the Contractor will receive written notification. The Contractor shall not begin any painting or paint removal work until the Engineer has accepted the

submittals. The Contractor shall not construe Engineer acceptance of the submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety concerns. Acceptance of the submittals does not relieve the Contractor from the responsibility to conduct the work according to the requirements of Federal, State, or Local regulations, this specification, or to adequately protect the health and safety of all workers involved in the project and any members of the public who may be affected by the project. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

153. CONTRACTOR QUALIFICATIONS. The cleaning and painting Contractor shall possess current SSPC certifications and shall maintain certified status throughout the duration of the painting work under the Contract. The certifications shall be appropriate for the type of work being performed, and shall be maintained as follows:

- (a) SSPC-QP1 for field painting.
- (b) SSPC-QP2 for hazardous paint removal in the field.
- (c) SSPC-QP3 for shop painting.

154. QUALITY CONTROL (QC) INSPECTIONS. The Contractor shall perform first line, in progress QC inspections. The Contractor shall implement the submitted and accepted QC Program to insure that the work accomplished complies with these specifications.

The Contractor's Quality Control Manager is responsible for managing the Contractor's QC Program and shall possess a minimum classification as a National Association of Corrosion Engineers (NACE) Coating Inspector Level 2 - Certified. Copies of the certification shall be provided.

The Quality Control Inspector shall possess a minimum classification as a National Association of Corrosion Engineers (NACE) Coating Inspector Level 1. Copies of the certification shall be provided. The Quality Control Inspector shall not participate in any production activities related to surface preparation or painting and shall be onsite full time during any operations that affect the quality of the coating system, including but not limited to surface preparation and chloride remediation, coating mixing and application, and evaluations between coats, and upon project completion. Completed daily reports for all quality control testing and observations shall be provided to the Engineer before work resumes the following day.

The personnel performing any QC tests shall be trained in coatings inspection and the use of the testing instruments. Documentation of training shall be provided. Painters shall perform wet film thickness measurements, with the Quality Control Inspector conducting random spot checks of the wet film. The Contractor shall not replace the QC personnel assigned to the project without advance notice to the Engineer, and acceptance of the replacement(s) by the Engineer.

Contractor QC inspections shall include, but not be limited to, the following:

- (a) Suitability of protective coverings and the means employed to control project debris and paint spills, overspray, etc.

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- (b) Ambient conditions.
- (c) Compressed air cleanliness.
- (d) Surface preparation and surface profile (solvent cleaning, pressure washing, hand/power tool or abrasive blast cleaning, etc.).
- (e) Chloride remediation.
- (f) Coating application (materials verification, mixing, thinning, induction/sweat-in time, and wet/dry film thickness).
- (g) Recoat times and cleanliness between coats.
- (h) Coating continuity and coverage (freedom from runs, sags, overspray, dry spray, pinholes, shadow-through, skips, misses, etc.).

Records of Contractor QC inspections shall document the location on the structure and any applicable product batch numbers.

The following equipment shall be provided by the Contractor as necessary to perform QC inspections:

- (a) Psychrometer or comparable equipment for the measurement of dew point and relative humidity, together with all necessary weather bureau tables or psychrometric charts.
- (b) Surface temperature Digital Spot Thermometer.
- (c) SSPC Visual Standards VIS 1 - Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning; SSPC-VIS 3 - Visual Standard for Power and Hand-Tool Cleaned Steel; SSPC-VIS 4 - Guide and Reference Photographs for Steel Prepared by Water Jetting, and/or SSPC-VIS 5 - Guide and Reference Photographs for Steel Prepared by Wet Blast Cleaning, as applicable.
- (d) Commercially available putty knife of a minimum thickness of 1 mm (40 mils) and a width between 25 and 75 mm (1 and 3 inches).
- (e) Testex Press-O-Film Replica Tape (or approved equal) and Spring Micrometer.
- (f) Latex cell (collection) - Quantab® Chloride Titrator Strip (testing) for chloride determinations, or approved equal.
- (g) Wet Film Thickness Gage.
- (h) Blotter paper for compressed air cleanliness checks.
- (i) Type 2 Electronic Dry Film Thickness Gage per SSPC - PA2 Measurement of Dry Coating Thickness with Magnetic Gages.
- (j) Calibration standards for dry film thickness gage.
- (k) Light meter for measuring light intensity during paint removal, surface preparation, painting, and inspection activities.
- (l) Printed copies of all applicable ASTM and SSPC Standards used for the work.

(m) SSPC Manual of Good Painting Practice.

The instruments shall be calibrated within 12 months of the date of project usage or according to the equipment manufacturer's recommendations and the Contractor's QC Program if they require a shorter duration.

If item 631.18 is not included in the Contract, the Contractor's QC inspection equipment shall be made available to the Engineer for QA observations as requested.

155. HOLD POINT. Specific inspection items throughout these specifications are designated as Hold Points. These Hold Points are for the Engineer to perform QA inspections. Unless other arrangements are made at the project site, the Contractor shall provide the Engineer with a minimum 4 hour notification before a Hold Point inspection will be reached. If the 4 hour notification is provided and the work is ready for inspection at that time, and the necessary QC inspections are performed, the Engineer will conduct the necessary observations. QA inspections will be performed only after a proper QC inspection by the Contractor. If the work is not ready at the appointed time, unless other arrangements are made, an additional 4 hour notification is required. Permission to proceed beyond a Hold Point without a QA inspection will be granted solely at the discretion of the Engineer, and only on a case-by-case basis.

If re-work is necessary as determined by a QA inspection, it shall be accomplished and a new Hold Point for the re-work shall be observed as defined above.

156. QUALITY ASSURANCE (QA) OBSERVATIONS. The Engineer will conduct QA observations of any or all phases of the work. The presence or activity of Engineer observations in no way relieves the Contractor of the responsibility to provide all necessary daily QC inspections and to comply with all requirements of this specification.

The Engineer has the right to reject any work that was performed without adequate provision for QA observations.

157. INSPECTION ACCESS AND LIGHTING. The Contractor shall facilitate the Engineer's observations as required, including allowing ample time to view the work. The Contractor shall furnish, erect, and move scaffolding or other mechanical equipment to permit close observation of all surfaces to be cleaned and painted. This equipment shall be provided during all phases of the work. Examples of acceptable access structures include:

- (a) Mechanical lifting equipment, such as scissor trucks, hydraulic booms, etc.
- (b) Platforms suspended from the structure comprised of trusses or other stiff supporting members and including rails and kick boards.
- (c) Simple catenary supports are permitted only if independent lifelines for attaching a fall arrest system according to VOSHA regulations are approved.

When the surface to be inspected is more than 1.8 m (6 feet) above the ground or water surface, and fall protection is not provided (e.g. railings), the Contractor shall provide the Engineer with a lifeline according to VOSHA regulations. The lifeline and

attachment shall not direct the fall into oncoming traffic. The Contractor shall provide a method of attaching the lifeline to the structure independent of the inspection facility or any support of the platform. When the inspection facility (e.g. platform) is more than 800 mm (2½ feet) above the ground, the Contractor shall provide a VOSHA compliant means of access onto the platform.

The Contractor shall provide artificial lighting in areas where natural light is inadequate, as determined by the Engineer, to allow proper cleaning, inspection, and painting. Illumination for inspection shall be at least 325 LUX (30 foot candles). Illumination for cleaning and painting, including the working platforms, access, and entryways shall be at least 215 LUX (20 foot candles).

158. SURFACE PREPARATION AND PAINTING EQUIPMENT. All cleaning and painting equipment shall include gages capable of accurately measuring fluid and air pressures and shall have valves capable of regulating the flow of air, water, or paint as recommended by the equipment manufacturer. The equipment shall be maintained in proper working order. Diesel or gasoline powered equipment shall be positioned or vented in a manner to prevent deposition of combustion contaminants on any part of the structure.

Hand tools, power tools, pressure washing, water jetting, abrasive blast cleaning equipment, brushes, rollers, and spray equipment shall be of suitable size and capacity to perform the work required. All power tools shall be equipped with vacuums and High Efficiency Particulate Air (HEPA) filtration. Appropriate filters, traps, and dryers shall be provided for the compressed air used for abrasive blast cleaning and conventional spray application. Paint pots shall be equipped with air operated continuous agitation devices unless prohibited by the coating manufacturer. The air discharge from power tools and air motors shall be directed away from steel surfaces; if this is not possible a filtering device shall be appropriately placed.

159. PRE-PAINT MEETING (HOLD POINT). A meeting shall be held after the acceptance of all submittals related to the structural steel painting. The purpose of the meeting shall be to review all aspects of the cleaning and painting of the steel and containment and disposal of lead paint cleaning residues, if included in the Contract.

Individuals attending the meeting representing the Contractor shall be the Project Superintendent, Quality Control Manager, and the Quality Control Inspector. If the Contract requires containment and disposal of lead paint cleaning residues, the Quality Control Inspector for the containment system shall also attend. A qualified manufacturer's technical representative for the coating system shall also attend.

The Engineer will notify the Contractor a minimum of 7 days in advance of the meeting.

160. TEST SECTIONS FOR EXISTING STEEL (HOLD POINT). Prior to surface preparation, the Contractor shall prepare a test section(s) on each structure to be painted in a location(s) which the Engineer considers to be representative of the existing surface condition and steel type for the structure as a whole. More than one test section may be needed to represent the various design configurations of the structure. The purpose of the test section(s) is to demonstrate the use of the tools and degree

of cleaning required (cleanliness and profile) for each method of surface preparation that will be used on the project. Each test section shall be approximately 0.465 square meters (5 square feet). The test section(s) shall be prepared using the same equipment, materials, and procedures as the production operations. The Contractor shall prepare the test section(s) to the specified level of cleaning according to the appropriate SSPC visual standards, modified as necessary to comply with the requirements of these specifications. The written requirements of these specifications prevail in the event of a conflict with the SSPC visual standards. Only after the test section(s) have been approved shall the Contractor proceed with surface preparation operations.

The test section shall be preserved and sealed with a clear coat. At the conclusion of painting activities the test section shall be re-blasted and the specified coating system applied.

For the production cleaning operations, these specifications and written definitions, the test section(s), and the SSPC visual standards shall be used, in that order, for determining compliance with Contract Document requirements.

Additional compensation will not be allowed the Contractor for preparation of the test section(s).

161. AMBIENT CONDITIONS. Surfaces to be painted after cleaning shall remain free of moisture and other contaminants. The Contractor shall control operations to insure that dust, dirt, or moisture does not come in contact with surfaces cleaned or painted that day.

(a) Shop Application. The following ambient conditions shall be met:

- (1) The surface and ambient temperatures shall be at least 3°C (5°F) above the dew point during final surface preparation operations.
- (2) The surface and ambient temperatures shall be a minimum of 4°C (40°F), at least 3°C (5°F) above dew point, and the maximum relative humidity shall be  $\leq 85\%$  during the application and cure/dry time of each coat of the paint system. If the manufacturer's published literature is more restrictive it shall be followed for specific temperature, dew point, and humidity conditions during the application cure/dry of each coat. The cure/dry time shall be measured as the time following application when the ambient conditions are within the ranges above.

The Contractor shall monitor and document temperature, dew point, and relative humidity at the beginning of each work day and every 4 hours during surface preparation and coating application, in the specific areas where the work is being performed. Monitoring shall continue at a minimum of 4 hour intervals throughout the curing/drying period. The Engineer has the right to reject any work that was performed outside the ambient conditions listed above. Rejected work shall be removed, re-cleaned, and repainted at the Contractor's expense.



(b) Field Application. The following ambient conditions shall be met:

- (1) The surface and ambient temperatures shall be at least 3°C (5°F) above the dew point during final surface preparation operations.
- (2) The surface and ambient temperatures shall be a minimum of 4°C (40°F), at least 3°C (5°F) above dew point, and the maximum relative humidity shall be  $\leq 85\%$  during the application and cure/dry time of each coat of the paint system. If the manufacturer's published literature is more restrictive it shall be followed for specific temperature, dew point, and humidity conditions during the application cure/dry of each coat. The cure/dry time shall be measured as the time following application when the ambient conditions are within the ranges above.
- (3) If the Contractor proposes to control the weather conditions inside containment, proposed methods and equipment for heating and/or dehumidification shall be included in the Surface Preparation/Painting Plan submitted for the Engineer's review. Any heating/dehumidification proposals reviewed by the Engineer shall be implemented at no additional cost to the Agency.
- (4) Cleaning and painting shall be performed between April 15th and October 31st, inclusive, unless otherwise authorized in writing by the Engineer.

If the weather conditions are forecasted to be outside the limits above during surface preparation, application, and/or the curing/drying period, then work shall not proceed.

The Contractor shall monitor and document temperature, dew point, and relative humidity at the beginning of each work day and every 4 hours during surface preparation and coating application, in the specific areas where the work is being performed. The frequency of monitoring shall increase if weather conditions are changing. If the weather conditions are forecast to be borderline relative to the limits established by the manufacturer, monitoring shall continue at a minimum of 4 hour intervals throughout the curing/drying period. The Engineer has the right to reject any work that was performed under unfavorable weather conditions. Rejected work shall be removed, re-cleaned, and repainted at the Contractor's expense.

162. COMPRESSED AIR CLEANLINESS. Prior to using compressed air for abrasive blast cleaning, blowing down the surfaces, and painting with conventional spray, the Contractor shall verify that the compressed air is free of moisture and oil contamination in accordance with the requirements of ASTM D 4285. The tests shall be conducted at least one time each shift for each compressor system in operation. If air contamination is evident, the Contractor shall change filters, clean traps, add moisture separators or filters, or make other adjustments as necessary to achieve clean, dry air. The Contractor shall also examine the work performed since the last acceptable test for evidence of defects or contamination caused by the compressed air. Affected work shall be repaired at the Contractor's expense.

163. LOW PRESSURE WATER CLEANING AND SOLVENT CLEANING (HOLD POINT). The Contractor shall notify the Engineer 24 hours in advance of beginning surface preparation operations.

- (a) Water Cleaning/Debris Removal Prior to Total Coating Removal for Existing Steel. The Contractor shall thoroughly clean the surfaces scheduled for coating work as specified below. All water and debris shall be collected for proper disposal.

Washing shall involve the use of chlorine free potable water at a minimum of 7 MPa (1000 psi) and less than 34 MPa (5000 psi) pressure, in accordance with "Low Pressure Water Cleaning" of SSPC-SP12. Paint spray equipment shall not be used to perform the water cleaning. The cleaning shall be performed in such a manner as to remove dust, dirt, chalk, insect and animal nests, bird droppings, loose paint, and other foreign matter prior to solvent cleaning. The water, debris, and any loose paint removed by water cleaning shall be collected for proper disposal. The washing shall be completed no more than 2 weeks prior to surface preparation.

If detergents or additives are added to the water, the detergents/additives shall be included in the submittals and not used until accepted by the Engineer. When detergents or additives are used, the surface shall be rinsed with chlorine free potable water before the detergent water dries.

After washing has been accepted by the Engineer, all traces of asphaltic cement, oil, grease, diesel fuel deposits, and other soluble contaminants which remain on the steel surfaces to be painted shall be removed by solvent cleaning in accordance with SSPC-SP1, supplemented with scraping (e.g. to remove large deposits of asphaltic cement or grease coatings) as required.

The tops of pier caps and abutments shall be cleaned free of dirt, paint chips, insect and animal nests, bird droppings, and other foreign matter and the debris collected for proper disposal.

- (b) Water Cleaning Between Coats. When foreign matter has accumulated on a previously applied coat, washing shall be performed prior to the application of subsequent coats. The water does not need to be collected unless it contacts existing lead containing coatings. Washing shall involve the use of non-chlorinated potable water at a minimum of 7 MPa (1000 psi) and less than 34 MPa (5000 psi) pressure, in accordance with "Low Pressure Water Cleaning" of SSPC-SP12. Paint spray equipment shall not be used to perform the water cleaning.

164. STRUCTURAL STEEL MATING SURFACES, EXISTING STEEL. All laminar, stratified, or pack rust that has formed on or between the existing steel surfaces shall be removed as follows:

- (a) Disassembled Mating Surfaces. When the Contract requires existing mating surfaces to be disassembled, the Contractor shall clean and prepare the mating surface as a faying surface. Faying surfaces for all steel connections shall be abrasive blast cleaned and prime coated only as specified herein prior to being re-assembled.

- (b) Assembled Mating Surfaces. Pack rust formed along the perimeter of mating surfaces of connected plates or shapes of structural steel

shall be removed to the extent feasible without mechanically detaching the mating surface. Pack rust between mating surfaces shall be removed to a level equal to or below the level of mating surfaces between which the rust is packed. Any pack rust remaining after cleaning the mating surfaces shall be tight and intact when examined using a dull putty knife. The tools used to remove these corrosion products shall be identified in the submittals and accepted by the Engineer. If the surface preparation or removal of rust results in nicks or gouges, the work shall be suspended, and the damaged areas repaired at the Contractor's expense to the satisfaction of the Engineer. The Contractor shall also demonstrate that they have made the necessary adjustments to prevent a reoccurrence of the damage prior to resuming work.

As approved by the Engineer, epoxy penetrating sealer and sealant caulk shall be applied to pack rusted mating surfaces which have been addressed as specified above. The sealer shall be applied in the 25 to 50 micron (1 to 2 mils) dry film thickness range.

165. SURFACE PREPARATION (HOLD POINT). New steel to be galvanized shall be cleaned and pickled per SSPC-SP8, unless otherwise approved by the Engineer. The following methods of surface preparation shall be used for existing steel. The method specified applies to the entire surface, including areas that may be concealed by the containment connection points. In each case, as part of the surface preparation process, soluble salts shall be remediated as specified under SOLUBLE SALT REMEDIATION (HOLD POINT) of this Section. The Contractor shall also note that the surface of the steel beneath the existing coating system may contain corrosion and/or mill scale. Removal of said corrosion and/or mill scale shall be considered included in this work and no extra compensation will be allowed.

- (a) Limited Access Areas. A best effort with the specified methods of cleaning shall be performed in limited access areas, such as the backsides of rivets inside built up box members. The equipment being used for the majority of the cleaning may need to be supplemented with other commercially available equipment, such as angle nozzles, to properly clean the limited access areas. The acceptability of the best effort cleaning in these areas is at the sole discretion of the Engineer.
- (b) "Near-White Metal Blast Cleaning". This surface preparation shall be done only on existing steel and shall not be done on galvanized members. This surface preparation shall be accomplished in accordance with the requirements of SSPC-SP10 "Near-White Metal Blast Cleaning". The designated surfaces shall be prepared by dry abrasive blast cleaning. A "Near-White Metal Blast Cleaned" surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining.

Random staining shall be limited to no more than 5 percent of each 58 square centimeters (9 square inches) of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. With the exception of crevices as defined below, surface discoloration is considered to be a residue that must be removed, rather than a stain, if it possesses enough mass

or thickness that it can be removed as a powder or in chips when scraped with a pocketknife.

A surface profile shall be created on the steel as defined in SURFACE PROFILE (HOLD POINT) of this Section.

At the discretion of the Engineer, after a best effort cleaning, slight traces of existing coating may be permitted to remain within crevices such as those created between rivets, bolts, and plates, and the underlying steel. When traces of coating are permitted to remain, the coating shall be tightly bonded when examined by probing with a dull putty knife. The traces of coating shall be confined to the bottom portion of the crevices only, and shall not extend onto the surrounding steel or plate or onto the outer surface of the rivets or bolts. Pitted steel is excluded from exemption considerations and shall be cleaned in accordance with SSPC-SP10.

If hackles or slivers are visible on the steel surface after cleaning, the Contractor shall remove them by grinding followed by re-blast cleaning. At the discretion of the Engineer, the use of power tools to clean the localized areas after grinding, and to establish a surface profile acceptable to the coating manufacturer, can be used in lieu of blast cleaning.

If the surfaces are prepared using wet abrasive methods, attention shall be paid to tightly configured areas to assure that the preparation is thorough. After surface preparation is completed, the surfaces, surrounding steel, and containment materials/scaffolding shall be rinsed to remove abrasive dust and debris. Non-chlorinated potable water shall be used for all operations. An inhibitor may be added to the supply water and/or rinse water to prevent flash rusting. If a rust inhibitor is proposed, the Contractor shall provide a sample of the proposed inhibitor together with a letter from the coating manufacturer indicating that the inhibitor is suitable for use with their products. The surfaces shall be allowed to completely dry before the application of any coating.

- (c) Condition of Edges/Corners. All existing sharp edges and corners, such as those generated by torch cutting, shearing, milling, and/or drilling shall be rounded to a radius between 1.6 and 3.2 mm (1/16 and 1/8 inch). The inspection of all edges will be tactile and/or visual to assess and document that the edges/corners were appropriately rounded.

- 166. ABRASIVES. Abrasive blast cleaning shall be performed using either expendable abrasives (other than silica sand) or recyclable steel grit abrasives. Expendable abrasives shall be used one time and disposed of. Abrasive suppliers shall certify that the expendable abrasives meet the requirements of SSPC-AB1 and that recyclable steel grit abrasives meet the requirements of SSPC-AB3. On a daily basis, the Contractor shall verify that recycled abrasives are free of oil contamination by conducting oil content tests in accordance with SSPC-AB2.

All surfaces prepared with abrasives not meeting the SSPC-AB1, AB2, or AB3 requirements, as applicable, shall be solvent cleaned or low pressure water cleaned as directed by the Engineer, and re-blast cleaned at the Contractor's expense.

When metallic abrasives are used, extra care shall be given to recovering all of the abrasive from joints, horizontal surfaces, and hard to access areas to prevent rust bleed caused by fugitive abrasives.

167. SURFACE PROFILE (HOLD POINT). The abrasives used for blast cleaning shall have a gradation such that the abrasive will produce a uniform surface profile of 38 to 114 microns (1.5 to 3.5 mils). If the profile requirements of the coating manufacturer are more restrictive, the Contractor shall advise the Engineer and comply with the more restrictive requirements. For recycled abrasives, an appropriate operating mix shall be maintained in order to control the profile within these limits.

The surface profile produced by the Contractor's surface preparation procedures shall be determined by replica tape and spring micrometer at the beginning of the work, and each day that the surface preparation is performed. Areas having unacceptable measurements shall be further tested to determine the limits of the deficient area. The replica tape shall be attached to the daily report.

When unacceptable profiles are produced, work shall be suspended. The Contractor shall submit a plan for the necessary adjustments to insure that the correct surface profile is achieved on all surfaces. The Contractor shall not resume work until the new profile is verified by the QA observations and the Engineer confirms that the profile is acceptable.

168. SOLUBLE SALT REMEDIATION (HOLD POINT). The Contractor shall implement surface preparation procedures and processes that will remove chloride from the surfaces. Surfaces that may be contaminated with chloride include all areas that are subject to roadway spray or run-off.

Methods of chloride removal shall be determined by the Contractor. If steam or water cleaning methods of chloride removal are utilized over surfaces where the coating has been completely removed, and the water does not contact any lead containing coatings, the water does not have to be collected. The Contractor shall provide the proposed procedures for chloride remediation in the Surface Preparation/Painting Plan.

Upon completion of the chloride remediation steps, the Contractor shall use Latex cell (collection) - Quantab® Chloride Titrator Strip (testing), or approved equal, to test representative surfaces that were previously rusted (e.g. pitted steel) for the presence of remaining chlorides. Remaining chloride levels shall be no greater than 7 ug/square centimeters (0.2 millionth ounce/0.155 square inches) as read directly from the surface without any multiplier applied to the results. The testing must be performed, and the results must be acceptable, prior to painting each day.

A minimum of 5 tests per 93 square meters (1000 square feet), or fraction thereof completed in a given day, shall be conducted at project start up. If any results of greater than 7 ug/square centimeters (0.2 millionth ounce/0.155 square inches) are detected, the surfaces shall be re-cleaned and re-tested at the same frequency. If acceptable results are achieved on three consecutive days in which testing is conducted, the test frequency may be reduced to 1 test per 93 square meters (1000 square feet) prepared each day, provided the chloride remediation process remains unchanged. If unacceptable results are encountered, or the methods of chloride remediation are changed, the Contractor shall resume testing at a frequency of 5 tests per 93 square meters (1000 square feet). The

Engineer shall approve of the actual location of the chloride tests prior to them being performed.

Following successful chloride testing, the chloride test areas shall be cleaned. Commercial Grade Power Tool Cleaning can be used to clean the test locations when the specified degree of cleaning is in accordance with SSPC-SP10.

169. SURFACE CONDITION PRIOR TO PAINTING (HOLD POINT). Prepared surfaces shall meet the specified degrees of cleaning immediately prior to painting, and shall be painted before rusting appears on the bare surface. If rust appears or bare steel remains unpainted for more than 8 hours, the affected area shall be prepared again at the expense of the Contractor. Galvanized surfaces shall be painted within the time frames specified in ASTM D 6386.

All loose paint and surface preparation cleaning residue on bridge steel surfaces, scaffolding and platforms, containment materials, and tops of abutments and pier caps shall be removed prior to painting.

When lead paint is being disturbed, cleaning shall be accomplished by HEPA vacuuming.

The quality of surface preparation and cleaning of surface dust and debris must be accepted by the Engineer prior to painting. The Engineer has the right to reject any work that was performed without adequate provision for QA observations to accept the degree of cleaning. Rejected coating work shall be removed and replaced at the Contractor's expense.

170. GENERAL PAINT REQUIREMENTS. Paint storage, mixing, and application shall be accomplished according to these specifications and as specified in the paint manufacturer's written instructions and product data sheets for the paint system used. In the event of a conflict between these specifications and the coating manufacturer's instructions and data sheets, the Contractor shall advise the Engineer and comply with the most restrictive requirements.

Unless noted otherwise, if a new concrete deck or repair to an existing deck is required, painting, except primer painting of surfaces exposed by deck repairs, shall be done after the deck is placed and the forms have been removed.

- (a) Paint Storage and Mixing. All paint shall be stored according to the manufacturer's published instructions, including handling, minimum and maximum temperatures, and warming as required prior to mixing. All coatings shall be supplied in sealed containers bearing the manufacturer's name, product designation, batch number, and mixing/thinning instructions. Leaking containers shall not be used. The paint shall be stored in a secure fireproof location.

Mixing shall be performed according to the manufacturer's instructions. Thinning shall be performed using thinner provided by the manufacturer, and only to the extent allowed by the manufacturer's written instructions. In no case shall thinning be permitted that would cause the coating to exceed the local Volatile Organic Compound (VOC) emission restrictions. For multiple component paints, only complete kits shall be mixed and used. Partial mixing is not allowed.

The ingredients in the containers of paint shall be thoroughly mixed by mechanical power mixers according to the manufacturer's instructions, in the original containers before use or mixing with other containers of paint. The paint shall be mixed in a manner that will break up all lumps, completely disperse pigment, and result in a uniform composition. Paint shall be carefully examined after mixing for uniformity and to verify that no unmixed pigment remains on the bottom of the container. Excessive skinning or partial hardening due to improper or prolonged storage will be cause for rejection of the paint, even though it may have been previously inspected and accepted. Manufacturer recommended induction/sweat-in times and temperature of mixed coatings shall be observed.

Multiple component coatings shall be discarded after the expiration of the pot life. Single component paint shall not remain in spray pots, paint buckets, etc. overnight and shall be stored in a covered container and remixed before use.

The Engineer reserves the right to sample and test field paint (individual components and/or the mixed material). If the paint does not meet the product requirements due to excessive thinning or because of other field problems, the coating shall be removed from that section of the structure and replaced as directed by the Engineer at no additional cost to the Agency.

- (b) Application Methods. Unless prohibited by the coating manufacturer's written instructions, paint may be applied by spray methods, rollers, or brushes. If applied with conventional or airless spray methods, paint shall be applied in a uniform layer with overlapping at the edges of the spray pattern.

The painters shall monitor the wet film thickness of each coat during application. The wet film thickness shall be calculated based on the specified dry film thickness using the solids by volume of the material and the amount of thinner added.

When brushes or rollers are used to apply the coating, additional applications may be required to achieve the specified thickness per layer.

Galvanizing or primer coatings shall be applied to all bare metal surfaces. All disassembled faying surfaces shall receive a primer coating that will remain in the assembled connection. Unless otherwise specified in the Contract Documents, all faying surfaces shall be either galvanized to meet the Class C slip coefficient value of not less than 0.33 as specified by AASHTO or coated with an inorganic zinc rich primer to meet the Class B slip coefficient value of not less than 0.50 as specified by AASHTO.

- (c) Re-coating and Film Continuity (Hold Point for Each Coat). Paint shall be considered dry for re-coating according to the re-coat time/temperature/humidity criteria provided in the manufacturer's instructions and when an additional coat can be applied without the development of film irregularities such as lifting, wrinkling, or loss of adhesion of the under coat. If surfaces are contaminated, washing shall be accomplished prior to intermediate and final coats. Wash water does not have to be collected unless the water contacts existing lead containing coatings.

Painting shall be done in a neat and workmanlike manner. Each coat of paint shall be applied as a continuous film of uniform thickness free of defects including, but not limited to, runs, sags, overspray, dry spray, pinholes, voids, skips, misses, and shadow-through. Defects such as runs and sags shall be brushed out immediately during application.

171. PAIN T SYSTEM. The paint system listed below shall be applied as specified.

The paint manufacturer's relative humidity, dew point, and material, surface, and ambient temperature restrictions shall be provided with the submittals and shall be strictly followed. Written recommendations from the paint manufacturer for the length of time each coat must be protected from cold or inclement weather (e.g. exposure to rain) during the drying period shall be included in the submittals. Upon acceptance by the Engineer, these times shall be used to govern the duration that protection must be maintained during drying.

The manufacturer's technical representative shall be on the project for the first 48 hours of paint application and after that time be available to be back on project with 24 hour notice.

Unless indicated otherwise in the Contract, the Contractor shall apply an additional stripe coat to edges, rivets, bolts, crevices, welds, and similar surface irregularities. The stripe coat shall be applied by brush such that the coating is thoroughly worked into or on the irregular surfaces, and shall extend onto the surrounding steel a minimum of 25 mm (1 inch) in all directions. The purpose of the stripe coat is to build additional thickness and to assure complete coverage of these areas. The stripe coat is in addition to the requirement for penetrating sealer.

The stripe coat shall not be applied as part of the application of the full coat. The stripe coat shall be applied and dried separately according to the manufacturer's recommended drying times. Also, the stripe coat shall be color contrasting to the full coat.

In the case of the prime coat, the full coat shall be applied first to protect the steel, followed by the stripe coat after the full coat has dried. In the case of the intermediate or top coat, the stripe coat shall be applied first and allowed to dry before applying the intermediate or top coat.

Amine blush is a residue that can form on newly applied epoxy coating films under certain conditions. Amine blush often appears as a yellowish milky and/or a blotchy residue on the coating surface and is a deterrent to the adhesion of subsequently applied coating layers. If amine blush is detected, the Contractor shall provide the Engineer with written procedures from the coating manufacturer for complete removal prior to the application of additional coating layers.

- (a) System 1 - OZ/E/U - for Bare Steel. System 1 shall consist of the application of a full coat of organic (epoxy) zinc-rich primer, a full intermediate coat of epoxy, and a full finish coat of aliphatic urethane. Stripe coats of the prime and intermediate coats shall be applied. The film thicknesses of the full coats shall be as follows, as measured in accordance with SSPC-PA2:



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- (1) One full coat of organic zinc-rich primer between 90 and 125 microns (3.5 and 5.0 mils) dry film thickness. The prime coat shall be tinted to a color that contrasts with the steel surface.
  - (2) One full intermediate coat of epoxy between 75 and 100 microns (3.0 and 6.0 mils) dry film thickness. The intermediate coat shall be a contrasting color to both the first coat and the finish coat.
  - (3) One full finish coat of aliphatic urethane between 65 and 100 microns (2.5 and 4.0 mils) dry film thickness. Finish coat color shall be according to Contract Documents.
- (b) System 2 - G/E/U - for Bare Steel. System 2 shall consist of hot-dipped galvanized steel and the application of a full intermediate coat of epoxy, and a full finish coat of aliphatic urethane. Stripe coats of the intermediate coat shall be applied. The film thicknesses of the full coats shall be as follows, as measured in accordance with SSPC-PA2:
- (1) One full intermediate coat of epoxy between 75 and 100 microns (3.0 and 6.0 mils) dry film thickness. The intermediate coat shall be a contrasting color to both the first coat and the finish coat.
  - (2) One full finish coat of aliphatic urethane between 65 and 100 microns (2.5 and 4.0 mils) dry film thickness. Finish coat color shall be according to Contract Documents.

The total dry film thickness for this system, exclusive of areas receiving the stripe coats, shall be between 140 and 200 microns (5.5 and 10.0 mils).

172. REPAIR OF DAMAGE TO NEW COATING SYSTEM AND AREAS CONCEALED BY CONTAINMENT. The Contractor shall repair all damage to the newly installed coating system and areas concealed by the containment/protective covering attachment points, at no cost to the Agency. If the damage extends to the substrate and the original preparation involved abrasive blast cleaning, the damaged areas shall be prepared to Power Tool Cleaning - Commercial Grade. If the original preparation was other than blast cleaning or the damage does not extend to the substrate, the loose, fractured paint shall be cleaned to Power Tool Cleaning - Modified SP3.

The surrounding coating at each repair location shall be feathered for a minimum distance of 40 mm (1½ inches) to achieve a smooth transition between the prepared areas and the existing coating.

If the bare steel is exposed, all coats shall be applied to the prepared area. If only the intermediate and finish coats are damaged, the intermediate and finish coats shall be applied. If only the finish coat is damaged, the finish coat shall be applied.

Repair of the galvanizing surface shall meet the requirements of ASTM A 780.

All Hold Points and specifications are applicable to the repair of damaged areas and areas concealed by containment.

Damage to vehicles and property caused by Contractor painting and/or surface preparation activities shall be the Contractor's expense.

173. SPECIAL INSTRUCTIONS.

- (a) At the completion of the work, the Contractor shall stencil the painting date and the paint code on the bridge. The letters shall be capitals, not less than 50 mm (2 inches) and not more than 75 mm (3 inches) in height.

The stencil shall contain the following wording: "PAINTED BY (Insert the name of the Contractor)" and shall show the month and year in which the painting was completed, followed by the appropriate code for the coating material applied, all stenciled on successive lines.

Coding shall be as follows:

CODE LA (for full lead abatement)

CODE Z1 (for Paint System 1)

CODE Z2 (for Paint System 2)

This information shall be stenciled on the cover plate of a truss end post near the top of the railing, or on the inside face of an outside beam/girder near one end of the bridge, or at some equally visible surface near the end of the bridge, as designated by the Engineer.

- (b) All surfaces painted inadvertently shall be cleaned immediately to the satisfaction of the Engineer.

- (c) The paint used for stenciling shall be compatible with the top coat.

The cost of all work outlined above for stenciling is included in the cost of painting, and no extra compensation will be allowed.

174. GREASE COATING. A coat of grease rustproofing compound shall be uniformly applied by brush or spray at an approximate rate of 1.86 m<sup>2</sup>/3.785 liters (20 ft<sup>2</sup>/gal) after the final coat of paint has fully cured. A fully cured condition has occurred when a thumbnail driven into the coating surface does not leave an impression and when a thumb firmly pushed against the surface and twisted does not disturb the coating.

Unless otherwise specified in the Contract, the length of beams or girders to be grease coated (at the ends) shall be equal to the end depth of the member, e.g. a 1.2 m (4 feet) deep girder shall be coated from its end to a length of 1.2 m (4 feet) from the point of bearing, including all exposed surface areas of attachments or members within this distance.

Surfaces adjacent to areas being grease coated shall be protected against over-spray. Non-metallic and stainless steel surfaces shall not be coated.

INSTALLATION OF MULTI-DUCT CONDUIT SYSTEM  
FOR THE ACCOMMODATION OF FIBER OPTIC CABLE

175. DESCRIPTION. This work shall consist of furnishing all labor, tools, equipment, and materials necessary for the installation of a complete conduit system. The conduit system will span the entire length of the bridge and each 4 inch conduit shall terminate in a separate underground vault located in the median at either end of the bridge (4 vaults total, 2 at each end). The system shall consist of two (2) multi duct conduit, each of which shall contain four (4) 1-1/4 inch ducts. Galvanized rigid metal conduit shall be used on all above grade structures. Schedule 40 PVC conduit shall be used in direct burial applications. All bridge attachments shall be connected or mounted to the stringers of the bridge, attachments to the bridge deck will not be accepted. All attachments shall be field bolted to the stringers of the bridge, welding of attachments will not be accepted. All attachment materials shall be constructed of galvanized steel. Conduit system shall not exceed 170 degrees in total bend radius between vaults.
176. GENERAL.
- (b) The Galvanized Steel multiduct conduit shall be a nominal 4 inches in diameter outer conduit with four, 1-1/4 inch preassembled inner ducts. The outer conduit shall use threaded connector and the inner ducts shall use a bell and spigot type connection.
  - (c) The inner ducts, and any spacers used internally, shall be all dielectric.
177. CONDUIT.
- (178) The outer conduit shall be 4 inch Galvanized Steel conduit, suitable for exposed installation, and shall conform to UL 6, and ASA C-80.1. The conduit shall be manufactured from milled steel tubing with a wall thickness similar to Schedule 40 pipe. The conduit shall be hot-dipped galvanized inside and out throughout its entire length and the threads shall be galvanized. Minimum weight of galvanized coating shall be one ounce per square foot.
  - (b) The inner duct assembly shall consist of four HDPE color coded ducts. Each duct shall have a minimum inside diameter of 1-1/4 inch. The four ducts shall be preassembled in the factory and inserted into the outer conduit. Each duct shall have a minimum inside diameter of 1.26 inches and a minimum wall thickness of 0.07 inches. The four ducts shall be preassembled in the factory and inserted into the outer conduit. The inner ducts shall have a minimum burn through time of 90 minutes based upon Bellcore's Technical Reference TR-NWT-000356 Coefficient of Friction Test.
  - (178) IThe conduit system shall provide mechanisms to ensure that the conduit expansion and contraction stresses are normalized.
  - (178) Internal spacers shall be factory installed to hold the inner ducts in proper spacing and alignment. Spacers shall be molded from a high impact plastic, and be factory certified to withstand all handling pressures and stresses.

- (178) External spacers for the support of the conduit on a structure and separation of conduits on a structure shall be fabricated from galvanized steel (such as Uni-Strut), and be factory certified to withstand all handling pressures and stresses.
- (178) The conduit shall be designed to provide for connecting (coupling) one complete section of conduit assembly to the next section by use of a threaded end on the outer conduit and gasketed bell joint on one end of each of the four inner ducts, and a spigot end at the other end of the inner ducts. The conduit sections shall be designed to assemble spigot into bell for the inner ducts and by threaded type connector for the outer conduit.
- (178) The seals at the outer conduit and the inner ducts shall be anti-reversing.
- (178) The coupling shall be manufactured from electro-galvanized steel shall be factory assembled, and shall be supplied with lead-ins to facilitate assembly.
- (178) Each complete conduit section shall be identically keyed to provide for proper alignment of the inner ducts.
- (j) Conduit couplings shall be provided to couple the following conduit combinations:
  - 178. HDPE to HDPE inner conduit
  - 178. PVC to Galvanized steel outer conduit
  - 178. Galvanized steel to Galvanized steel
- (k) Special termination kits shall be provided by the conduit manufacturer for terminating the conduit in manholes and junction boxes. The kits shall provide for a water tight seal of conduit to structure wall and between inner ducts and outer ducts.
- (l) Complete conduit sections, including outer conduit and inner ducts, shall be manufactured in 10 foot sections.
- (m) Complete conduit rigid bend sections, including outer conduit and high temperature burn though resistant inner duct, shall be manufactured, and shall be complete with bell and spigot on the inner ducts. The outer conduit rigid metallic sweep elbows shall conform to UL 6.

178. COLOR CODING AND LABELING.

- (179) Inner ducts shall be distinguishable from each other by color coding. The entire duct shall be colored by industry standard coloring additive to the duct material, not by an external applied coloring.
- (b) The outer duct shall have a longitudinal print line that denotes, "Install This Side Up", to allow for the proper alignment of the inner ducts.

179. VAULTS.

- (a) Submit Manufacturer's drawings and specifications.
  - 1. The contractor may propose alternate designs upon approval of the Engineer. Vaults must be design by a Registered Professional Engineer.
  - 2. Drawings shall bear the seal of a Registered Professional Engineer and will not deviate from the functional dimensions shown on the plans.
- (b) Vaults shall be precast concrete with H20 rating.
- (c) Provide fiber vaults that have the cover frames cast separately from the vault structure, and are removable and replaceable.
- (d) Supply Type IV-PC Fiber Optic and Utility Vaults with a hinged metal lid for unpaved areas.
- (e) Provide hinged metal lids that are double-doored (split) and double hinged.
- (f) Provide a lid that operates freely over 180 degrees.
- (g) Provide a lid with drop handles for easy opening.
- (h) Provide a neoprene gasket between the hinged lid and the vault frame.
- (i) Provide lids with a grounding lug with  $\frac{1}{2}$  - 13 NC female threads on the underside of the lid.
- (j) Furnish metal lids that have a non-skid diamond pattern or similar surface that has a raised pattern of at least 3/32 inch high.
- (k) Provide lids for all fiber vaults that are marked, "VAOT FIBER OPTIC" using a minimum 3 inch high letters with 1/8 inch line thickness.
  - 1. Form letters by engraving, casting, stamping, or with a neat weld bead.
  - 2. Lid Access Points: recessed steel pull slots or holes to allow removal or opening of the lid with a hook or lever.

180. BACKFILL.

- (a) Place 12 inches of free draining granular backfill borrow under vaults.
- (b) Hand tamp granular backfill borrow or approved native soil around the fiber vault lid.
- (c) Match the top 6 inches to the composition, density, and elevation of the surrounding surface.
- (d) Level the top of fiber vault and grade accordingly.

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- (e) Field-locate fiber vaults to avoid steep slopes and low lying locations with poor drainage.

181. MAINTENANCE MARKERS.

- (a) Furnish and install Fiber Glass Maintenance Marker posts for each box location:

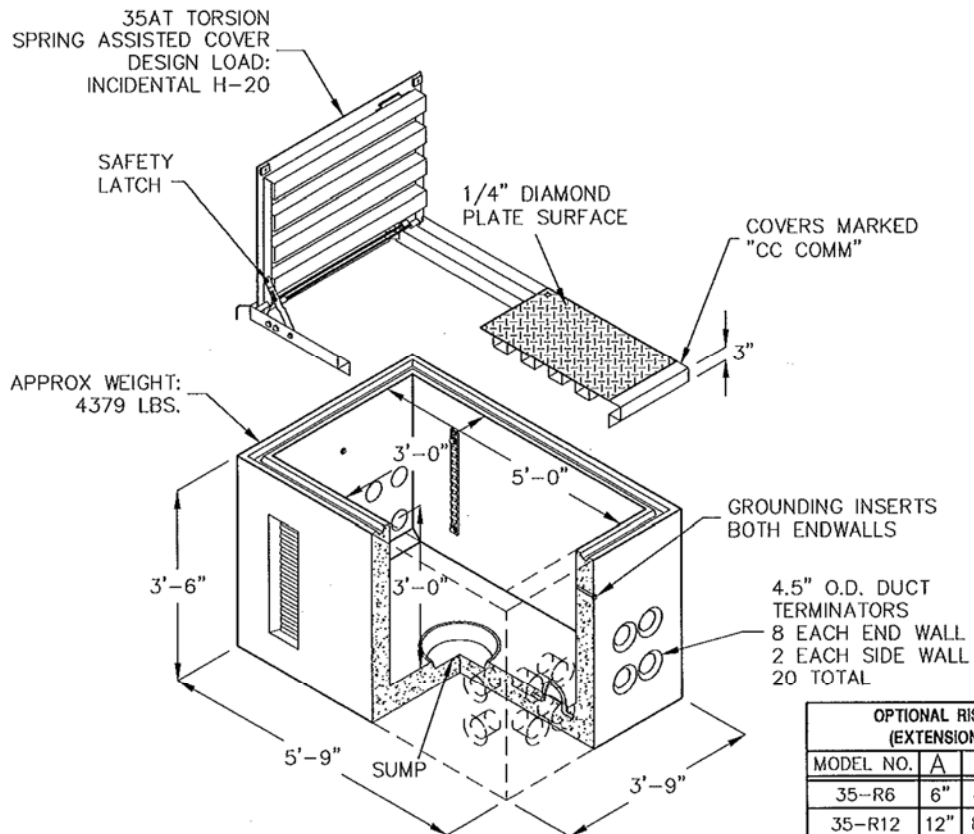
1. 4 inch wide by 6 ft tall
2. 4 ft exposed after installation
3. Orange in color
4. Labeled "VAOT FIBER OPTIC."

Vaults shall be Jensen UV35TA or equal.

*CC Communications*  
 TELEPHONE • LONG DISTANCE • INTERCITY • WIRELESS

## UV35TA PULLBOX

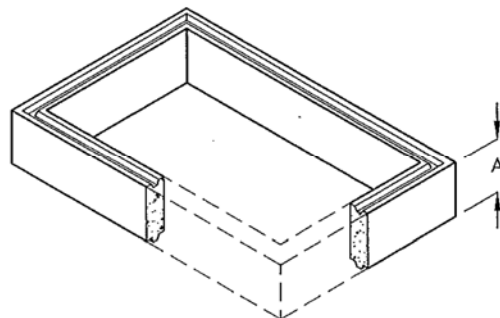
3'-0" X 5'-0" X 3'-0" I.D.  
 (NOMINAL DIMENSIONS)  
 CC COMMUNICATIONS



KNOCKOUTS, DUCT TERMINATORS, RACKING, PULLING IRONS, ETC. PER CURRENT CC COMMUNICATIONS SPECIFICATIONS.

DESIGN LOAD: INCIDENTAL H-20 TRAFFIC SUITABLE FOR OFF STREET LOCATIONS AWAY FROM HIGH DENSITY TRAFFIC.

FOR COMPLETE DESIGN AND PRODUCT INFORMATION CONTACT JENSEN PRECAST.



CONCRETE SEGMENTAL CONSTRUCTION

182. GENERAL. The work specified in this Specification consists of constructing structural cast-in-place concrete segments and elements (pier tables, closures and portions cast-in-place on falsework). The final structure shall conform to lines, grades and design dimensions shown on the plans and with the provisions of these Specifications. This work also includes reinforcing steel embedded in the segments.

Except as modified herein, all construction and materials shall conform to the Vermont Agency of Transportation's (Agency) 2011 Standard Specifications for Construction (hereinafter referred to as the "Standard Specifications").

All materials, details, and procedures shall be as specified herein. Casting of segments shall not begin until review of the Working Drawings, required computations, the post-tensioning system, and concrete mix design, including a hot and cold weather mix design, has been completed and approved by the QAM and released for construction by the VTrans Resident Engineer. The segments shall be match-cast and have multiple shear keys along the length of the web and alignment keys along the length of the top and bottom slab. Continuous typical longitudinal mild reinforcing shall be provided through all segment joints.

Block-outs for post-tensioning anchorages that extend to either the interior or exterior surfaces of the slabs are not permitted.

All materials shall be new.

The engineer who has sealed the design calculations for falsework and specialized construction equipment (traveling form system) shall physically inspect the construction equipment and certify to the QAM in writing that the equipment has been fabricated and installed in accordance with the released for construction drawings and calculations, prior to its use. The engineer shall sign and seal the letter of certification.

183. DEFINITION OF TERMS. The following terms apply to segmental bridge construction:

- (a) Segment: Refers to a modular section of the superstructure and/or substructure consisting of a certain cross-section shape and length as detailed on the plans.
- (b) Segment Joint: A full width and depth joint between consecutive concrete placements of an individual element shape.
- (c) Construction Joint: A joint within an individual section or element, created by consecutive concrete placements.
- (d) Element: The various components of the box girder superstructure that consists of segments cast-in-place with the traveling form system, pier tables over the piers cast-in-place on falsework/formwork, closures that are cast-in-place between cantilever tips, and that portion of the box girder superstructure that is cast-in-place on falsework/formwork.
- (e) Balanced Cantilever (Construction): A method whereby superstructure segments are sequentially constructed, in



cantilever, alternately on either side of the pier to a point where a closure is cast-in-place with an adjacent span or cantilever tip.

- (f) Casting Curve or Casting Curve Geometry: The curve of casting geometry that has to be followed in the casting form in order to achieve the theoretical bridge profile and alignment after all the final structural and time dependent (creep and shrinkage) deformations have taken place. The casting curve is a combination of the theoretical bridge geometrical profile grade, alignment and the camber.
- (g) Camber: The amount by which the concrete profile at the time of casting must differ from the theoretical geometric profile grade in order to compensate for all structural dead load, post-tensioning, all long-term time dependent deformations (creep and shrinkage) including all the intermediate construction stages and effects (the opposite of deflections). For cast-in-place construction, these values must include short and long term deflections of the foundations, piers, bearings, form work, falsework supports and the superstructure elements.
- (h) Construction Elevation: the elevation to which a segment control point is to be at the time the structure is initially self-supported. (This is not necessarily the profile grade but rather the profile grade corrected by the amount and direction of deflections calculated to occur from that stage onwards.)
- (i) Geometry Control: Monitoring the as-built alignment and profile of the cantilever relative to the horizontal alignment and theoretical casting curves, and making the necessary adjustments to conform to construction tolerances during cantilever construction.
- (j) Construction Engineer: The Design-Builder's Engineer that provides construction engineering, geometry control, erection engineering, Working Drawings, and other services necessary for the construction of the structure.
- (k) Supplier: The firm or organization responsible for supplying certain proprietary hardware or equipment for incorporation in the structure.
- (l) Plans: Approved design plans prepared by and sealed by the Design Manager and released for construction by VTrans.

184. WORKING DRAWING REQUIREMENTS. The Design-Builder shall prepare detailed Working Drawings in accordance with RFP Part 2, which include, but are not necessarily limited to, the following.

- (a) Segment Fabrication System. Complete details of the proposed segment fabrication system, including casting forms, travelers, operational details and geometry control observation and measuring system. The casting form details may be provided by presenting a generalized drawing with a table of specific dimensions for the various segment forms.
- (b) Segments, Pier Tables, Closures, Portions Cast-in-Place on Falsework. Detailed integrated working drawings of the superstructure segments, pier tables, closures and portions cast-in-place on falsework. These submittals shall include, but not

necessarily limited to, the following:

- (1) Fully and accurately dimensioned views showing the geometry of each segment including projections, recesses, notches, openings, blockouts, and the like.
  - (2) Details of mild reinforcing steel to scale clearly shown as to size, spacing, location, splices and bends, cover, clearances in conformance with AASHTO as well as special reinforcing steel required for the performance of the anchors but not shown on the plans.
  - (2) Details of inserts or holes including any necessary localized strengthening and the materials and methods to fill and finish such holes.
  - (4) The size, type, and components of the post-tensioning system to be used. Indicate duct type, size and support spacing. Locate all relevant details and grout inlets/outlets.
  - (5) Fully integrated drawings to scale and in sufficient detail to show the relative positions of all the items that are to be embedded in the concrete, and their embedment depth. Such embedded items include the prestressing ducts, vents, grout tubes, anchorage reinforcement and anchorage hardware, reinforcing steel, anchor bolts, drainage assemblies, utility conduits, inserts, and other such items. Such drawings shall be adequate to ensure that there will be no conflicts between the planned positions of any embedded items and that the concrete cover and all clearances are adequate and allow for proper placement and consolidation of concrete.
- (c) Post-Tensioning System. Complete details for the post-tensioning ducts, anchorage hardware, any additional anchorage reinforcing, and inserts to be embedded in the segments.
- (d) Casting Manual. A manual for the casting and geometry control of the segments prepared in accordance with the information provided in the plans or as required by this Specification. (This is referred to as the "Casting Manual").

Casting curves prepared by and in accordance with the casting and construction methods, schedule, loads, and material properties proposed by the Design-Builder. The casting curves shall be of sufficient accuracy to allow the determination of control point settings for accurately casting the segments with the use of the traveling form system. The control points shall be located near the segment joints. The casting curves shall account for the bending and axial shortening of the substructure elements.

Preparation of the casting curve shall recognize all deviations from straight line and deformations due to the final required alignment, self-weight, future superimposed dead loads, construction loads, post-tensioning stresses including secondary moments, creep and shrinkage. Each casting curve submittal shall be accompanied by all information (loads, casting and construction schedules, material properties, etc.) considered in its development. In developing casting curves, deformations due to creep and shrinkage and the concrete modulus of elasticity shall be

computed using the recommendations of CEB-FIP Model Code for Concrete structures. CEB-FIP stands for Comité Euro-International De Béton-Fédération Internationale De La Précontrainte.

Preparation of casting curves is dependent upon the construction sequence and schedule. Thus, if the Design-Builder proposes a change to a construction procedure that was previously approved, he shall develop a new casting curve in the same manner as required for the original casting curve. With submittal of a revised casting curve, the Design-Builder shall include a proposed method(s) and location(s) for transitioning between the current curve(s) in use and the submitted curve(s). Preparation of casting curves shall be done at no additional cost and considered incidental to the contract.

- (e) Construction Manual. A manual for the detailed step-by-step construction of the segments including all intermediate procedures relating to any construction equipment, falsework, movement of equipment, counterweights, support jacking, stressing of temporary post-tensioning bars, closure operations including any partial stressing across the closure during concrete curing, main post-tensioning tendon sequences, stressing loads and tendon elongations, construction elevations, the field survey and alignment control methods to be employed for setting the initial and subsequent segments and any other relevant operations. (This is referred to as the "Construction Manual")

The detailed step-by-step procedure for construction of segments shall include the casting sequence including all intermediate procedures relating to any construction equipment, falsework, stripping of forms, movement of equipment, counterweights, and support jacks. Stages for which theoretical positions of control points are to be computed shall include the segment in place prior to applying post-tensioning and the segment with post-tensioning applied.

The theoretical position shall be computed taking into consideration:

- (1) Effect of formwork/falsework deformations.
- (2) Effects of construction dead and live load.
- (3) Effects of post-tensioning.
- (4) Effects of creep and shrinkage.
- (5) The required final profile of the roadway as shown in the plans.

The procedure shall also include a method for measuring and recording the elevations and alignment of all control points at each stage of construction.

The Design-Builder shall prepare a new construction procedure at any time that he proposes to deviate from the sequence of schedule of construction contained in an approved construction procedure under which he is operating.

- (f) Field Survey and Construction Control. Field survey and alignment control methods to be employed for casting segments are the sole responsibility of the Design-Builder. One (1) copy of the field survey records shall be provided to the QAM in a timely manner to allow review prior to the Design-Builder's use of the information.
- (g) Construction Equipment. Complete details covering equipment to be used to support and cast the segments, pier tables, closures, and portions cast-in-place on falsework; details related to access of post-tensioning stressing equipment; construction methods to be used; the sequence of construction and all loads to be imposed on any portion of the permanent structure by the construction equipment.
- (h) Calculations. Design calculations prepared under the direction of, and signed and sealed by, a Professional Engineer registered in the State of Vermont shall be submitted for any construction equipment including travelers, falsework, shoring and other temporary construction which may be required to accomplish the work.

Design calculations prepared under the direction of, and signed and sealed by, a Professional Engineer registered in the State of Vermont shall be submitted to show that the loads imposed on the permanent structure during construction will not adversely affect the structural adequacy of the permanent structure, nor exceed allowed stresses during the construction process.

All submittals listed above shall be prepared by and sealed by the Design Manager or Construction Engineer (except for fully integrated Working Drawings) as appropriate. Any revision of materials, components, construction methods or sequencing indicated on the plans and/or previously released for construction Working Drawings shall be prepared and sealed by the Design Manager. No work shall begin on any item covered by the Working Drawings until final review and approval by the Design Manager and Release for Construction by the Agency.

185. QUALITY CONTROL. The Design-Builder is responsible for all quality control for the casting of segments, closure joints/segments and that portion of the superstructure cast-in-place on falsework. The Design-Builder shall include Concrete Segmental Construction Quality Control as a section of his overall Construction Quality Control Plan as defined in RFP Part 2. The plan shall clearly define the QC procedures, QC personnel, frequency of QC activities, remedial actions if required and other items that are needed in a detailed QC Plan.

The Design-Builder shall provide the QAM with copies, on a daily basis, of all quality control reports, documents and material certifications related to superstructure casting. This information shall include but is not limited to, pre and post pour casting reports, concrete batching and delivery tickets and any other information requested by the QAM. The Design-Builder shall also provide the QAM with copies of all reports related to the production of concrete supplied for the superstructure. This information shall include, but is not limited to, cement certifications, coarse and fine aggregate delivery tickets, admixture delivery tickets and certifications, equipment calibration and certification reports and any other QC testing activities as required by the approved QC Plan.

All QC activities related to the superstructure casting shall be performed

at a frequency greater than or equal to that specified in the Standard Specification or these Special Provisions. The Design-Builder shall be responsible for the sampling and testing of fresh concrete to be used for the superstructure. Further, the Design-Builder shall be responsible for the molding, curing and testing of concrete compression test cylinders. All activities, equipment and facilities related to the molding, curing and testing of concrete compression test cylinders shall be provided and maintained by the Design-Builder.

186. CONCRETE. All concrete shall conform to the Standard Specifications. The proposed mix design shall be submitted to the Design Manager for review and approval and release for construction by VTrans. Gradation for coarse aggregate utilized in the superstructure concrete shall be such that 100 percent passes a one-inch sieve. Screenings will not be permitted as a substitute for silica sand in concrete for the superstructure. The class of concrete for use in each element of construction shall be as shown in the plans. The minimum compressive strength at 28 days shall not be less than 6,000 psi. Concrete used to cast pier tables, closures, and portions cast-in-place on falsework shall be the same mix design as that used to cast the segments. Calcium nitrite shall be used in the superstructure concrete at a minimum rate of 4 gallons per cubic yard.
187. REINFORCING STEEL. All reinforcing steel shall conform to the Project Specifications.
188. POST-TENSIONING SYSTEM. Post-tensioning hardware components to be embedded in or external to superstructure segments shall conform to the requirements of the Special Provision for Post-Tensioning System. Components are not interchangeable and shall comply with the details of the approved Working Drawings.
189. HIGH PERFORMANCE GROUT FOR BEARING PLINTHS. High performance grout for bearing plinths, if used, shall be High Performance Grout that is ready-to-use, non-shrink, non-corrosive, non-metallic and achieves a high early strength (5,000 psi in one day). High Performance Grout shall meet the requirements of ASTM C 1107 Specification for Non-Shrink Grout, Grades A, B, & C and requirements of ASTM C 827 and be submitted to the Agency for review and approval.
190. EPOXY GROUT FOR TEMPORARY HOLES. Epoxy grout for repairing temporary holes in the deck shall be as specified herein.
  - (a) The material shall produce a low exothermic reaction and have flow and fill characteristics suitable for machine base plate applications. The material will be extended with the aggregate supplied by the manufacturer. Mix with the full aggregate loading.
  - (b) The material shall be factory pre-proportioned including factory supplied aggregate. Deliver products in original containers with manufacturer's name, date of manufacture, product identification label and batch numbers. Materials shall be within the manufacturer's recommended shelf life. Store and condition the product in full compliance with manufacturer's recommendations.
  - (c) The epoxy grout plus aggregate mix shall meet or exceed the specified physical properties stated herein as determined by the following standard ASTM test methods.

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| Property  | Test Value                       | Test Method |
|---|----------------------------------|-------------|
| Compressive Strength, Cubes (7 day cure at 77°F)  | > 10,000 psi                     | ASTM C579B  |
| Tensile Strength at 7 days                        | > 2,000 psi                      | ASTM C307   |
| Flexural Strength (7 day cure at 77°F)            | > 3,600 psi                      | ASTM C 580  |
| Modulus of Elasticity (7day cure at 77°F)         | < 2,100,000 psi                  | ASTM C580   |
| Coefficient of Thermal Expansion at 74 to 210° F  | < 20 x 10 <sup>-6</sup> in/in/°F | ASTM C531   |
| Peak Exotherm, Specimen, 12 x 12 x 3 in.          | < 150°F                          | ASTM D2471  |
| Slant Shear at 7 days (Bond Strength to Concrete) | > 3,000 psi                      | ASTM C882   |
| Thermal Compatibility                             | 5 Cycles Passed                  | ASTM C884   |
| Linear Shrinkage at 7 days                        | 0.025%                           | ASTM C531   |
| Flowability and Bearing Area                      | 90% Contact area                 | ASTM C1339  |
| Gel Time, Specimen 12 x 12 x 3 in.                | < 4:00 (hr.)                     | ASTM D2471  |

191. HIGH MOLECULAR WEIGHT METHACRYLATE (HMWM). The methacrylate system shall be a three component system consisting of:

- a. Methacrylate monomer
- b. Cumene hydroperoxide (CHP) initiator
- c. Cobalt promoter.

The initiator and promoter shall be approved by the monomer manufacturer.

The methacrylate material shall meet the following physical and performance requirements:

| Physical Properties of Methacrylate Resin |                                    |
|---|------------------------------------|
| Viscosity (Brookfield RVT)                | 14-20 cps at 50 rpm                |
| Density (ASTM D1481)                      | 8.5 - 9.0 lb/gal at 77°F           |
| Flash Point (ASTM D93)                    | >200°F (Pensky Martens CC)         |
| Order                                     | Low                                |
| Bulk Cure Speed                           | 3 Hours @ 73°F (max)               |
| Surface Cure                              | 8 Hours @ 73°F (max)               |
| Gel Time (ASTM D2471)                     | 60 minutes (max)                   |
| Tack Free Time                            | 5 Hours (max) (at 72°F and 50% RH) |
| Compressive Strength (AASHTO T106)        | 6,500 psi (min)                    |
| Tensile Strength (ASTM C307)              | 1,300 psi (min)                    |
| Shear Bond Adhesion (ASTM C882)           | 600 psi (min)                      |
| Wax Content                               | 0%                                 |

The monomer shall have a shelf life of no less than 12 months and shall be no more than 8 months old at the time of application. Provide each container shipped to the job site with the following information on a manufacturer's label: manufacturer's name, product name, lot or batch number, date of production, and drum serial number. Identify the catalysts by their generic classification and provide the date of manufacture.

192. DESIGN OF FORMS. The design and engineering of the traveling forms as well as their construction shall be the responsibility of the Design-Builder. Traveling forms shall be inspected by the QAM prior to each use. Forms that are worn, damaged or otherwise unacceptable, as determined by the QAM, shall be repaired to the QAM's satisfaction before the casting of any segment will be authorized. Any segment cast in forms unacceptable to the QAM may be subject to rejection and removal. Forms that will not produce segments complying with the specified casting tolerances shall not be used until corrections are made.

Forms shall be mortar-tight and sufficiently rigid to prevent distortion due to the pressure of the concrete and other loads incidental to the concrete operations, including vibration. Forms shall be capable of casting the segments as shown in the plans.

All exposed surfaces of each element of the structure shall be formed with materials that will produce a similar surface texture, color and appearance for all concrete surfaces. The form surfaces of forms for the superstructure segments shall be made of steel. The metal used for forms shall be of such thickness that the forms will remain true to shape. All bolt and rivet heads shall be countersunk. Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together and to allow form removal without injury to the concrete.

193. PREPARATION FOR CASTING. The inside surfaces of forms shall be cleaned of all dirt, mortar and foreign material. Forms shall be properly coated with form oil prior to each use. The form oil shall be commercial quality form oil or other equivalent coating that will permit the ready release of the forms and will not discolor the concrete. Form oil shall be applied such that the finished surface of each segment is uniform in color as compared to the previously and subsequently cast segments. Form oil shall be applied such that none is deposited on the reinforcement in the forms.

Care shall be exercised in setting up forms for casting segments. All materials to be encased within the concrete of the segment shall be properly positioned and supported. Provisions for all projections, recesses, notches, openings, block-outs and the like shall be made in accordance with the approved Working Drawings.

It is the intent of this specification that the segments, pier tables, closures and portions cast-in-place on falsework have a uniform appearance of concrete without stains and blemishes. After the casting of the first pier table and first five (5) segments, the Design Manager, Construction Manager, QAM and VTrans Resident Engineer will jointly inspect the appearance of the members. If they are not uniform in appearance, the Design-Builder shall propose methods to repair these members and to produce subsequent members that are uniform in appearance. Only bridge members that have a uniform appearance will be accepted for incorporation into the structure. This joint inspection is to be conducted thereafter on a mutually agreed upon schedule but at least twice a month during superstructure construction.

Where sections of forms are to be joined, a maximum offset of 1/16 inch for flat surfaces and 1/8 inch for corners and bends will be permitted.

The Design-Builder shall accurately survey forms before and after each concrete placement for the purpose of monitoring settlements and distortion in shape. These surveys will be submitted to the QAM. If any

settlements or distortions are of great enough magnitude to interfere with achieving the required tolerances, casting with these forms shall be discontinued until the problem is corrected.

194. GEOMETRY CONTROL.

- (a) Casting Manual. Before commencing casting operations, the Design-Builder shall submit his proposed method of geometry controls for the casting operation. This submittal shall be in the form of a "Casting Manual" and shall include, but not be limited to, the following information: a detailed narrative of the geometry control theory, a detailed narrative of the step-by-step geometry control procedure, detailed calculation forms, and a set of sample calculations. This submittal shall include all measuring equipment, procedures, location of control points to be established on each segment and qualifications of personnel who will carry out geometry control.

The casting manual shall cover all geometry control operations necessary for casting and shall be in agreement with the Design-Builder's chosen methods of casting, including construction survey, elevation and alignment control. Casting shall not commence without approval of the geometry control method.

- (b) Personnel. The Design-Builder shall provide personnel experienced in casting control to carry out the daily tasks of geometry control. Geometry control shall be under the direct responsible charge of a Professional Engineer or Land Surveyor registered in the State of Vermont.
- (c) Instruments and Control. Provision shall be made to protect instruments from construction activities and to minimize the effects of sun, wind and temperature variations on the accuracy of readings.
- (d) Segment Hardware and Measurements. Immediately after casting of a segment is complete, the length of the segment along the line of each web shall be measured, recorded and compared with theoretical values. References for horizontal and vertical control shall be established as follows:
  - (1) Horizontal Control. A wire stirrup on the horizontal control line shall be placed at both ends of the segment. A line not more than 0.001 feet in width shall be scribed in a permanent manner into each stirrup. Wire stirrups shall be stainless steel or plastic, and shall be approved by the Design Manager and Resident Engineer.
  - (2) Vertical Control. A flat head bolt, with a pin point center-punched in the head shall be set approximately flush with the surface of the concrete over each web at the leading end of the segment. The bolts shall be stainless steel or plastic, and shall be approved by the Design Manager and Resident Engineer.
- (e) Requirements for Casting of Superstructure Segments.
  - (1) Instruments used to measure elevations shall be precision levels equipped with parallel plate micrometers or a digital



level, capable of obtaining first order control and invar rods with center point bases.

- (2) Instruments used to make horizontal measurements shall be a centerline sighting theodolite and centerline offset measuring tool.
- (3) Elevation and centerline-offset measurements shall be observed to an accuracy of  $\pm 0.001$  feet.
- (4) The set-up position of the form before casting shall be independently determined by two observers. Casting shall not begin until these surveys agree within the following tolerances:

Elevation:  $\pm 0.005$  feet on any control point.

Horizontal:  $\pm 0.01$  feet on a segment centerline offset.

- (5) After-cast observations shall be independently determined by two observers. They shall be checked until the independent observations agree within the following tolerances:

Elevation:  $\pm 0.005$  feet on any control point.

Horizontal:  $\pm 0.01$  feet on a segment centerline offset.

195. EMBEDDED ITEMS. Reinforcing steel shall be fabricated and placed in accordance with the approved Working Drawings and as required herein. No reinforcing steel shall be cut or removed to permit proper alignment of tendon ducts or other embedded items without approval by the Design Manager and Resident Engineer. Any bar that cannot be fabricated to clear a post-tensioning tendon shall be replaced by additional bars, with adequate lap lengths, according to methods approved by the Design Manager.

In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/2 inch, or 1/12 of the spacing between bars, whichever is less. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch. The top and bottom clear cover of reinforcing steel shall be within 1/4 inch of the clear cover limits dimensioned on the plans. The end and edge clear cover of the reinforcing steel shall be within one inch of the clear cover limits dimensioned on the plans.

In the event of a conflict between post-tensioning ducts and reinforcing bars, the post-tensioning shall generally have priority and the position of the bars shall be adjusted in a manner approved by the Design-Manager. Any such conflicts shall be brought to the attention of the Design Manager for resolution and approval.

Embedded ducts for tendons shall be positioned accurately (within 1/4 inch) in respect to their vertical, linear and transverse position within each segment. Positive methods shall be utilized to assure that ducts will not be displaced during casting. Ducts that act to change the alignment of tendons shall be marked so that proper positioning is assured prior to casting and can be verified after casting.

Ducts internal to the concrete section shall be properly aligned when passing from segment to segment and from the segment to a cast-in-place closure.

Where an external tendon enters or exits the face of the concrete at deviation blocks and diaphragms except at anchor locations, a small blockout shall be provided. The blockout shall be approximately 2 inches larger in diameter or overall dimensions than the tendon duct and have a depth equal to at least the minimum prescribed concrete cover dimension shown in the plans.

Intermediate support of ducts internal to the concrete shall be provided in accordance with the Special Provision for Post-Tensioning System. Adequate spacing shall be provided for the duct supports. After installation in the forms, the end of the ducts shall be sealed to prevent entry of water and debris. Following each pour of concrete, the Design-Builder shall ensure that all empty ducts are unobstructed, free of water and debris, and undamaged.

Tie-down and other traveler/form support devices incorporated in segments shall be adequate to distribute the stresses without damage to the segment.

Drain/vent pipes shall be located in the bottom slab of each segment adjacent to the webs (on both sides) and at the high side of each bottom post-tensioning anchor block or internal barrier. Drain/vent pipes shall be 2 inch diameter and may be formed using permanent PVC pipes or corrugated plastic ducts set flush with the top of the bottom slab. Provide a small drip recess,  $\frac{1}{2}$ " by  $\frac{1}{2}$ " around the bottom of pipe inserts and vermin guards for all drains and holes.

Flexible barriers shall be provided at each expansion joint segment to seal openings and prevent birds from roosting on the box end ledges. Barriers shall be UV and weather resistant and easily replaced.

The anchoring devices for transverse top slab post-tensioning shall be recessed so that the ends of the prestressing steel and all parts of anchoring devices will be at least two inches inside the end surface of the segment.

Transverse post-tensioning anchors shall be placed into the form before the concrete is cast. Temporary block-outs to allow for later installation of anchors shall not be allowed. Local bursting, grid or multiple U-bar reinforcement shall be accurately located and securely fixed in position.

Ducts and connection devices for future conduits shall be placed into the segments at the locations shown on the approved Working Drawings.

196. PLACING CONCRETE. Concrete shall not be deposited into forms until the entire set-up of the forms, reinforcements, ducts, and anchorage has been thoroughly inspected and checked (witness point). The placing of concrete shall not proceed until the rate of producing and placing concrete is sufficient to complete the proposed pour and finishing operations within the scheduled time. Furthermore, experienced concrete finishers shall be available where required for finish work and all necessary finishing tools and equipment are on hand at the site of the work and are in satisfactory condition for use.

During conveying, placement, and initial set, the concrete shall be protected against undue drying or rise/fall in temperature and inclement weather. The placing of concrete shall not proceed until adequate

measures, and protection, are available to prevent weather damage during conveying and placement. This includes shelter from rain intrusion during conveying, placement and curing.

Special care shall be taken to plan the sequence of placing concrete so as to assure that voids do not occur within the concrete in areas where air is likely to be entrapped within the forms or in areas where flow of the plastic concrete is constrained by embedded items.

Concrete shall not be dropped more than four feet, unless confined by closed chutes or pipes. Formwork shall not be considered as chutes unless the formwork is sloped at an angle of at least 4:1 vertical to horizontal. Care shall be taken to prevent segregation when discharging concrete into the forms. Care shall be taken to fill each part of the form by depositing the concrete as near to the final position as possible. After the discharge of individual concrete loads into the forms, concrete shall not be bodily moved from place to place within the forms by mechanical vibrators or other similar equipment.

Concrete shall be placed in horizontal layers not more than 24 inches thick except as hereinafter provided. Each layer shall be placed and consolidated before the preceding layer has taken initial set. Each layer shall be so consolidated as to avoid the formation of a construction (cold) joint with a preceding layer before it has taken an initial set.

For segments, concrete shall first be placed in the central portion of the bottom slab between the inside edges of the internal web forms, leaving a narrow gap of 6 to 12 inches for inspection and consolidation of the bottom corners when the next load is placed in the webs. Concrete shall then be placed in each web to connect and consolidate with the concrete already placed in the bottom slab. Then place concrete in the remainder of the webs in lifts not exceeding 24 inches at a time up to the top of the webs but not into the slab over the webs. Care shall be exercised when consolidating the webs to ensure that voids are not created by forcing concrete to flow down to the bottom slab. After the webs are full, concrete shall be placed in the top slab: first from one wing tip to the top of the adjacent web, then from the other wing tip to the adjacent web, finally in the middle of the top slab between webs. However, placement of bridge deck slab concrete on superelevation and/or grade that exceeds 2 percent shall progress from the low point upward. All top slab concrete shall be thoroughly consolidated and blended with previous lifts while passing over the top of the webs.

Immediately after all the concrete has been placed and consolidated, all accumulations of mortar splashed upon the remaining exposed reinforcement and surfaces of forms shall be removed before the concrete takes its initial set. Care shall be taken when cleaning reinforcing steel to prevent damage to or breakage of the concrete-steel bond.

Placing equipment shall be of a size and design to permit placing of concrete within a workable time period to avoid cold joints or blemishes between successive lifts. Placing equipment shall be cleaned as necessary at the end of each operation or workday and, just prior to reuse, shall again be checked and cleaned of hardened concrete and foreign materials.

If belt conveyors are utilized, they shall be horizontal or at a slope which will not cause excessive segregation or loss of ingredients. Concrete shall be protected against undue drying or rise in temperature. An approved device shall be used at the discharge end of a belt conveyor

to prevent aggregate segregation. Mortar shall not be allowed to adhere to the return length of the belt. Concrete shall be discharged into a hopper or through a baffle.

No construction joints will be permitted within a segment except as detailed on the approved Working Drawings.

197. CASTING TOLERANCES. The following tolerances apply to the fabrication of superstructure segments, pier tables, closures, and portions cast-in-place on falsework:

|                          |                 |
|--------------------------|-----------------|
| Width of Web             | + 0.25 inches   |
| Depth of Bottom Slab     | + 0.1875 inches |
| Depth of Top Slab        | + 0.1875 inches |
| Overall Depth of Segment | + 0.1875 inches |
| Overall Width of Segment | + 0.25 inches   |
| Length of Segment        | + 0.375 inches  |
| Diaphragm Dimensions     | + 0.375 inches  |

The top slab surfaces shall not deviate from a plane at any location by more than 0.025 inches per foot and not exceed a total of 0.25 inches

Dimensions from segment to segment shall be adjusted so as to compensate for any deviations within a single segment so that the overall dimensions of each completed component will conform to the dimensions shown on the plans.

198. CONSTRUCTION GEOMETRY TOLERANCES. Elevations and alignment of segments shall be carefully measured at each stage of construction with instruments capable of providing the degree of accuracy necessary to assure satisfying construction tolerances. Any deviation from the table of elevations and alignment prepared by the Design-Builder shall be corrected so as to prevent accumulation of deviations using a method submitted by the Design-Builder and reviewed by the QAM. If measured elevations deviate from the table of elevations, the QAM or the VTrans Resident Engineer have the right to suspend further construction of superstructure elements until the cause of the deviation is discovered and a corrective action plan is submitted and approved. No additional payment or time will be allowed to the Design-Builder as a result of this suspension for unacceptable construction geometry deviation. Readings shall be taken within one hour of sunrise.

The following tolerances shall apply to construction of superstructure segments:

- (a) The maximum differential between the outside face of adjacent segments shall not exceed 3/16 inch.
- (b) Transversely, the angular deviation from the theoretical slope difference between two successive segment joints shall not exceed 0.001 radians.
- (c) Longitudinally, the angular deviation from the theoretical slope change between two successive segments shall not exceed 0.003 radians.
- (d) The difference in roadway elevation at the connection of two adjacent segments (measured perpendicular to the deck surface) and

across closure joints shall be no greater than 1/8 inch. The Design-Builder is responsible for restoring the roadway surface finish to conform to the specified requirements.

- (e) Dimensions from segment to segment shall be adjusted to compensate for any deviations within a single segment so that the overall dimensions of each completed span conform to the dimensions shown on the plans. The accumulated maximum error should not exceed 1/1000 of the span length for either vertical profile or horizontal alignment.
  - (f) Deviations exceeding construction tolerances listed above shall be corrected in subsequent castings. The method of correcting for such deviations shall be addressed in the casting manual.
199. CONSOLIDATION BY VIBRATION. All concrete shall be consolidated by means of approved vibrators together with any other equipment necessary to perform the work as specified. Vibration of concrete shall conform to the Standard Specifications with the following exceptions.

Internal vibrators shall have a minimum frequency of 8,000 vibrations per minute and sufficient amplitude to consolidate the concrete effectively. At least two standby vibrators in working condition shall be provided for emergency use in case of malfunction. The use of external vibrators for consolidating concrete will be permitted and may be required when the concrete is inaccessible for adequate consolidation. When external vibration is used, the forms shall be constructed sufficiently rigid to resist displacement or damage. Care shall be exercised when placing and consolidating concrete so that reinforcing, post-tensioning ducts, anchorages and any other embedded items are maintained in their proper positions and are not damaged.

200. FINISHING TOP SURFACES OF SUPERSTRUCTURE BOX GIRDER SEGMENTS. When the concrete has been placed and vibrated in a section of sufficient width to permit working, the exposed surface shall be struck off level and with a screed such that a slight excess of concrete is carried ahead of the screed to insure filling of all low spots. The screed shall be designed rigid enough to hold true to shape. A hydraulically driven, bare steel tube rotating in the opposite direction of travel may be used if heavy enough to prevent undue distortion.

Longitudinally, the screed shall be moved back and forth across the concrete while one end rests on the upper surface of the form (bulkhead) and the other end on the match-cast segment.

The screed shall be used a sufficient number of times, and at such intervals to produce a uniform surface, true to grade and free of voids. Then, the surface shall be worked to a smooth finish with a long handled wood or metal float of the proper size, or hand floated from bridges over the top slab. After the water sheen has disappeared from the surface of the top slab, but while the concrete is still plastic, the final finish shall be applied to the top slab. The final finish shall be a float finish as described in the Standard Specifications.

Surfaces directly under barriers or rail plinths shall receive a finish that is dense and is roughened to amplitude of approximately 1/8 inch.

Only minimum hand finishing shall be permitted and there shall be no overworking of the top slab. The top slab shall receive a wet cure in

accordance with the Standard Specifications Section 501.

201. REMOVAL OF FORMS. The segment forms shall remain in-place until the concrete has reached the compressive strength required for form removal and the post-tensioning required for form removal has been stressed.

Care shall be exercised in removing the forms to prevent spalling and chipping of the concrete.

202. TEST SAMPLES. Test samples and testing for compressive strength of concrete on each placement of concrete shall be made by the Design-Builder to control the construction activities and ensure adequate strength of these components at various stages of their manufacture and assembly. Test cylinders shall be made from concrete representative of that used to cast the structural component, in accordance with the applicable portion of AASHTO T 22 and T 23, cured in the same manner as the structural components to ensure adequate compressive strength has been achieved in accordance with the design plan requirements for the following conditions:

- (a) Prior to form release and/or applying construction loads to the component.
- (b) Prior to post-tensioning tendons if the component is less than 28 days old.

The test specimens shall be stored in or on the element, in a condition representative of the curing conditions to which the element is exposed. The Design-Builder shall provide sufficient specimens to allow for additional tests as necessary and shall maintain complete records of all testing. The test specimens shall be clearly labeled with permanent markings identifying the representative element.

All activities, equipment and facilities related to the molding, curing and testing of concrete compression test cylinders shall be provided and maintained by the Design-Builder.

203. CURING CONCRETE. It is the responsibility of the Design-Builder to submit a Concrete Curing and Protection Plan for review and Release for Construction by VTrans. The Design-Builder shall include measures to be taken to protect and properly cure the concrete except as specified herein. If the method Released for Construction fails to produce satisfactory results, the Design-Builder shall use other methods or shall alter the method used, so as to provide acceptable segments, at no additional cost to the Agency.

The minimum curing period, comprised of the initial and final curing, shall be ten days or until the concrete has achieved the required 28 day compressive strength as determined by the above test cylinders cured under the same conditions as the segment, whichever is longer. When the ambient temperature is below 35°F, concrete surface temperatures shall be maintained above 50°F during the initial curing period. The initial curing period is defined as the period of time until the concrete has achieved the required compressive strength specified for stressing the post-tensioning and lowering the forms as determined by test cylinders cured under the same conditions as the segment.

- (a) Initial Curing Period. Immediately after placing the fresh concrete, it shall be cured through the initial curing period by one of the following methods. However, membrane curing compound

will not be considered an acceptable alternative for the initial curing period.

- (1) Forms-in-Place Method. For formed surfaces, leave the forms in place without loosening. Cover all exposed concrete surfaces and cure in accordance with Standard Specifications Section 501. Secure all moisture barriers so that wind will not displace them.
- (2) Water Method. All surfaces other than slabs shall be protected from the sun and the whole structure shall be kept wet for the initial curing period. The concrete surface shall be kept moist and cured in accordance with Standard Specifications Section 501.
- (3) Blanket Method. Electrically heated curing blankets or insulation blankets may be used in cold weather to maintain specified curing temperature and to retain moisture in concrete. Blankets shall be lapped (8 inches minimum) and shall be free of holes. Blankets shall be secured at laps and edges to prevent moisture from escaping.
- (4) Steam Method. After placement of the concrete, members shall be held for a minimum four hour pre-steaming period. If the ambient air temperature is below 50°F, steam shall be applied during the pre-steaming period to hold the air surrounding the member at a temperature between 50 °F and 90 °F. When the ambient air temperature is above 50°F, the member shall remain undisturbed in the ambient air for a four hour pre-steaming period.

To prevent moisture loss on exposed surfaces during the pre-steaming period, members shall be covered with a moisture-tight covering as soon as surface finishing is complete or the exposed surfaces shall be kept wet by an approved fog spray. The moisture-tight covering shall be removed just prior to initiating the steam curing. Alternatively, the segment enclosure shall be fully closed and the relative humidity shall be maintained at 95% or higher.

Enclosures for steam curing shall allow free circulation of steam around all surfaces of the segment either formed or exposed and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner as to prevent the loss of steam and moisture. These enclosures may also provide the required weather protection during conveying, placement and curing of the concrete if they are substantial enough to prevent wind and rain damage during the casting operations.

Steam at the jets shall be low pressure and in a saturated condition. Live steam shall not be directed on the concrete, test cylinders, or forms such as to cause localized high temperature. During application of the steam the temperature rise within the enclosure shall not exceed 40°F per hour. The curing temperature shall at no point within the enclosure exceed 150°F and shall be maintained at a constant level for

a minimum period of 12 hours in order to develop the required strength for handling at the time of form removal. The steam curing cycle shall include a gradual cooling period during which the rate of decrease in temperature shall not exceed 40°F per hour. The steam curing cycle shall include the gradual cooling period until the temperature inside the enclosure is within ±20°F of the outside ambient temperature.

The Design-Builder shall provide temperature recording devices to make an accurate, continuous and permanent record of the curing temperature. At least two continuous temperature records per casting machine are required. A copy of the continuous temperature recordings from the casting machines shall be submitted to the Project Collaboration Worksite.

Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.

- (5) Radiant Heat Method. Enclosures for radiant heat curing shall allow free circulation of heat around all surfaces of the segment either formed or exposed. Measures shall be taken as soon as possible after casting to prevent moisture loss on all exposed surfaces.

During application of heat, the temperature rise within the enclosure shall not exceed 40°F per hour. The curing temperature shall at no point within the enclosure exceed 150°F and shall be maintained at a constant level for a minimum period of 12 hours in order to develop the required strength for removal of forms. A gradual cooling period, during which the rate of decrease in temperature in the enclosure shall not exceed 40°F per hour, shall be included in the curing cycle. This cycle shall include the gradual cooling period until the temperature inside the enclosure is within ±20°F of the outside ambient temperature.

The Design-Builder shall provide temperature recording devices to make an accurate, continuous and permanent record of the curing temperature. At least two continuous temperature records per form are required. A copy of the continuous temperature recordings from the forms shall be provided to the QAM.

Control cylinders shall be covered to prevent moisture loss and placed in a location where temperature is representative of the average temperature in the enclosure.

- (b) Final Curing Period. Except for segments cured by the Steam or Radiant Heat Methods, curing of a segment shall continue after the initial curing period, by the application of a membrane curing compound (conforming to the requirements of AASHTO M 148) to all exposed surfaces except the segment face against the bulkhead to be used as the next match-cast face.

An approved, white-pigmented compound shall be used on the top deck surface and an approved, clear compound shall be used on all other exposed surfaces. Curing materials shall be submitted for review



and approval by the Design Manager and released for construction by VTrans. The membrane curing compound shall be of a consistency suitable for spraying at temperatures prevalent at the time of construction operations, and which forms a continuous, uniform film. It shall be free from precipitated matter caused by conditions of storage or temperature. The compound shall be relatively nontoxic.

The membrane curing compound shall remain intact through the minimum curing period specified above for the segment. Under no circumstances shall the concrete surfaces be allowed to dry prior to curing compound application.

Curing compound delivered to the job in drums shall be in the manufacturer's original container, labeled with the manufacturer's name, plant location, grade designation of compound, lot number and quantity. Curing compound delivered in bulk shall be supplied from and delivered to storage tanks designed to provide thorough agitation by means of compressed air. Thorough agitation shall be performed prior to shipment from manufacturer's plant and prior to use at job site.

Membrane curing compound shall be mixed with a mechanically operated mixer immediately before each use to provide uniform consistency. Application shall be in accordance with the manufacturer's recommendations, subject to the rate of application specified herein. The rate of application for membrane curing compound shall be at least one gallon per 150 square feet. If a surface is dry after stripping forms, the concrete shall immediately be thoroughly wet with water and the curing compound applied just as the surface film of water disappears. If curing compound is to be applied by spraying, the sprayer shall be compressor driven and of sufficient size to provide uniform mist. Standby equipment will be required in case of mechanical failure. Hand held pump-up sprayers will be permitted for standby equipment. However, the hand held pump-up sprayers shall not be used except in case of mechanical failure. The membrane curing compound covering shall be continuous, flexible and without defects. Failure to comply with these requirements will result in suspension of further concrete placements until proper control is re-established.

Curing compound shall be applied to create a uniform appearance from one segment to the next. If it is determined by the Resident Engineer that the curing compound creates a visual difference in the color of the segments the exterior surfaces shall be lightly sandblasted to remove the color variation, at no additional cost to the Agency.

204. FINISHED SURFACES. In addition to any Aesthetic Finishes defined in the Technical Proposal, all exterior surfaces of the superstructure concrete that are exposed to view in the finished structure, except for roadway surfaces of the superstructure, will be finished by rubbing with burlap and grout composed of equal parts of cement and clean, sharp sand to produce a smooth surface of uniform color and appearance.
205. DAMAGED OR DEFECTIVE SUPERSTRUCTURE ELEMENTS. It is the intent of this project that each superstructure element be cast with zero defects. The Design-Builder shall inspect each concrete placement visually for evidence of damage or defect immediately after the forms are removed and

bring all such evidence of damage or defect to the attention of the QAM. Elements may be inspected at any time during construction as deemed necessary by the QAM to monitor compliance with this specification. The following procedures shall be used to address damaged or defective elements:

- (a) General. Isolated defects are imperfections or damage that may occur randomly and infrequently. Recurring defects are imperfections or damages of the same general type and nature, which continue to be found in the same general location of the segments at an unacceptable frequency.

As a minimum, the first pier table and first five segments cast will be jointly inspected by the Design Manager, the Construction Manager, the QAM and the VTrans Resident Engineer after removal of the forms. All defects shall be identified and categorized by the QAM during this inspection. The Design-Builder shall examine the defects and document in a non-compliance report:

- (1) The measures to be taken to prevent recurring defects in future castings.
- (2) The method of repair of all defects discovered as a result of the inspection as required herein.

If recurring defects continue following implementation of preventive measures, or as detected at any time during the construction, the QAM will instruct the Design-Builder, in writing, to cease operations producing such defective elements.

The Design-Builder shall examine the defects and propose in writing:

- (1) measures he shall take to prevent recurring defects in future elements and (2) the method of repairing all defects discovered as a result of the inspection as required herein.

- (b) Classification of Damage or Defects. The QAM and VTrans Resident Engineer will determine what constitutes damage or defect, whether the damage or defect is isolated or recurring, and will categorize it according to the following:

- (1) Cosmetic: Cosmetic defects or damages are those which do not affect the ability of the element to resist construction or service loads or reduce the life expectancy of the structure. This category includes superficial discontinuities such as non-structural cracks less than 0.025 inches wide that do not extend to the centerline of reinforcing in non-prestressed elements, small spalls or honeycombed areas, entrapped air pockets (bug holes) or any defect that does not extend beyond the centerline of any reinforcing steel, or to any elements of the post-tensioning system. However, cosmetic defects of other types and causes may also be designated.

Repair of cosmetic or superficial defects shall be made in such a manner that the aesthetics and the structural integrity are restored in accordance with this specification.

- (2) Structural: This includes any defect which will impair the ability of the element to adequately resist construction or service loads or reduce the life expectancy of the structure.

Any defect or damage that extends beyond the centerline of any reinforcing steel or into any component of the post-tensioning system or occurs in the deck portion of the element is considered a structural defect. However, structural defects of other types and causes may also be designated by the Resident Engineer.

Repair of structural defects shall be such that the aesthetics and structural integrity shall be completely restored to a condition to be expected had the defect or damage not occurred.

- (3) Rejectable: These are any defects or damage that will impair the ability of the element to adequately resist service loads or construction loads, or will reduce the life expectancy of the structure and which cannot be successfully repaired such that the structural integrity is completely restored.

Any element with a rejectable defect shall be removed from the work and replaced at no additional cost.

Damaged or defective elements may be rejected by the QAM for the following reasons:

- (a) Failure of Design-Builder to develop an appropriate repair procedure.
  - (b) Failure of the Design-Builder to execute the repair according to the approved procedure.
  - (c) Rejection by the QAM of the proposed repair procedure or repair.
  - (d) Failure of the Design-Builder to provide the required certification or demonstration that the repair was successful and that the defect no longer exists, as required below.
  - (e) Failure of the Design-Builder to eliminate recurring defects.
  - (f) Determination by the QAM that the work or materials used in the work does not meet other requirements of the Contract Documents and is not acceptable.
- (c) Repairs. Repair situations shall be analyzed on a case-by-case basis and repaired only after approval of the repair procedures by the Design Manager and release for construction by VTrans.

Repairs shall be documented with a non-compliance report containing the following minimum information:

- (1) A detailed description and sketch of the defect.
- (2) The magnitude and type of the most critical construction loading condition to which the defective area will be subjected.
- (3) Detailed reinforcement requirements, material types, surface

treatments, curing methods and general repair procedures proposed. The procedure shall clearly indicate those areas required to be repaired before stressing post-tensioning, and those areas to be repaired after stressing post-tensioning.

- (4) Repairs to the segment face may need to be made prior to casting the adjacent, match-cast segments.
- (5) The nondestructive testing method and procedure by which the Design-Builder shall demonstrate that the defect no longer exists and the element has been restored to a condition to be expected had the defect or damage not occurred.

206. CAST-IN-PLACE CLOSURES AND FILLING OF BLOCKOUTS.

- (a) Concrete. Concrete for closure joints, closure segments, cast-in-place segment ribs/wings and filling of blockouts shall comply with the same specifications, compressive strength and criteria as the concrete in the cast-in-place segments, or as approved by the Agency. It shall be carefully placed, consolidated and cured to provide dense, uniform concrete, free from blemish. Casting, curing and finishing shall be in accordance with these specifications, the Standard Specifications and procedures prepared by the Design-Builder, approved by the Design Manager and QAM, and released for construction by VTrans.
- (b) Strength at Transfer (Application of Prestress). The concrete shall reach a minimum required shown on the plans and Standard Specifications prior to stressing any post-tensioning.
- (c) Formwork. Formwork shall be adequately supported to take all loads applied and shall not be removed until the concrete has reached its required strength and the post-tensioning tendons have been stressed (longitudinal and transverse). The formwork and release agent shall be of a type to provide the required surface finish to match that of the cast-in-place segments.
- (d) Closure Beams and Placement. Closure beams at closure placement shall be supported from the box girders on each side of the closure and locked together vertically, longitudinally, and transversely so that the applied concrete closure loads will yield equal deflections to both sides of the closure and maintain the segments relative positions during construction of the closure. Closure beams shall not be removed until the closure concrete has reached its specified strength and longitudinal continuity tendons are stressed. The concrete shall be placed in the closure at a time when the temperature differential between the top and bottom slab is minimum.

207. REPAIR OF TEMPORARY HOLES. Temporary holes in the deck shall be filled with an epoxy grout meeting the requirements of "Epoxy Grout for Temporary Holes" Section above. Immediately before placing the epoxy grout (within 24 hrs.), the concrete surfaces shall be mechanically cleaned and roughened to remove any laitance and expose the small aggregate. Grit blasting or water blasting using a minimum 10,000 psi nozzle pressure is required, unless an inverted cone blockout or a plastic corrugated duct blockout has been used. Surfaces shall be flushed with water and blown dry. The material shall be mixed, placed and cured in strict compliance with the manufacture's recommendations.

After completion of the deck grinding and grooving, repaired holes, block-outs and an area extending 6 inches outside the perimeter of the repair shall be coated with High Molecular Weight Methacrylate (HMWM) meeting the requirements of the "High Molecular Weight Methacrylate (HMWM)" section above. HMWM shall be applied and surplus removed strictly in accordance with the manufacturer's instructions and as follows:

- (1) Use uniformly graded 6-20 (or similar), clean, bagged, blast sand for spreading over the applied polymer on bridge decks and other riding surfaces. Certify that the sand has a maximum moisture content that does not exceed 0.25% and that the maximum amount of dust or other material that may pass through a No. 200 sieve (-200 content) is not greater than 0.75%.

Store the sand at a location that will preserve the above described conditions and characteristics of the sand until applied.

- (2) On the day of application, thoroughly power-sweep the area to be treated to remove all dust, dirt or debris present. On bridge decks and other riding surfaces, use a tractor mounted (or similar) power broom with non-metallic bristles suitable for the intended purpose.

Use a power vacuum after sweeping when sealing cracks on grooved bridge decks. Re-clean the deck as necessary just prior to the application as debris may be blown back onto the work area by adjacent traffic or other means. If present, remove oils and oil based substances from the concrete surface using an approved solvent.

- (3) Provide adequate containment to prevent the sealer material from flowing beyond the designated area of application. Plug any drain holes or openings within the work area. Prevent airborne material from dispersing

208. WATERTIGHT DECKS. After completing all grinding and grooving activities on the riding surface; all segment joints, closures, and deck hole repairs shall be checked to assure every location is watertight. All locations showing evidence of leaks shall be repaired using a High Molecular Weight Methacrylate (HMWM) or epoxy injection.

209. FINAL CLEAN UP. Before final acceptance, the Design-Builder shall clean the interior of the concrete box of all rubbish, excess materials, loose concrete, dirt and debris. The interior of the box girders shall then be swept out. The final clean up shall be performed after all work on the interior of the box girders, including grouting of all tendons and utility work included in the contract, has been completed.

#### POST-TENSIONING SYSTEM

210. GENERAL. The work specified in this Specification shall consist of furnishing, installing, stressing and grouting prestressing steel for concrete segmental bridges in accordance with the requirements of these Specifications. It shall also include the furnishing and installing any appurtenant items necessary for the particular prestressing system used, including but not limited to anchorage assemblies, additional reinforcing bars required to resist stresses caused by anchorage assemblies, ducts, vents, inlets, outlets and grout used for pressure grouting ducts.

Except as modified herein, all construction and materials shall conform to the Vermont Agency of Transportation's (Agency) 2011 Standard Specifications for Construction (hereinafter referred to as the "Project Specifications").

Use of a post-tensioning system is subject to review and approval by the Design Manager and release for construction by VTrans. Only post-tensioning systems of the proper type and size for the tendons shown on the design plans shall be used. Substitution of components from different post-tensioning systems shall not be allowed. Post-tensioning systems shall utilize tendons fully encapsulated in anchorages and ducts. Systems that transfer prestress force by bonding the prestress steel directly to concrete shall not be used. For permanent applications, the use and location of bar couplers is subject to approval by the Design Manager and release for construction by VTrans. Strand or tendon couplers are not permitted.

All post-tensioning material shall be stored in a weatherproof building, shed or container until the time of use.

As used in this Specification, the supplier is the firm or organization responsible for supplying the proprietary post-tensioning hardware and equipment for incorporation in the structure. All components of a post-tensioning system, including steel pipes, shall come from a single supplier. Prestressing steel can be obtained from any supplier.

211. POST-TENSIONING SYSTEMS DEFINITIONS.

- (a) Actual Ultimate Tensile Strength (AUTS): The actual breaking strength obtained in tests of a single representative strand or bar, breaking outside the anchorage. For multi-strand or bar tendons, AUTS equals the AUTS of a single tendon element (strand, bar) times the number of such elements in the tendon. Representative samples must be from the same coil of strands or the same bar from which strands or bars are cut and used in connection efficiency tests. (Reference PTI "Acceptance Standards for Post-Tensioning Systems". See also, "GUTS" and "MUTS".)
- (b) Anchor Nut: The threaded device that screws onto a threaded bar and transfers the force in the bar to the bearing plate.
- (c) Anchor Plate: That part of the anchorage hardware that bears directly on the concrete and by which the tendon force is transmitted to the structure.
- (d) Anchorage Assembly: An assembly of various hardware components that secure a tendon at its ends after it has been stressed and imparts the tendon force into the concrete.
- (e) Anchorage Zone: The general expression for combined general and local zones; see General zone, Local zone.
- (f) Anticipated Set: The wedge set assumed to occur in the design calculation of the post-tensioning forces at the time of load transfer; see Set.
- (g) Bar: High strength steel bars, normally available from 5/8 to 1-

3/4 inch diameter and usually threaded with a very coarse thread.

- (h) Basic Bearing Plate: Flat plate bearing directly against concrete meeting the analytical design requirements. Covered by this definition are square, rectangular, or round plates, sheared or torch cut from readily available steel plate, normally ASTM A36.
- (i) Bearing Plate: Any steel hardware that transfers the tendon force into a structure.
- (j) Confinement Reinforcement: Non-prestressed reinforcement in the local zone. Confinement reinforcement in the concrete ahead of tendon anchorages is limited to the local zone. Confinement reinforcement consists of spirals, orthogonal reinforcing bars, or a combination of both. For basic bearing plates confinement reinforcement is required in that volume of concrete in which compressive stresses exceed acceptable limits for unreinforced concrete as determined by rational analysis. For special bearing plates, confinement reinforcement is system dependent as determined by tests on individual anchorages. Test block reinforcement, in the portion surrounding the special bearing plate and immediately ahead of it, must represent the confinement reinforcement required in the local zone for that particular system.
- (k) Coupler: A device used to transfer the prestressing force from one partial-length prestressing tendon to another. (Strand couplers are not permitted.)
- (l) Duct: Material forming a conduit to accommodate post-tensioned tendon installation and provide an annular space for the grout which protects the prestressing steel.
- (m) Family of Systems: Group of post-tensioning tendon assemblies of various sizes which use common anchorage devices and design. All components within the family of systems are furnished by a single supplier and have a common design with varying sizes.
- (n) General Zone: The region in which the concentrated prestressing force spreads out to a more linear stress distribution over the cross-section of the structural member (Saint Venant Region). It includes the local zone. The general zone extends from the anchorage along the axis of the member for a distance equal to the overall depth of the member. The height of the general zone is equal to the overall depth of the member.
- (o) Guaranteed Ultimate Tensile Strength (GUTS): The tensile strength of the material that can be assured by the Manufacturer. GUTS should not be confused with " $f_{pu}$ " the specified ultimate tensile strength (AASHTO LRFD). (The term "GUTS" has been replaced by two definitions, "MUTS" and "AUTS" by the Post-Tensioning Institute.)
- (p) Local Zone: The local anchorage zone is the volume of concrete surrounding and immediately ahead of the anchorage device where concrete compressive stresses exceed acceptable values for unconfined concrete (concrete without confinement reinforcement). The local zone is defined as a rectangular prism of concrete surrounding the bearing plate and any integral confinement reinforcement. The transverse dimensions of the prism are equal to those of the bearing plate, including any integral confinement

reinforcement, plus the supplier's specified minimum edge covers. The length of the local zone extends over the confinement reinforcement. For anchorage devices with multiple bearing surfaces, the local zone extends over the distance from the loaded concrete surface to the bottom of each bearing surface of the anchorage device plus the maximum dimension of that bearing surface.

- (q) Minimum Ultimate Tensile Strength (MUTS): When measured as a force, for a single strand or bar breaking outside of the anchorage or the multiple of those single strand or bar forces for multi-strand or bar tendons; MUTS is the force equal to the nominal cross-sectional area of strand, or bar, times their nominal ultimate tensile stress. (Reference PTI "Acceptance Standards for Post-Tensioning Systems". See also, AUTS and GUTS.)
- (r) Post-Tensioning: A method of prestressing where tensioning of the tendons occurs after the concrete has reached a specified strength.
- (s) Post-Tensioning Scheme or Layout: The pattern, size and locations of post-tensioning tendons shown by the Design Manager on the Design Plans.
- (t) Post-Tensioning System: An assembly of specific models of hardware, including but not limited to anchorage assembly, local zone reinforcement, wedge plate, wedges, inlet, outlet, couplers, duct, duct connections and grout cap, used to construct a tendon of a particular size and type. The entire assembly must meet the system pressure testing requirement. Internal and external systems are considered independent of one another.
- (u) Prestressing Steel: The steel element of a post-tensioning tendon, which is elongated and anchored to provide the necessary permanent prestressing force.
- (v) Set: The total movement of a point on the strand just behind the anchoring wedges during load transfer from the jack to the permanent anchorages. Set movement is the sum of slippage of the wedges with respect to the anchorage head and the elastic deformation of the anchor components. For bars, set is the total movement of a point on the bar just behind the anchor nut at transfer and is the sum of slippage of the bar and the elastic deformation of the anchorage components.
- (w) Sheathing: General term for the duct material surrounding the prestressing element to provide corrosion protection or conduit for installation.
- (x) Special Bearing Plate: Any hardware that transfers tendon anchor forces into the concrete but does not meet the analytical design requirements. Covered by this definition are devices having single or multiple plane bearing surfaces, and devices combining bearing and wedge plate in once piece. They normally require confinement reinforcement.
- (y) Strand: An assembly of several high strength steel wires wound together. Strands usually have six outer wires wound in long-pitch helix around a single straight wire of a similar diameter.
- (z) Tendon: A single or group of prestressing elements and their



anchorage assemblies, which impart a compressive force to a structural member. Also included are ducts, grouting attachments, grout and corrosion protection filler materials or coatings. The main prestressing element is usually a high strength steel member made up of a number of strands, wires or bars.

- (aa) Tendon Size: The number of individual strands of a certain strand diameter or the diameter of a bar.
- (bb) Tendon Type: The relative location of the tendon to the concrete shape, internal or external.
- (cc) Wedge: A conically shaped device that anchors the strand in the wedge plate.
- (dd) Wedge Plate: The hardware that holds the wedges of a multi-strand tendon and transfers the tendon force to the anchorage assembly (commonly referred to as anchor head).
- (ee) Wire: A single, small diameter, high strength steel wire, typically the basic component of strand.

212. POST-TENSIONING GROUT RELATED DEFINITIONS.

- (a) Admixture: A material, usually a liquid or powder that is used as an ingredient of the cementitious grout and is added immediately before or during mixing.
- (b) Bleed: The autogenous flow of mixing water within or its emergence from, newly placed grout, caused by the settlement of the solid materials within the mass.
- (c) Contamination: Any foreign material found in a tendon at any point in time.
- (d) Cavitation: Air trapped during the grouting process through an irregular flow of grout through the duct. Cavitation can occur when grouts are injected from high points in the tendon profile or by a poor combination of grouting rate and viscosity, in which the grout traps air as it moves to the low point and does not completely fill the duct.
- (e) Final Set: A degree of stiffening of the grout mixture greater than the initial set, indicating the time required for the grout to stiffen sufficiently to resist, to an established degree, the penetration of a weighted test needle.
- (f) Fluidity: A measure of time, expressed in seconds necessary for a stated quantity of grout to pass through the orifice of a flow cone.
- (g) Grout: A mixture of cementitious materials and water with or without mineral additives or admixtures, proportioned to produce a consistency that may be pumped without segregation of the constituents when injected into the duct to fill the space around the prestressing steel.
- (h) Grout Cap: A device which contains the grout and forms a protective cover sealing the post-tensioning steel at the anchorage.

- (i) Grout Pipe: A small diameter pipe usually of plastic attached at a grout vent (inlet or outlet).
- (j) Grout Vent: see "vent".
- (k) Initial Set: A degree of stiffening of the grout mixture less than the final set, indicating the time required for the grout to stiffen sufficiently to resist, to an established degree, the penetration of a weighted test needle.
- (l) Inlet: Tubing or duct used for injection of the grout into the duct (see also "vent").
- (m) Outlet: Tubing or duct to allow the escape of air, water, grout and bleed water from the duct (see also "vent")
- (n) Permeability to Chloride: A measure of the grout's ability to resist chloride ion penetration.
- (o) Port or Grout Port: - see "Vent"
- (p) Potable Water: Water as defined by EPA (Environmental Protection Agency) drinking water standards.
- (q) Pressure Rating: The estimated maximum pressure that water in a duct or in a duct component can exert continuously with a high degree of certainty that failure of the duct or duct component will not occur (commonly referred to as working pressure).
- (r) Recharge: The ability of water, outside of the post-tensioning tendon, to migrate through some path and enter the tendon, usually, through the anchorage or at a breach in the duct.
- (s) Set Time: The lapsed time for the addition of mixing water to a cementitious mixture until the mixture reaches a specified degree of rigidity as measured by a specific procedure.
- (t) Setting: The process, due to the chemical reactions, occurring after the addition of mixing water, which results in a gradual development of rigidity of a cementitious mixture.
- (u) Thixotropic: The property of a material that enables it to stiffen in a short time while at rest, but to acquire a lower viscosity when mechanically agitated.
- (v) Volume Change: The change in volume produced by continued hydration of cement, exclusive of effects of the applied load and change in thermal or moisture content.
- (w) Vent or Grout Vent: An attachment to a duct through which grout is injected (inlet) or released (outlet) - also, a special hole in the anchorage or bearing plate which serves the same purpose. Vents may also be used for inspection of grout by inserting a probe or endoscope.
- (x) Water-Reducing Admixture: An admixture that either increases the slump of freshly mixed grout without increasing the water content or that maintains the slump with reduced amount of water due to factors other than air entrainment.

213. QUALIFICATIONS AND INSPECTIONS. Provide a crew foreman as follows:

Perform all post-tensioning field operations under the direct on-site supervision (crew foreman) of a qualified post-tensioning and grouting technician. The crew foreman for post-tensioning tendons installation and stressing shall have a current PTI Certification, Level 2 Bonded Post-Tensioning - Field Installation/Field Specialist and three years verifiable job-site experience in bridge related post-tensioning operations. The crew foreman for grouting operations shall be an ASBI Certified Grouting Technician with a continuous minimum verifiable experience of three years. All stressing and grouting operations shall be considered witness points and shall be conducted in the presence of the QAM.

214. WORKING DRAWINGS. Working Drawings are required for the integration of the post-tensioning system, reinforcement and other embedded items, including those for the Design-Builder's means and methods of construction for cast-in-place components. The Design-Builder/Supplier shall submit detailed Working Drawings that address the requirements of the design plans and Specifications as follows:

- (a) A complete description of, and details covering, each of the prestressing systems to be used for permanent and temporary tendons, including, but not necessarily limited to:
  - (1) Designation of the specific prestressing steel, dimensions, details and materials for all manufactured components such as anchorage devices, wedges, nuts, bar couplers, ducts, materials and accessories according to the post-tensioning system to be used.
  - (2) Tendon profile and clearances, duct supports, connections of ducts, connections at temporary bulkheads and the like, complying with the plans and the limitations of the selected post-tensioning system.
  - (3) Location and details of grout inlets and outlets, at anchorages, low-points, high-points and other required inspection points and the direction of grouting.
  - (4) Size, type, connections and sealing details for permanent grout caps.
  - (5) Protection system materials and application limits.
  - (6) Details covering assembly and installation of each type of prestressing tendon.
  - (7) Equipment, dimensions and clearances to be used in the prestressing operations.
  - (8) Procedure and sequence of operations for prestressing and securing tendons.
  - (9) Procedure for releasing temporary or permanent prestressing steel elements.
  - (10) Parameters to be used to calculate the typical tendon force

such as; expected friction coefficients, anchor set and prestress steel relaxation curves.

- (b) A table detailing the prestressing jacking sequence, jacking forces and initial elongations of each tendon at each stage of erection for all prestressing.
- (c) Complete details of the anchorage system for prestressing including certified copies of the reports covering tests performed on prestress anchorage devices as required herein, and details for any reinforcing steel needed due to stresses imposed in the concrete by anchorage plates.
- (d) For the operation of grouting prestressing tendons; the materials and proportions for grout, details of equipment for mixing and placing grout and methods of mixing and placing grout (also, locations and details of inlets and outlets for grouting and the direction of grouting).
- (e) Calculations to substantiate the prestressing system and procedures to be used including stress-strain curves typical of the prestressing steel to be furnished, required jacking forces, elongation of tendons during tensioning, seating losses, short-term prestress losses, long term prestress losses, temporary overstress, stresses in prestress anchorages including distribution plates and reinforcing steel needed in the concrete to resist stresses imposed by prestress anchorages. These calculations shall show a typical tendon force and anticipated losses from friction, wobble, anchor set, and anticipated adjustment for thermal affects.

Elongation calculations shall be revised when necessary to properly reflect the modulus of elasticity of strand tendons and/ or friction coefficient as determined from testing as required in Section "Testing of Prestressing Tendons by the Design-Builder" below.

- (f) Details of the apparatus and method to be used by the Design-Builder for the Testing of Prestressing Tendons by the Design-Builder as required by Section "Testing of Prestressing Tendons by the Design-Builder" below.
- (g) Calculations for post-tensioning shall be signed and sealed by a Professional Engineer registered in the State of Vermont.

215. FUTURE TENDONS. Future tendons shall be external, designed so that any one span can be strengthened independently of adjacent spans, and provided in the initial construction (including anchorage and required reinforcing). Also provide caps, in addition to the permanent grout cap, for the anchorages and pipes that will protect, weatherproof and that can be removed when necessary without compromising the intended use. Do not provide the following:

- (1) External plastic duct
- (2) Prestressing strand
- (3) Grout

216. CERTIFICATION OF POST-TENSIONING SYSTEMS. Only post-tensioning systems that are approved by the Design Manager and released for construction by VTrans shall be used. Suppliers seeking evaluation of their post-tensioning systems shall submit test results to the Design Manager and

include certified test reports from an independent laboratory audited by AASHTO Materials Reference Laboratory (AMRL) which shows the post-tensioning system meets all the requirements specified herein.

Plastic components shall be tested in a certified independent laboratory accredited through the laboratory accreditation program of the Geosynthetic Accreditation Institute (GAI) or the American Association for Laboratory Accreditation (A2LA). Certification of test reports may be performed by an independent laboratory located outside the U.S., if the independent laboratory is approved by the Agency. If any component of the post-tensioning system is modified or replaced, the appropriate component test and entire system test, if needed, shall be retested in accordance with the requirements herein and an updated application made to the Agency containing the test reports and revised system drawings. Before attempting to change post-tensioning system components contact the Agency for direction.

Certification test for the plastic shall be performed on a sample formed or cut from the finished product. The QAM shall be provided with certification that the plastic from the duct sample complies with all requirements of the specified cell class, stress crack rating and the specified amount of antioxidant. The supplier shall certify to the QAM that the post-tensioning system being furnished is in compliance with all requirements stated herein.

All components of a system shall be stamped with the suppliers name, trademark model number and size corresponding to catalog designation. Post-tensioning systems consist of an assembly of components for various sizes of strand or bars assembled and pressure tested. Post-tensioning systems will have to be developed and tested for both internal (corrugated duct) and external (smooth duct) applications for those shown on the design plans.

Prior to installing any post-tensioning hardware, the Design-Builder shall furnish the QAM with a certification from the supplier that the post-tensioning system chosen for the project meets the requirements of this provision and is a post-tensioning system approved by the Design Manager and released for construction by VTrans. Upon completion of post-tensioning installation, the Design-Builder shall provide a certification that the post-tensioning system supplied was installed without modification and met the requirements of the contract documents.

The supplier may submit to the Design Manager for consideration, post-tensioning system certifications by other U.S. agencies.

217. PRESTRESSING STEEL.

- (a) Strand: Unless otherwise noted on plans, strand shall be uncoated, Grade 270, low relaxation 7-wire strand conforming to requirements of ASTM A 416 "Standard Specification for Steel Strand, Uncoated Seven Wire Strand for Prestressed Concrete".
- (b) Thread-Bar: Unless otherwise noted on the plans, prestress bars shall be uncoated, Grade 150, high strength deformed thread bars, Type II, conforming to the requirements of ASTM A 722, "Standard Specification for Uncoated High Strength Steel Bar for Prestressing Concrete".

218. THREAD-BAR COUPLERS. Thread-bar couplers shall meet the requirements of ASTM A 722. Bar couplers shall be used only at locations specifically shown on the plans or approved by the Design Manager and released for construction by VTrans. A bar coupler shall develop at least 95 percent of the required ultimate strength of the bar with a minimum elongation of two percent when tested in the unbonded condition measured in 10 foot gauge lengths, without failure of the coupler or the thread-bar.

Testing of couplers by the QAM shall be performed using samples of the prestressing bar to be used on the project. The test specimen shall be assembled in an unbonded state and during testing the anticipated set shall not be exceeded.

Only threaded type couplers shall be used with post-tensioning thread bars. Post-tensioning thread-bars shall be threaded into  $1/2$  the length of the coupler  $\pm 1/4$  inch so that when two bars are mated in a coupler, the length of each bar positively engaged in the coupler shall be half the coupler's length within the acceptable tolerances. No coupling or splicing will be permitted with strands.

219. POST-TENSIONING ANCHORAGES. All prestressing steel shall be secured at the ends by means of permanent type anchoring devices. Prestress anchorages shall develop at least 95 percent of the actual ultimate tensile strength of the prestressing steel, when tested in an unbonded state, without exceeding the anticipated set.

Anchorage shall be tested to meet or exceed the testing requirements of the AASHTO LRFD Bridge Construction Specifications. Written certification shall be provided to the QAM.

The anchorage system shall be so arranged that the prestressing force in the tendon may be verified prior to the removal of the stressing equipment.

For tendon anchorages, the design and furnishing of any reinforcement (in addition to the reinforcement shown on the design plans) which is needed to resist bursting and splitting stresses imposed on the concrete by the proposed anchorage system shall be the responsibility of the Design-Builder.

Prestress anchorage devices shall effectively distribute prestressing loads to the concrete and shall conform to the following requirements:

- (a) Anchorages shall be designed so that the average concrete bearing stress is in compliance with the "AASHTO LRFD Bridge Design Specifications".
- (b) Bending stresses in the plates or assemblies induced by the pull of the prestressing steel shall not exceed the yield point of the material in the anchorage plate when 95 percent of the ultimate strength of the tendon is applied. Nor shall it cause visual distortion of the anchor plate.

The body of the anchorage shall be galvanized in accordance with ASTM 123. Other components of the anchorage including wedges, wedge plate and local zone reinforcement are not required to be galvanized. The bearing surface and wedge plate shall be made from ferrous metal. All permanent anchorages shall be equipped with a permanent grout cap that is vented and bolted to the anchorage.

Wedge plates shall have centering lugs or shoulders to facilitate alignment with the bearing plate.

Permanent anchorages shall have a grout vent suitable for inspection from either the top or front of the anchorage. The vent shall facilitate the dual purpose of grouting or post-grouting inspection by drilling, if necessary, using a straight bit, and by insertion of a probe or endoscope. The geometry of the grout outlets must facilitate being drilled using a 3/8 inch diameter straight bit to facilitate inspection directly behind the anchor plate. Anchorages may be fabricated to facilitate both inspection locations or may be two separate anchorages of the same type each providing singular inspection entry locations.

Trumpets associated with anchorages shall be made from either ferrous metal or polypropylene plastic material conforming to the material requirements of corrugated plastic duct. The thickness of the trumpet at the transition location (choke point) shall not be less than the thickness of the duct. Alternately, the trumpet material may be a polyethylene or polyolefin containing antioxidant(s) with a minimum Oxidation Induction Time (OIT) according to ASTM D 3895 of not less than 20 minutes. Test the remolded finished polyolefin material for stress crack resistance using ASTM F 2136 at an applied stress of 348 psi resulting in a minimum failure time of 3 hours.

220. PERMANENT GROUT CAPS. Anchorages shall be fitted with a permanent grout cap made from polymer or ASTM A 240 Type 316L stainless steel. The resins used in the polymer shall be either nylon Acrylonitrile-Butadiene-Styrene or polyester. For products made from nylon, the cell class of the nylon according to ASTM D 5989 shall be S-PA0141 (weather resistant), S-PA0231 or S-PA0401 (ultimate strength no less than 10,000 psi with UV stabilizer added). The cap shall have an "O" ring or precision fitted flat gasket seal against the bearing plate. The grout cap shall have a grout vent oriented to the top of the cap. Grout caps shall be rated for a minimum pressure of 150 psi. Use ASTM A 240 Type 316L stainless steel bolts to attach the grout cap to the anchorage. Certified test reports of the chemical analysis of stainless steel caps is required for verification.
221. GROUT VENTS (INLETS AND OUTLETS), VALVES AND PLUGS. All inlets and outlets shall be equipped with pressure rated mechanical shut-off valves or plugs. Grout vents at inlets and outlets, valves, vent plugs or caps shall be rated for a minimum pressure rating of 150 psi. Grout vents (inlets and outlets) shall have a minimum inside diameter of 3/4 inch for strand and 3/8 inch for single bar tendons and four-strand duct. Dual mechanical shutoff valves shall be provided when performing vertical grouting.

All permanent attachments to anchorages and ducts for grout vents (inlets and outlets) and threaded vent plugs or caps shall be made of ASTM A 240 Type 316 stainless steel, nylon or polyolefin materials. For products made from nylon, the cell class of the nylon according to ASTM D 5989 shall be S-PA0141 (weather resistant), S-PA0231 or S-PA0401 (ultimate strength no less than 10,000 psi with UV stabilizer added). Products made from polyolefin shall contain antioxidant(s) with a minimum Oxidation Induction Time (OIT) according to ASTM D 3895 of not less than 20 minutes. The finished polyolefin material shall be tested to satisfy stress crack resistance using ASTM F 2136 at an applied stress of 348 psi with a minimum failure time of 3 hours.

Temporary items, not part of the permanent structure, may be made of any suitable material.

Grout vents (inlets and outlets) shall be provided at locations designated on the approved Working Drawings, in accordance with the requirements in this Specification.

222. DUCTS AND PIPES. Only plastic duct, steel pipe or a combination of plastic duct and steel pipe shall be used for ducts. All connectors, connections and components of post-tensioning system hardware shall be sufficiently air and water tight to pass the pressure test requirements herein. Smooth plastic duct shall be used for external post-tensioning systems. Corrugated plastic duct shall be used for all internal post-tensioning systems except where steel pipe is required.

All duct material shall be sufficiently rigid to withstand loads imposed during placing of concrete and internal pressure during grouting while maintaining its shape, remaining in proper alignment and remaining watertight.

The duct system, including splices and joints shall effectively prevent entrance of cement paste or water into the system and shall effectively contain pressurized grout during grouting of the tendon. For internal tendons, duct or pipe splices and joints shall not be located within 6 inches of the match-cast segment joint.

The interior diameter of ducts for single bars shall be at least 1/2 inch greater than the nominal diameter of the bar measured across the upstanding deformations. For prestressing bars with couplers, the entire length of duct shall be 1/2 inch larger than the diameter of the coupler. The interior diameter of ducts for tendons consisting of more than one strand, bar or wire shall be such that the interior area of the empty duct is not less than 2.5 times the net area of the prestressing steel.

Steel pipe and plastic duct may be connected directly to each other when the outside diameters do not vary more than 0.08 inch. Use a reducer when the outside diameters of the steel pipe and plastic duct are outside of this tolerance.

Steel pipe which is embedded in a deviation block, beam or diaphragm shall be bent to a uniform radius along a curve extending between tangent points located three inches inward from the face of the deviation block, beam or diaphragm.

223. SPECIFIC MATERIAL PROPERTIES OF DUCTS, PIPES AND ATTACHMENTS.

(a) Galvanized Rigid Steel Pipe. Steel pipe shall be galvanized steel pipe conforming to the requirements of ASTM A 53, Type E, Grade B. The nominal wall thickness of the pipe shall not be less than that of Schedule 40 unless otherwise specified. The pipe shall be bent so as to accurately conform to the alignment of the tendon taking into consideration the minimum bending radius shown in the design plans or Working Drawings.

(b) Corrugated Plastic Duct (HDPP)

(1) Material for Corrugated Plastic Duct (HDPP). Plastic ducts shall not be made from recycled material. Only seamless



fabrication methods shall be used to manufacture ducts. Corrugated duct shall be manufactured from non-colored, unfilled polypropylene meeting the requirements of ASTM D 4101 "Standard Specification for Polypropylene Plastic Injection and Extrusion Materials" with a cell classification range of PP0340B14541 to PP0340B67884. The duct shall be white in color containing antioxidant(s) with a minimum Oxidation Induction Time (OIT) according to ASTM D 3895 of 20 minutes and contain a non-yellow light stabilizer. Duct shall have a minimum thickness as defined in the following table.

| Duct Shape | Duct Diameter | Duct Thickness |
|------------|---------------|----------------|
| Flat       | any size      | 0.08 inches    |
| Round      | 0.9 inches    | 0.08 inches    |
| Round      | 2.375 inches  | 0.08 inches    |
| Round      | 3.0 inches    | 0.10 inches    |
| Round      | 3.35 inches   | 0.10 inches    |
| Round      | 4.0 inches    | 0.12 inches    |
| Round      | 4.5 inches    | 0.14 inches    |
| Round      | 5.125 inches  | 0.16 inches    |
| Round      | 5.71 inches   | 0.16 inches    |

- (2) Minimum Bending Radius for Corrugated Plastic (HDPP). In addition to the component testing stated herein, the manufacturer shall establish through testing, the minimum bending radius for the duct. The test shall consist of a modified duct wear test as described in Chapter 4, Article 4.1.7 of FIB Technical Report, Bulletin 7, titled "Corrugated Plastic Duct for Internal Bonded Post-Tensioning". The test apparatus shall be identical to the wear test apparatus with the same clamping force as a function of the number of strands in the duct; however, modify the procedure as follows: do not move the sample along the strand to simulate wear; the test duration will be 7 days. Upon completion of the test duration, remove the duct and the minimum wall thickness along the strand path must not be less than 0.06 inch for duct up to 3.35 inches diameter and not less than 0.08 inch for duct greater than 3.35 inches in diameter.
- (3) Testing Requirements for Corrugated Plastic. The duct system components and accessories shall meet the requirements of Chapter 4, Articles 4.1 through 4.1.8 of FIB Technical Report, Bulletin 7, entitled "Corrugated Plastic Duct for Internal Bonded Post-Tensioning" as modified herein. (Copies of the technical report are available from the International Federation of Structural Concrete (FIB) at [fib@epfl.ch](mailto:fib@epfl.ch).)

The requirements in FIB Technical Report, Bulletin 7, are modified as follows: the lateral load resistance test (FIB 4.1.4), shall be conducted without the use of a duct stiffener plate and using a load of 150 pounds for all sizes; wear resistance of duct (FIB 4.1.7) must not be less than 0.06 inch for duct up to 3.35 inches in diameter and not less than 0.08 inch for duct greater than 3.35 inches in diameter; bond behavior of duct (FIB 4.1.8) must achieve 40 % GUTS in a maximum length of 16 duct diameters.

To satisfy the intent of these tests, the results for static pull-out tests from previous projects utilizing identical duct and prestressing steel with similar concrete and grout material may be submitted in lieu of executing new pull-out tests. However, if the previous results are unacceptable or if there is a significant difference in the materials used, then the Design-Builder shall provide results from new tests for this project.

- (4) Corrugated Duct Connections and Fittings. All splices, joints, couplings and connections between ducts and to anchorages shall be made using devices or methods (i.e. mechanical couplers) producing a smooth interior alignment with no lips or kinks. All connections and fittings shall be airtight. Duct tape is not permitted to join or repair duct connections. Connections and fittings shall be made from polyolefin materials containing antioxidant stabilizer(s) meeting the requirements of Section "Grout Vents (Inlets and Outlets), Valves and Plugs" or Section "Specific Material Properties of Ducts, Pipes and Attachments" of this Specification.

(c) Smooth Duct

- (1) Material for Smooth Duct. Smooth ducts shall be manufactured from 100% virgin polyethylene resin meeting the requirements of ASTM D3350 with a minimum cell class of 345464C. Use resin containing antioxidant(s). Perform OIT test on samples taken from the finished product resulting in a minimum Oxidative Induction Time (OIT) according to ASTM D3895 of 40 minutes. Manufacture duct with a dimension ratio (DR) of 17.0 or less as established by either ASTM D3035 or ASTM F714 as appropriate for the manufacturing process used.

Smooth ducts shall meet the minimum pressure rating (working pressure) of 100 psi and shall be manufactured to either of the following Specifications: ASTM D3035 "Standard Specifications for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter" or ASTM F714 "Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter".

- (2) External Smooth Duct Connections. Heat welding techniques shall be used to make splices between sections of plastic duct, in accordance with the duct manufacturer's instructions or connections shall be made with electrofusion coupler or other mechanical couplers meeting the material requirements of this Specification. Ensure all connections have a minimum pressure rating (working pressure) of 100 psi, produce a smooth interior alignment and a connection with no lips or kinks.
- (3) External Steel Pipe Connections. All connections between steel pipes embedded in concrete and plastic ducts shall be made using a mechanical coupler or a circular sleeve made of Ethylene Propylene Diene Monomer (EPDM), having a minimum pressure rating (working pressure) of 100 psi. Use EPDM

materials having 100% quality retention as defined by ASTM D1171 Ozone Chamber Exposure Method B.

EPDM sleeves shall have a minimum wall thickness of 3/8 inch and be reinforced with a minimum of four ply polyester reinforcement. The power seated band and clamps shall be 3/8 inch wide, constructed from 316 stainless steel, and installed on each end of the boot to seal against leakage of grout. The band shall be installed with an 80 to 120 seating force. The band and clamps shall be permanent.

224. SHIPPING AND STORAGE OF DUCTS. Duct shall be furnished with end caps to seal the duct interior from contamination. Ducts shall be shipped in bundles which are capped and covered during shipping and storage. Ducts shall be protected against ultraviolet degradation, crushing, excessive bending, dirt contamination and corrosive elements during transportation, storage and handling. End caps supplied with the duct shall not be removed until the duct is incorporated into the bridge component. Duct shall be stored in a location that is dry and protected from the sun. Storage must be on a raised platform and completely covered to prevent contamination; if necessary, duct shall be washed before use to remove any contamination.

225. MECHANICAL COUPLERS AND HEAT SHRINK SLEEVE REQUIREMENTS. Mechanical couplers shall be made from stainless steel, plastic or a combination of these materials. Plastic resins for couplers shall meet the requirements for plastic ducts. ASTM A240 Type 316 stainless steel shall be used for metallic components.

Heat shrink sleeves shall have uni-directional circumferential recovery and be manufactured specifically for the size of the duct being coupled consisting of an irradiated and cross linked high density polyethylene backing for external applications. Furnish adhesive having the same bond value to steel and polyolefin plastic materials. The heat shrink sleeves shall have an adhesive layer that will withstand 150° F operating temperature, meeting the requirements of the following table:

| Property                          | Test Method        | Minimum Requirements |                      |
|-----------------------------------|--------------------|----------------------|----------------------|
|                                   |                    | Internal Application | External Application |
| Minimum Fully Recovered Thickness |                    | 92 mils              | 111 mils             |
| Peel Strength                     | ASTM D 1000        | 29 pli               | 46 pli               |
| Softening Point                   | ASTM E 28          | 162°F                | 216°F                |
| Lap Shear                         | DIN 30 672M        | 87 psi               | 58 psi               |
| Tensile Strength                  | ASTM D 638         | 2,900 psi            | 3,480 psi            |
| Hardness                          | ASTM D 2240        | 46 Shore D           | 52 Shore D           |
| Water Absorption                  | ASTM D 570         | Less than 0.05%      | Less than 0.05%      |
| Color                             |                    | Yellow               | Black                |
| Minimum Recovery                  | Heat Recovery Test | 33%                  | 23%                  |

226. SYSTEM PRESSURE TEST REQUIREMENTS.

- (a) General. For each family of post-tensioning systems, a pressure test shall be performed on an assembled system as defined herein. For each family of post-tensioning systems two assemblies shall be tested (largest and smallest) from the family. The post-tensioning

assembly shall include at least one of each component required to make a tendon from grout cap to grout cap. If applicable, plastic duct to steel pipe connections and segment duct couplers shall be included.

- (b) Grouting Component Assembly Pressure Test. The anchorage and grout cap shall be assembled with all required grouting attachments (grout tube, valves, plugs, etc.). The opening in the anchorage where the duct connects shall be sealed. Condition the assembly by maintaining a pressure of 150 psi in the system for 3 hours. After conditioning, the assembly must sustain a 150 psi internal pressure for 5 minutes with no more than 15 psi reduction in pressure. For systems using the same anchorages, grout caps and grouting attachments as a previously approved system, the Grouting Component Assembly Pressure Test may include documentation from a previous submittal with written certification that the same components are being utilized in both anchorages.
- (c) External Duct Systems. System pressure testing for external duct requires two additional tests.
  - (1) The anchorage and its connection to the duct/pipe assembly shall be tested in accordance with and meet the requirements for internal duct systems (duct/pipe assembly consists of all components internal to the diaphragm concrete). The assembly shall be tested at 1.5 psi.
  - (2) The duct and pipe assembly consisting of all external duct connections (welded duct splices, duct-pipe, etc.) and a grout vent shall comply with the following test. Condition the assembly by maintaining a pressure of 150 psi in the system for 3 hours. After conditioning, the assembly shall sustain a 150 psi internal pressure for 5 minutes with no more than 15 psi reduction in pressure. The length of the test pipe assembly for the second test is 15 feet.
- (d) Internal Duct Systems. The assembly shall be tested for compliance with the requirements of Chapter 4, Article 4.2, Stage 1 and Stage 2 Testing contained in FIB Technical Report, Bulletin 7, titled "Corrugated Plastic Duct for Internal Bonded Post-tensioning". For bar systems modify the system test length to 15 feet.
- (e) Acceptability from Previous Tests. To satisfy the intent of the above tests, results from previous projects utilizing identical ducts and similar concrete may be submitted in lieu of executing new tests. However, if the previous results are unacceptable or if there is a significant difference in the materials used, then the Design-Builder shall provide results from new tests for this project

227. SAMPLING AND TESTING OF PRESTRESSING ELEMENTS. All testing shall be done in accordance with ASTM Specifications.

The following samples of materials, devices and test certifications shall be furnished.

- (a) Three randomly selected samples, each five feet long, of post-tensioning bar, per manufacturer, per size of bar, per heat of steel, with a minimum of one sample per shipment.

- (b) Three randomly selected samples, each five feet long, of prestressing strand for each size of strand from each shipment, with a minimum number of one sample for every ten reels delivered.
- (c) If bar couplers are to be used, three samples with two specimens each consisting of four foot lengths of the specific prestressing bar coupled with a bar coupler from the materials to be used on the project.
- (d) For each type of duct material intended for the project, one sample, four feet long, from each production lot or per 10,000 linear feet, whichever is greater.

With each sample of prestressing steel strand or bar furnished for testing, a certification shall be submitted to the QAM stating the manufacturer's minimum guaranteed ultimate tensile strength for that sample.

The QAM and VTrans reserves the right to reject any material or device which is determined to be defective or was damaged subsequent to testing.

228. LOTS AND IDENTIFICATION (DESIGN-BUILDER'S QUALITY CONTROL). A "Lot" is that parcel of components as described herein. The manufacturer of prestressing steel and bar couplers shall assign an individual number to each Lot of strand, wire, bar or devices at the time of manufacture. All bars of each size and mill heat of steel and all strands from each manufactured reel, bundle or package shipped to the project shall be identified by tag or other acceptable means as to Manufacturer's Lot number. The Design-Builder shall be responsible for establishing and maintaining a procedure by which all prestressing materials and devices can be continuously identified with the manufacturer's Lot number. Items which at any time cannot be positively identified as to Lot number shall not be incorporated into the work.

Low relaxation strand shall be clearly identified as required by ASTM A 416. Any strand not so identified will not be acceptable.

The Design-Builder shall furnish manufacturer's certified reports covering the tests required by this Specification. A certified test report stating the guaranteed minimum ultimate tensile, yield strength, elongation and composition shall be furnished for each lot of prestressing steel. When requested, typical stress-strain curves for prestressing steel shall be furnished. A certified test report stating strength when tested using the type prestressing steel to be used in the work shall be furnished for each Lot of prestress anchorage devices.

229. TESTING OF PRESTRESSING TENDONS BY THE DESIGN-BUILDER.

- (a) General. The Design-Builder shall perform certain testing of prestressing tendons as specified herein. Re-evaluate the theoretical elongations shown on the Working Drawings using the results of the tests as appropriate and correct as necessary. Revisions to the theoretical elongations are subject to approval by the Design Manager and release for construction by VTrans.
- (b) Tendon Modulus of Elasticity Test. One tendon modulus of elasticity test shall be performed in accordance with the following procedure.

For the purpose of accurately determining the tendon elongations

while stressing, two samples of each size of tendon shall be bench tested to determine the modulus of elasticity prior to stressing the initial tendon.

For the purpose of this test, the bench length between anchorages must be at least 40 feet and the tendon duct at least 2 inches clear of the tendon all around. The test procedure must consist of stressing the tendon at an anchor assembly with a load cell at the dead end. The test specimen shall be tensioned to 80% of ultimate in ten increments and then de-tensioned from 80% of ultimate to zero in ten decrements. For each increment and decrement, the gauge pressure, elongations and load cell force shall be recorded. Elongations shall be noted at both ends and the central 30 feet, measured to an accuracy of  $\pm 1/32$  inch. Elongations shall be corrected for wedge set at the dead end.

The modulus is calculated as follows:

$$E = \frac{P \times L}{A \times d_L}$$

Where;

P = force in tendon,

L = distance between pulling wedges and dead end wedges or exact length in center 30 feet of the tendon.

A = cross sectional area of the tendon based nominal area.

$d_L$  = strand elongation for load P.

If the bench test result varies from the modulus of elasticity used for the shop or working drawings by more than 1%, adjustments shall be made to theoretical elongations.

If the source of prestressing steel changes during the project, additional test series or substantiation from previous projects, not to exceed one per source will be required.

The apparatus and methods used to perform the test must be submitted to the QAM for approval. Tests must be conducted in the QAM's presence.

A test report entitled "Tendon Modulus of Elasticity Test" shall be prepared prior to installing the tendons.

To satisfy the intent of this test, results for modulus of elasticity from a previous project utilizing prestressing steel of the same grade, size, and from the same source may be used in lieu of new testing, unless new testing is directed by the Resident Engineer.

- (c) In-Place Friction Test of Tendons. For tendons in excess of 100 feet long, a minimum of one tendon in a tendon group performing the same function shall be tested in place. Functional tendon groups are cantilever tendons, continuity tendons, draped external tendons or continuous profiled tendons passing through one or more spans, etc. The selected tendon will represent the size and length of the group of tendons being tested.

The test procedure shall consist of stressing the tendon at an anchor assembly with a load cell or a second certified jack at the

dead end to 80% of ultimate tendon strength in eight equal increments. For each increment, the gauge pressure, elongation and load cell force shall be recorded. Account shall be taken of any wedge seating in both the live end (i.e., back of jack) and the dead end (i.e., back of load cell) and any friction within the anchorages, wedge plates and jack as a result of slight deviations of the strands through these assemblies. For long tendons requiring multiple jack pulls with intermediate temporary anchoring, an accurate account shall be kept of the elongation at the jacking end allowing for intermediate wedge seating and slip of the jack's wedges.

If elongations or dead end forces fall outside a  $\pm 7\%$  range compared to the anticipated elongations or dead end forces, reasons shall be sought and detailed calculations made to confirm that the final tendon forces are in agreement with the approved Plans.

In reconciling theoretical and actual elongations and forces, the value of the expected friction and wobble coefficients shall not be varied by more than  $\pm 10\%$ . Significant shortfall in elongations is indicative of poor duct alignments and/or obstructions. Corrections or compensations for such elongations shall be made in a manner proposed by the Design-Builder, subject to review and approval by the Design Manager and release for construction by VTrans.

One successful friction test for each tendon group is required for the project.

If there are irreconcilable differences between forces and elongations, or other difficulties during the course of routine stressing operations, additional in-place friction tests may be required.

The apparatus and methods used to perform the test must be submitted for approval. Tests must be conducted in the QAM's presence.

Test reports of the "In-Place Friction Test" shall be submitted to the QAM within two weeks after successful installation of the tested tendon.

## 230. GROUT MATERIALS AND PROPERTIES.

- (a) General. Grout for tendons shall consist of portland cement and mineral admixtures for partial cement replacement, other specified or approved admixtures which impart low water content, flow, fluidity, minimum bleeding, non-shrink and, when necessary, set retarding properties to the grout. Grout shall have enhanced corrosion-resisting properties such as increased resistance to chloride penetration. There shall be no deliberate addition of materials containing chlorides. Grout shall be mixed using potable water.

Only commercial, pre-packaged, cement-based, enhanced, grout mixtures, meeting the requirements of this Specification, shall be used. Grout shall be stored in a location that is both dry and convenient to the work. Storage in the open must be on a raised platform and with adequate waterproof covering to protect the material. On-site storage of grout is limited to a maximum period

of one month.

Post-tensioning grout shall be formulated for proper use in either horizontal, vertical or repair applications. Grout fluidity shall be strictly maintained by production grouting flow-cone testing.

(b) Characteristics of Prepackaged Grouts.

- (1) Cement. Portland cement shall conform to requirements of AASHTO M85 (ASTM C150) Type I or Type II. The cement shall be fresh and not contain lumps or other indication of hydration or "pack set". The Design-Builder shall furnish, for each shipment of cement, a manufacturer's report stating results of tests made on samples of the material taken during production or transfer and certifying compliance with the applicable requirements of AASHTO M85 (ASTM C150).

- (2) Cement Replacement in Prepackaged Grouts. The following cementitious materials may be used for cement replacement in order to enhance the corrosion resisting and durability characteristics of grout used for aggressive environments:

Silica Fume: 0 to 15% replacement by weight of portland cement.

Fly-Ash (Class C or F): 0 to 30% replacement by weight of portland cement.

Slag: 0 to 55% replacement by weight of portland cement.

The water content shall be calculated for the total weight of cementitious material (cement plus replacement material) and expressed as water/cementitious ratio.

- (3) Water. Water shall be potable, clean and free of injurious quantities or substances (chlorides, sulfides, sulfates and nitrates) known to be harmful to Portland cement or prestressing steel. Water shall have chloride, sulfide, sulfate, and nitrate contents not greater than 500, 100, 650 and 13 ppm respectively.

Water used for grouting tendons shall be tested for the chemicals noted above at regular intervals not to exceed 120 days. Water shall be tested at the location where the water is placed into containers for the project. If the water is stored in containers, which might contaminate it (e.g. unlined metal tanks) then the QAM may request that tests be performed on water coming from the storage tanks. The Design-Builder shall provide the QAM with copies of test reports for the stored water.

- (4) Admixtures. Admixtures shall consist of chemicals that impart the following properties when incorporated into the grout mixture. These properties are low water content, good flow, fluidity, minimum bleeding (sedimentation of cement), expansion or non-shrink and, when necessary, increase in setting time. Any admixture containing chlorides, sulphites, fluorides or nitrates shall not be used in the grout. The date of manufacture and shelf life shall be clearly stamped on each container. No admixture shall be used for which the



shelf life recommended by the manufacturer has expired.

- (5) Non-Shrink Properties and Expansion Agents. Grout shall have non-shrink properties. However, gas evolving expansion agents and/or additives containing free aluminum or other components which produce hydrogen, carbon dioxide or oxygen gas shall not be used.
  - (6) Corrosion Inhibitors. Corrosion inhibiting chemical admixtures shall not be used.
  - (7) Chloride Ion Content. All constituent materials shall be such that the acid-soluble chloride ion content of the grout shall not exceed 0.08% by weight of portland cement as measured by ASTM C 1152 "Standard Test Method for Acid-Soluble Chloride in Mortar and Concrete."
- (c) Required Physical Properties of Grout. Prepackaged Grout shall meet or exceed the physical properties listed in Table 1 when mixed, prepared and tested at a normal temperature of 65°F to 78°F in a laboratory approved by the QAM.

Prepackaged grout shall be tested in accordance with the requirements of Table 1. Prior to beginning grouting operations, the Design-Builder shall furnish the QAM with a report detailing the results of all laboratory testing, including the types and number of tests performed, test procedures, results and comparison of results with specified values.

To satisfy the intent of the tests outlined in this Section, results from previous projects utilizing identical grouts may be submitted in lieu of executing new tests; or the prepackaged grout that has previously met the requirements of this Specification as independently certified by a laboratory approved by the QAM. However, if the previous results are unacceptable or if there is a significant difference in the materials used, then results from new tests for this project shall be submitted.

Table 1 - Physical Property Requirements for Prepackaged Grout

| Physical Property                      | Requirement   | Test Method   |
|--|---|---------------|
| Water-Cementitious Material Ratio      | Maximum 0.45  | n/a           |
| Grout Cube Strength                    | Min. 3,000 psi at 7 days<br>Min. 5,000 psi at 28 days             | ASTM C 942    |
| Total Chloride Ions                    | Maximum 0.08% by weight of cementitious material                  | ASTM C 1152   |
| Fine Aggregate (if utilized)           | 99% passing the No. 50 Sieve (300 micron)                         | ASTM C 136*   |
| Volume Change @<br>24 hours<br>28 days | 0.0% to + 0.1%<br>0.0% to + 0.2%                                  | ASTM C 1090** |
| Expansion                              | ≤ 2.0% for up to 3 hours  | ASTM C 940    |
| Wet Density - Laboratory               | Report maximum and minimum obtained test value lb/ft <sup>3</sup> | ASTM C 185    |

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|   |   |  |
|---|---|--|
| Wet Density - Field   | Minimum: 116.7lb/ft <sup>3</sup><br>Maximum 121.7 lb/ft <sup>3</sup>                      | API<br>Recommended<br>Practice 13B-1:<br>Mud Balance<br>Testing<br>Procedure |
| Compressive Strength<br>28 day (Average of 3<br>cubes)  | ≥7,000 psi  | ASTM C 942   |
| Initial Set of Grout  | Minimum 3 hours<br>Maximum 12 hours   | ASTM C 953   |
| Fluidity Test***<br>Efflux Time from Flow<br>Cone:<br><br>Immediately after mixing                            | Minimum 20 Seconds<br>Maximum 30 Seconds<br>Or<br>Minimum 9 Seconds<br>Maximum 20 Seconds | ASTM C 939<br><br>ASTM C<br>939****  |
| Fluidity Test***<br>Efflux Time from Flow<br>Cone:<br><br>30 minutes after mixing<br>with remixing for 30 sec | Maximum 30 Seconds<br>Or<br>Maximum 30 Seconds  | ASTM C 939<br><br>ASTM C<br>939****  |
| Bleed   | Vertical Tendon Rise:<br>0 to 2 ft: 4%<br>2 to 6 ft: 2%<br>More than 6ft: 0%              | ASTM C1741   |
| Permeability @ 28 days  | Maximum 2500 coulombs<br>at 30 V for 6 hours  | ASTM C<br>1202*****  |

\*ASTM C 117 procedure shall be modified to use a #50 sieve. The percent passing the #50 sieve after washing the sieve shall be determined.

\*\*ASTM C 1090 shall be modified to include verification at both 24 hours and 28 days.

\*\*\*Adjustments to flow rates shall be achieved by strict compliance with the manufacturer's recommendations. The time of efflux is the time to fill a one liter container placed directly under the flow cone.

\*\*\*\*Grout fluidity shall meet either the standard ASTM C 939 flow cone test or the modified test, as follows. The ASTM C 939 flow cone test shall be modified by filling the cone to the top instead of to the standard level. The efflux time shall be the time to fill a one liter container placed directly under the flow cone.

\*\*\*\*\* When evaluating grouts, the ASTM C 1202 procedure shall be modified to perform the test at 30 volts rather than 60 volts. Testing shall be performed on grout samples at 28 days of age. For grouts containing pozzolanic mineral admixtures, testing may be performed on grout samples at 90 days of age.

- (d) Accelerated Corrosion Test Method (ACTM). An accelerated corrosion test shall be performed by the Design-Builder as outlined in Appendix B of the "Specification for Grouting of Post-Tensioning Structures" published by the Post-Tensioning Institute. The time

to corrosion for both the grout being tested and the control sample using a 0.45 water-cement ratio neat grout shall be reported.

A grout that shows a longer average time to corrosion in the ACTM than the control sample and the time to corrosion exceed 1,000 hours is considered satisfactory.

- (e) Repair Applications. Repair applications are used to augment grouting operations which did not completely fill the duct or anchorage. Repairs may be made with the same grout approved for use in the tendons as long as the volume of the void is less than 0.5 gal. In all other cases, a non-sanded grout meeting the requirements of Section (c) above with a modified maximum permeability of 2,800 coulombs (ASTM C 1202 at 30 volts) shall be used. Non-sanded grouts shall have a 95% passing on the #100 sieve and 90% passing the #170 sieve as determined by ASTM C 33. Each sieve may be washed and dried before weighing in accordance with the procedure in ASTM C 117 modified for sieve size.
  - (f) Acceptance by Previous Tests. To satisfy the intent of the tests outlined in Sections (c), (d), (e), and (f) above, results from previous projects utilizing identical grouts may be submitted to the QAM in lieu of executing new tests. However, if the previous results are unacceptable or if there is a significant difference in the materials used, then the Design-Builder shall provide results from new tests for this project. Also, for pre-packaged grouts, the QAM may waive the requirements for these particular tests based upon satisfactory prior performance of the proposed grout material, mixing and installation methods.
231. GROUT SUPPLY QUALITY CONTROL. The Design-Builder shall provide to the QAM, a copy of grout quality control data sheets from the Manufacturer, for each lot number and shipment of grout material supplied to the site. Material with a total time from manufacture in excess of six months must be retested and certified by the supplier before use or be removed from the project and be replaced by approved materials. A lot is that parcel of material making up a particular shipment.
232. EPOXY GROUT FOR ANCHORAGE POUR-BACKS. Pour-backs protecting post-tensioning anchorages shall be as specified herein.
- (a) The material shall produce a low exothermic reaction and have flow and fill characteristics suitable for machine base plate applications. The material will be extended with the aggregate supplied by the manufacturer. Mix with the full aggregate loading.
  - (b) The material shall be factory pre-proportioned including factory supplied aggregate. Deliver products in original containers with manufacturer's name, date of manufacture, product identification label and batch numbers. Materials shall be within the manufacturer's recommended shelf life. Store and condition the product in full compliance with manufacturer's recommendations.
  - (c) The epoxy grout plus aggregate mix shall meet or exceed the specified physical properties stated herein as determined by the following standard ASTM test methods.

| Property  | Test Value                       | Test Method |
|---|----------------------------------|-------------|
| Compressive Strength, Cubes (7 day cure at 77°F)  | > 10,000 psi                     | ASTM C579B  |
| Tensile Strength at 7 days                        | > 2,000 psi                      | ASTM C307   |
| Flexural Strength (7 day cure at 77°F)            | > 3,600 psi                      | ASTM C 580  |
| Modulus of Elasticity (7day cure at 77°F)         | < 2,100,000 psi                  | ASTM C580   |
| Coefficient of Thermal Expansion at 74 to 210° F  | < 20 x 10 <sup>-6</sup> in/in/°F | ASTM C531   |
| Peak Exotherm, Specimen, 12 x 12 x 3 in.          | < 150°F                          | ASTM D2471  |
| Slant Shear at 7 days (Bond Strength to Concrete) | > 3,000 psi                      | ASTM C882   |
| Thermal Compatibility                             | 5 Cycles Passed                  | ASTM C884   |
| Linear Shrinkage at 7 days                        | 0.025%                           | ASTM C531   |
| Flowability and Bearing Area                      | 90% Contact area                 | ASTM C1339  |
| Gel Time, Specimen 12 x 12 x 3 in.                | < 4:00 (hr.)                     | ASTM D2471  |

233. ELASTOMERIC COATING SYSTEM. Surfaces of protective pour-backs placed over post-tensioning anchorages in accordance with this Specification shall be coated with an elastomeric coating suitable for vertical surfaces in accordance with the design plans and this Specification.

- (a) The elastomeric coating system shall provide a waterproof barrier over the designated post-tensioning anchorages and or other areas designated in the plans. The components of the coating system shall be supplied by a single manufacturer and sold as a waterproof coating system. The surface preparation and application of the coating system shall be applied in strict accordance with the manufacturer's specifications.
- (b) The use of an epoxy prime coat is dependent upon the requirements of the manufacturer's waterproofing system. The polyurethane chemistry may be either waterborne aromatic (moisture-curing) or aromatic (moisture-sensitive). The minimum thickness of the system shall not be less than 30 mils. The cured coating system shall meet the following requirements:

| Property   | Test Value                 | Test Method |
|--|----------------------------|-------------|
| Hardness, Shore A                                    | Between 60 and 90          | ASTM D2240  |
| Tensile Strength                                     | ≥750 psi                   | ASTM D412   |
| Elongation   | ≥400%                      | ASTM D412   |
| Tear Strength  | >70 pli                    | ASTM C957   |
| Abrasion Resistance<br>H-18<br>Wheels 1,000 gm/wheel | ≤350 mg loss / 1,000 revs. | ASTM C957   |
| Crack Bridging 1,000 Cy                              | System Passes              | ASTM C957   |
| Elongation Recovery                                  | ≥94%                       | ASTM C957   |

- (c) The elastomeric coating system shall be supplied with an aliphatic polyurethane top coating for use on epoxy grout pour-backs.

234. PROTECTION OF PRESTRESSING STEEL.

- (a) Before Installation of Tendons in Ducts. All prestressing steel shall be protected against physical damage at all times from manufacture to grouting or encasing in concrete. Prestressing steel that has sustained physical damage at any time shall be rejected. Any reel that is found to contain broken wires shall be rejected and the reel replaced. The wire must be bright and uniformly colored, having no foreign matter or pitting on its surface.

Prestressing steel shall be packaged in containers for protection of the steel against physical damage and corrosion during shipping and storage. A corrosion inhibitor, which prevents rust or other results of corrosion, shall be placed in the package or form, or shall be incorporated in a corrosion inhibitor carrier type packaging material. The corrosion inhibitor shall have no deleterious effect on the steel or concrete or bond strength of steel to concrete. Inhibitor carrier type packaging material shall conform to the provisions of Federal Specifications MIL-P-3420. Packaging or forms damaged from any cause shall be immediately replaced or restored to original condition.

The prestressing steel shall be stored in a manner which will at all times prevent the packing material from becoming saturated with water and allow a free flow of air around the packages. If the useful life of the corrosion inhibitor in the package expires, it shall immediately be rejuvenated or replaced.

At the time the prestressing steel is installed in the work, it shall be free from loose rust, loose mill scale, dirt, paint, oil, grease or other deleterious material. Removal of tightly adhering rust or mill scale will not be required. Prestressing steel that has experienced rusting to the extent it exhibits pits visible to the naked eye shall not be used in the work.

The shipping package shall be clearly marked with the heat number and with a statement that the package contains high-strength prestressing steel and care is to be used in handling, and the type, kind and amount of corrosion inhibitor used, including the date when placed, safety orders and instructions for use shall also be marked on the package or form. Specifically designate low relaxation (stabilized) strands per requirements of ASTM A 416. Strands not so designated will be rejected.

- (b) After Installation of Tendons in Ducts. After installation in the ducts, prestressing steel shall be protected from corrosion and the duct system shall be sealed to prevent moisture intrusion from the time of tendon installation to the time of grouting. In addition, all grout vents shall be closed or plugged at all times during the period prior to grouting except that low-point drainage vents shall remain open and point downward.

Grouting shall proceed as soon as possible after installation and stressing of the tendons. To minimize the adverse effects, the time from installing the tendons in an unstressed condition to grouting after stressing shall not exceed the following periods:

Very damp atmosphere (RH > 70%)/over salt water - 7 calendar days

Moderate to dry atmosphere ( $40\% < RH < 70\%$ ) -20 calendar days  
Very dry atmosphere ( $RH < 40\%$ ) - 40 calendar days

In this context, the "RH" is the average annual relative humidity for the site. For this project, the maximum time shall be 20 calendar days.

Any light surface discoloration or corrosion forming during this period shall not be cause for rejection of the prestressing steel.

Flushing of grout is not permitted and vacuum grouting is required to repair all voids and blockages, except small grout cap voids less than  $\frac{1}{4}$  inch in depth. Flushing of ducts is only permitted if a lubricant is required to reduce the friction. When flushing is permitted, use flush water containing slack lime (calcium hydroxide) or quicklime (calcium oxide) in the amount of 0.17 lb/gal.

Except when waived by VTrans in writing, failure to grout tendons within the time limit specified above will result in stoppage of the affected work as directed by VTrans.

- (c) Tendon Protection between Installation and Stressing. Measures shall be taken to protect the prestressing steel when there is a period of more than 24 hours between installation of the tendons in ducts and stressing. Bare strand projecting out of an anchorage shall be wrapped in continuous plastic sheeting and sealed using waterproof tape extending from the tendon anchorage, and the anchorage opening shall be sealed with plastic and waterproof tape in a sufficient manner to prevent moisture intrusion. All grout vents shall be closed or plugged, all duct connections shall be sealed and drainage vents shall be open, pointing downward.
- (d) Tendon Protection during Staged or Segmental Construction. When plans provide for the tendons to be installed in one unit or segment, either longitudinally, transversely or vertically, with a length of bare strand left projecting for purposes of threading into another unit or segment during later erection operations, the provisions described in Section (c) above shall apply. All of the prestressing steel shall be protected immediately after it is first installed in the first unit or segment until the tendon is grouted in the second unit or segment.
- (e) Use of Temporary Corrosion Inhibitors. It is the intent of the Specifications that the tendons be grouted within the time limit specified above. Corrosion inhibitors shall not be used without prior approval. Corrosion inhibitors that require flushing shall not be used. The product to be used, if the use of a corrosion inhibitor is approved, shall be Cortec Corporation's MCI 309 vapor phase corrosion inhibitor powder or approved equal.

235. INSTALLATION OF DUCTS, GROUT INJECTION PORTS AND OUTLET VENTS.

- (a) General. All post-tensioning anchorages, ducts, inlet and outlet pipes, miscellaneous hardware, reinforcing bars, and other embedded items shall be accurately and securely fastened at locations shown on the design plans or on the approved Working Drawings. Ducts for tendons shall be made using the minimum number of duct splices possible.

- (b) Tolerances. In their final position post-tensioning ducts shall be within the following tolerances:

| Table of Duct Position Tolerances   |                                  |                                  |
|---|----------------------------------|----------------------------------|
| Tolerances  | Vertical position<br>Inches      | Lateral position<br>Inches       |
| Horizontal tendons in slabs or in slab regions of larger members:                                       | $\pm 1/4$                        | $\pm 1/2$                        |
| Longitudinal draped super-structure tendons in webs:<br>Tendon over supports or in middle third of span | $\pm 1/4$                        | $\pm 1/4$                        |
| Tendon in middle half of web depth  | $\pm 1/2$                        | $\pm 1/4$                        |
| Longitudinal, generally horizontal, superstructure tendons usually in top or bottom of member:          | $\pm 1/4$                        | $\pm 1/4$                        |
| Horizontal tendons in substructures and foundations:  | $\pm 1/2$                        | $\pm 1/2$                        |
| Vertical tendons in webs  | Longitudinal position<br>$\pm 1$ | Transverse position<br>$\pm 1/4$ |
| Vertical tendons in pier shafts   | $\pm 1/2$                        | $\pm 1/4$                        |

In all other cases, tendons shall not be out of position by more than  $\pm 1/4$  inch in any direction.

Entrance and exit angles of tendon paths at anchorages and/or at faces of concrete shall be within  $\pm 3$  degrees [ $\pm 5\%$ ] of desired angle measured in any direction and any deviations in the alignment shall be accomplished with smooth transitions without any kinks.

Angle changes at duct joints must not be greater than  $\pm 3$  degrees [ $\pm 5\%$ ] in any direction and must be accomplished with smooth transitions without any kinks.

Anchorages shall be located within  $\pm 1/4$  inch of desired position laterally and  $\pm 1$  inch along the tendon except that minimum cover requirements must be maintained.

Anchorage confinement reinforcement in the form of spirals, multiple U shaped bars or links, shall be properly centered around the duct and to start within  $1/2$  inch of the back of the main anchor plate.

If conflicts exist between the reinforcement and post-tensioning duct, the position of the post-tensioning duct shall prevail and

the reinforcement shall be adjusted locally with the Design Manager's approval and release for construction by VTrans.

- (c) Ducts. Ducts shall be accurately aligned and located as shown on the design plans or according to the approved Working Drawings and as required herein. All internal ducts shall be secured in position at regular intervals not exceeding 30 inches for steel pipes, 24 inches for round plastic duct and 12 inches for flat ducts to prevent movement, displacement or damage from concrete placement and consolidation operations. Any additional mild reinforcing or other devices required to support post-tensioning ducts shall be supplied by the Design-Builder.

For external tendons, ducts shall be straight between connections to internal pipes at anchorages, diaphragms and deviation saddles and shall be supported at intermediate locations, as required, according to the design plans or approved Working Drawings.

All duct alignments, including curves and straight portions, shall be smooth and continuous with no lips, kinks or dents. This also applies to curves in pre-bent steel pipe.

All ducts shall be carefully checked and repaired as necessary before placing any concrete.

After installation of ducts, until grouting is complete, all ends of ducts, connections to anchorages, splices, vents (inlets and outlets) shall remain sealed at all times. An absolute seal shall be provided of anchorage and duct termination locations by using plumber's plugs or equal. Grout vents (inlets and outlets) shall be installed with plugs or valves in the closed position. Low point drainage outlets shall be left open. The use of duct tape shall not be permitted. Ducts shall be carefully inspected and repaired before placing of the concrete is started. Care shall be exercised during placement of the concrete to avoid displacing or damaging the ducts.

All splices, joints, couplings, vent connections (inlets and outlets) and valves shall be part of the approved post-tensioning system. Approved shrink-sleeve material may be used to repair duct. The use of duct tape to repair or seal duct shall not be permitted.

- (d) Grout Vents (Inlets and Outlets) and Drains. Grout pipes shall be installed on each duct to serve as injection or evacuation vents during grouting and to allow the escape of air, water, grout and bleed water. Drainage vents, point downward, shall be provided at low points of tendon profile to allow any accumulated moisture to be drained prior to installing tendons.

The length of an inlet or outlet shall be sufficient to extend out of the concrete to allow for proper closing. At all high points the outlet shall connect at the uppermost part of the duct profile.

Inlets and outlets shall be placed at locations shown on the design plans, on the approved Working Drawings, and/or the approved Grouting Operation Plan (see below). Locations shall be as follows:

- (1) At the top of each tendon anchorage
- (2) At top of each grout cap.



- (3) At each high point of the duct profile when the vertical distance between the highest and lowest point is more than 20 inches.
- (4) At all low points. The vent (outlet) shall be free draining.
- (5) At major changes in the cross-section of the duct.
- (6) At each side of post-tensioning bar-couplers.
- (7) At a distance of approximately 3 ft. from each high point in the direction of grout flow.
- (8) For external tendons, provide vents as close to the inside face of the diaphragm as practical, located on the top of the duct.
- (9) At other locations required by VTrans.

Grout pipes shall extend a sufficient distance out of the concrete member to allow for proper closing of valves.

- (e) Care and Protection of Ducts, Vents, Anchorages and Blockouts. Care shall be taken to ensure that all ducts, anchorages, blockouts, openings and vents are kept clean and free of debris, fuel, oils, other contaminants and site trash at all times prior to and after installing the tendons. Temporary plugs, seals and covers shall be used. Minor damage to ducts may be repaired by removing the local damage and splicing duct or couplers onto the intact section (prior to the placing of concrete). Repair of major duct damage requires the removal and replacement of the entire duct section.

Connections from grout hose to inlet and ejection ports and to vents shall be kept free from dirt and are airtight.

- (f) Placing Concrete. Methods used to place and consolidate concrete shall not displace or damage any of the post-tensioning ducts, anchorage assemblies, splices and connections, reinforcement or other embedded items. Duct splices shall be made so as to prevent duct kinks during concrete placement. Suitable mandrels shall be used as needed to maintain duct alignment and shape.

- (g) Proving of Post-Tensioning Ducts after Placing Concrete. Upon completion of concrete placement, longitudinal post-tensioning ducts shall be proven to be free and clear of any obstructions or damage and are able to accept the intended post-tensioning tendons by passing a torpedo through the ducts. The torpedo shall have the same cross-sectional shape as the duct and that is a 1/4 inch smaller all around than the clear, nominal inside dimensions of the duct. No deductions shall be made to the torpedo section dimensions for tolerances allowed in the manufacture or fixing of the ducts. For straight ducts, the torpedo shall be at least 2 feet long. For curved ducts, the torpedo length shall be determined so that when both ends touch the outermost wall of the duct, the torpedo is 1/4 inch clear of the innermost wall. If the torpedo will not travel completely through the duct, the QAM may reject the member, unless a workable repair is made to clear the duct. The torpedo must pass through the duct easily, by hand, without resorting to excessive effort or mechanical assistance.

Proving of ducts using a torpedo is not required for external tendons or for transverse tendons.

- (h) Problems and Remedies. The QAM will reject ducts or any part of the work found to be deficient. No remedial or repair work shall be

performed without approval by the Design Manager and release for construction by VTrans.

- (i) Installing Tendons. If a tendon duct has been contaminated with chlorides, it shall be thoroughly flushed before placing the prestressing strands using lime treated potable water. The last two gallons of flushing water shall be tested for presence of chlorides and oils. Chlorides in the water must be less than 600 ppm. If chloride levels exceed 600 ppm, flushing shall continue until the chloride level is below 250 ppm. Oil-free compressed air shall then be blown through the duct to remove any excess water.

Strands may be pushed or pulled through the ducts to make up a tendon using methods which will not snag on any lips or joints in the ducts. Strands which are pushed should be rounded off the end of the strand or fitted with a smooth protective cap. During the insertion of the post-tensioning strand into the duct, the strand shall not be intentionally rotated by any mechanical device.

Alternatively, strands may be assembled to form the tendon and pulled through the duct using a special steel wire sock ("Chinese finger") or other device attached to the end. The ends of the strands may not be welded together for this purpose. The end of the pre-assembled tendon shall be rounded for smooth passage through the duct.

All strands shall be cut using an abrasive saw or an approved plasma cutter. Flame cutting is not allowed.

Permanent tendons shall not be installed before the completion of testing as required by these Specifications or Plans, with the sole exception of the tendon to be tested in the "In Place Friction Test".

## 236. POST-TENSIONING OPERATIONS.

### (a) General.

- (1) Concrete Strength. Post-tensioning shall only be applied when the concrete has attained the required compressive strength as determined from test cylinders cured under the same conditions as the structural concrete.
- (2) Stressing Tendons. All post-tensioning steel shall be tensioned with hydraulic jacks so that the post-tensioning force is not less than that required by the design plans or approved Working Drawings. Monostrand jacks shall not be used to stress tendons with five or more strands.
- (3) Maximum Stress at Jacking. The maximum temporary stress (jacking stress) in post-tensioning steel shall not exceed 80% of the specific minimum ultimate tensile strength. Tendons shall not be overstressed to achieve elongation.
- (4) Initial and Permanent Stress. The post-tensioning steel must be anchored at initial stresses that will result in the long term retention of permanent stresses or forces of no less than those shown on the design plans or the approved Working Drawings. The initial stress after anchor set must not exceed

70% of the specified ultimate tensile strength of the post-tensioning steel.

Permanent stress and permanent force are the stress and force remaining in the post-tensioning steel after all losses, including long term creep and shrinkage of concrete, elastic shortening of concrete, relaxation of steel, losses in the post-tensioning steel from the sequence of stressing, friction and unintentional wobble of the ducts, anchor set, friction in the anchorages and all other losses peculiar to the post-tensioning system

- (5) Stressing Sequence. Except as noted on the design plans, approved Working Drawings or Erection or Post-Tensioning Manual, the permanent post-tensioning tendons shall be stressed from both ends. The required force may be applied at one end and subsequently at the other end or simultaneously at both ends.

Single end stressing is permitted when the following are satisfied:

- (a) Space limitations prohibit double end stressing.
- (b) The calculated elongation of the post-tensioning steel at the second end is 1/2 inch or less and wedges are power seated.
- (c) Single end stressing applied at alternate ends of paired adjacent post-tensioning tendons is required to produce a symmetrical force distribution in agreement with the plan design.

For construction in stages where some tendons are required to be stressed before others, install and stress tendons in accordance with the design plans or approved Working Drawings.

- (b) Stressing Jacks. When stressing tendons, only use equipment furnished by the supplier of the post-tensioning system (tendons, hardware, anchorages, etc.)
  - (1) Stressing Equipment. Each jack shall be equipped with a pressure gauge having an accurate reading dial at least six inches in diameter for determining the jack pressure.
  - (2) Calibration. Prior to use for stressing on the project, each jack and its gauge shall be calibrated as a unit. Initial jack calibration shall be done, using a proven load cell, by the post-tensioning supplier or by an independent testing laboratory, approved by the Agency. The calibration shall consist of three test cycles with the cylinder extension of the jack in various positions (i.e. 2 inch, 4 inch, 8 inch stroke). At each pressure increment, the forces from each test cycle shall be averaged to obtain an average force. Calibration shall be done with the cylinder extension approximately in the position that it will be when applying the final jacking force and with the jacking assembly (jack, pump, hoses, etc.) set up in an identical configuration to

that which will be used at the job site (i.e. same length hydraulic lines). Load cells used for calibration shall have been calibrated within the last 12 months. Certified calibration calculations and a calibration chart, both in English units of measure, shall be furnished to the QAM for each jack and gauge unit. Documentation denoting the load cell(s) calibration date and tractability to NIST (National Institute of Standards and Technology) along with the jack/gauge calibration shall be provided.

Recalibration of each jack shall be done at six month intervals and at other times when requested by the QAM. At the option of the Design-Builder, calibrations subsequent to the initial laboratory calibration may be accomplished by the use of a master gauge. The master gauge shall be calibrated at the same time as the initial calibration of the jacks, and shall be part of the unit for each jack. The data recorded during the initial calibrations shall be furnished to the QAM for use in the field. The master gauge shall be supplied by the Design-Builder in a protective waterproof container capable of protecting the calibration of the master gauge during shipment. The Design-Builder shall provide a quick-attach coupler next to the permanent gauge in the hydraulic lines which enables the quick and easy installation of the master gauge to verify the permanent gauge readings. The master gauge shall remain in the possession of the QAM for the duration of the project.

If a jack is repaired or modified, including replacing the seals or changing the length of the hydraulic lines, the jack shall be recalibrated by the approved testing laboratory. No extra compensation will be allowed for the initial or subsequent jack calibrations or for the use and required calibration of a master gauge.

- (c) Stressing of Tendons. The tensioning process shall be so conducted that tension being applied and the elongation of the post-tensioning steel may be measured at all times. A permanent record shall be kept of gauge pressures and elongations at all times and shall be submitted to the QAM. The post-tensioning force may be verified as deemed necessary by the QAM.

For all tendons, excluding post-tensioning bars with lengths less than 20 feet, the tendon force measured by gauge pressure shall agree within 7% of the theoretical elongation or the entire operation shall be checked and the source of error determined and remedied to the satisfaction of the QAM before proceeding with the work. Do not overstress the tendons to achieve the theoretical elongation. Elongations shall be measured to the nearest 1/16 inch. In determining why the measured tendon force and the theoretical elongation do not agree, the Design-Builder may elect to establish that the apparent modulus of elasticity of the post-tensioning steel varies from the value shown in the plans by conducting a bench test on a full size tendon in accordance with a procedure approved by the QAM. This test may be performed at a site remote from the project and shall be witnessed by the QAM. Equipment for tensioning the tendons must be furnished by the manufacturer of the system. Should agreement between pressure gauge readings and measured elongations fall outside the acceptable tolerances, the QAM may

require additional tendon modulus of elasticity and/or in-place friction tests in accordance with Section "Testing of Prestressing Tendons by the Design-Builder" above.

The anchor force for all permanent post-tensioning bars with lengths less than 20 feet shall be verified with a lift-off after initial stressing operations. The resulting lift-off shall be within  $\pm 7\%$  of the expected final anchor force as specified in the plans.

- (d) Friction. The design plans shall be prepared based on the assumed friction and wobble coefficients and anchor set noted on the plans. Calculations shall be submitted to show a typical tendon force diagram, after friction, wobble and anchor set losses, on the Working Drawings based upon the expected actual coefficients and values for the post-tensioning system used. These coefficients and values shall be shown on the Working Drawings.

If, in the opinion of the QAM, the actual friction significantly varies from the expected friction, revise post-tensioning operations so the final tendon force is in agreement with the plans.

When friction must be reduced, graphite with no corrosive agents may be used as a lubricant subject to the approval of the QAM. Lubricants shall be flushed from the duct as soon as possible after stressing is completed by use of lime treated potable water. After ducts have been flushed, they shall be immediately and thoroughly blown dry with oil-free air.

- (e) Wire Failures in Post-Tensioning Tendons. Multi-strand post-tensioning tendons having wires that have failed by breaking or slippage during stressing may be accepted providing that:
- (1) The completed structure must have a final post-tensioning force of at least 98% of the design total post-tensioning force at the affected sections.
  - (2) At any stage of erection, the post-tensioning force across a mating surface must be at least 98% of the force required for that stage.
  - (3) Any single tendon must have no more than 5% reduction in cross-sectional area of the post-tensioned steel due to the wire failure.

If these conditions cannot be met, then the affected tendon(s) shall be removed and replaced. Previously tensioned strands shall not be re-used.

- (f) Cutting of Post-Tensioning Steel. Post-tensioning steel shall be cut by an abrasive saw or an approved plasma-cutter within  $3/4$  to  $1-1/2$  inches away from the anchoring device. Flame cutting of prestressing steel is not allowed.
- (g) Record of Stressing Operations. The Design-Builder and QAM shall keep a record of the following post-tensioning operations for each tendon installed:
- (1) Project name, Project ID;
  - (2) Contractor and/or subcontractor;

- (3) Tendon location, size and type;
- (4) Date tendon was first installed in ducts;
- (5) Reel number for strands and heat number for bars;
- (6) Tendon cross-sectional area;
- (7) Modulus of elasticity;
- (8) Date stressed;
- (9) Jack and Gauge numbers per end of tendon;
- (10) Required jacking force;
- (11) Gauge pressures;
- (12) Elongations (theoretical and actual);
- (13) Anchor sets (anticipated and actual);
- (14) Stressing sequence (i.e. tendons to be stressed before and after);
- (15) Stressing mode (one end/ two ends/ simultaneous);
- (16) Witnesses to stressing operation (Design-Builder, QAM, VTrans);
- (17) Date grouted

Any other relevant information shall be recorded. A complete copy of all stressing and grouting operations shall be provided to the QAM.

(h) Duct Pressure Field Test.

- (1) After stressing and before grouting tendons, all grout caps, inlets and outlets shall be installed and all tendons tested with compressed air to determine if duct connections require repair.
- (2) Pressure tendons to 50 psi and lock-off the outside air source. Record time (seconds) elapsed to a pressure loss of 25 psi,  $\Delta T_{Test}$ . The minimum permissible elapsed time to a loss of 25 psi shall be computed for each tendon by the following equation:

$$\Delta T_{Test} = 7.14 \times (A_{Duct} - A_{Strand}) L_{Tendon}$$

Where cross-sectional areas  $A_{Duct}$  is the inside area of the duct in square feet,  $A_{Strand}$  is the area of the strand in square feet, and the tendon length  $L_{Tendon}$  is in feet. If  $\Delta T_{Test}$  is less than the minimum allowable, repair leaks and re-test until this specification is met.

- (3) Duct pressure field testing is not required for vertical post-tensioning bars embedded in segmental superstructure segments.
- (i) Cleaning and Flushing Tendons. Tendons shall not be flushed with water except as directed by the QAM.

If flushing is to be performed the inside of the duct system shall be flushed with water (under pressure) to remove all traces of the contaminants. Following the flushing operation, water shall be totally drained from within the duct system and it shall be blown out with compressed oil-free air to the extent necessary to dry the prestressing steel and inside surfaces of the ducts. The waste fluid flushed from the duct system shall be captured and disposed of properly.

- (j) Tendon Protection. Within four hours after stressing, install grout

caps and seal all other tendon openings. If acceptance of the tendon is delayed, all tendon openings and open ends of the anchorages shall be temporarily sealed. If tendon contamination occurs, the tendon shall be removed and replaced.

- (k) Re-Use of Temporary Post-Tensioning Bars. Post-tensioning bars used to apply temporary post-tensioning may be reused as temporary bars if they are undamaged and in accordance with the supplier's recommendations.

237. GROUTING.

- (a) General. After post-tensioning and anchoring of a tendon has been completed and accepted, the annular space between the prestressing steel and the duct shall be grouted in accordance with this Specification. Also grout all empty ducts. The interval between post-tensioning and grouting shall be limited as specified above. Immediately after post-tensioning, all grout vents, anchorages, and duct connections of each tendon shall be temporarily sealed to prevent entrance of air and water until just prior to tendon grouting.

At least six weeks before grouting commences, the Design-Builder shall submit a "Grouting Operation Plan" to the Construction Manager, Design Manager and QAM for review and comment. Written approval of the plan by the Design Manager and release for construction by VTrans is required before grouting proceeds. Any adjustments to the plan as a result of trials or mock-ups shall be incorporated and reapproved by the Design Manager and re-released for construction by VTrans. Grouting operations shall be under the supervision of a grout crew foreman with the qualifications noted in this special provision.

At a minimum the Grouting Operation Plan shall address the following:

- (1) Names and proof of training for the grouting crew and the crew supervisor in conformance with this specification;
- (2) Type, quantity, and brand of materials used in grouting including all certifications required;
- (3) Type of equipment furnished, including capacity in relation to demand and working condition, as well as back-up equipment and spare parts;
- (4) General grouting procedure;
- (5) Duct pressure test and repair procedures;
- (6) Method to be used to control the rate of flow within ducts;
- (7) Theoretical grout volume calculations;
- (8) Mixing and pumping procedures;
- (9) Direction of grouting;
- (10) Sequence of use of the inlets and outlet pipes;
- (11) Procedures for handling blockages;
- (12) Procedures for possible post grouting repair;
- (13) Design-Builder's QC forms that are to be signed daily by Grout Supervisor.

Before grouting operations commence, a joint meeting shall be held with the Design Manager, Construction Manager, QAM, Grouting Crew, and VTrans to discuss and understand the grouting operation plan, required testing and corrective procedures.

- (b) Supplies. Before grouting operations start, an adequate supply of water and compressed air for clearing and testing the ducts, mixing and pumping the grout shall be provided. Where water is not supplied through the public water supply system, a water storage tank of sufficient capacity must be provided.

A sufficient supply of grout material shall be available to complete the planned grouting operation.

- (c) Equipment.

- (1) General. Grouting equipment shall consist of measuring devices for water, a high-speed shear colloidal mixer, a storage hopper (holding reservoir) and a pump with all the necessary connecting hoses, valves, and pressure gauge. Pumping equipment shall have sufficient capacity to ensure that the post-tensioning ducts to be grouted can be filled and vented without interruption at the required rate of injection in not more than 30 minutes.

An air compressor and hoses with sufficient output to perform the required functions shall be provided.

- (2) Mixer, Storage Hopper. A high speed shear colloidal mixer shall be provided capable of continuous mechanical mixing to produce a homogeneous and stable grout free of lumps and undispersed cement. The colloidal grout machinery will have a charging tank for blending and a holding tank. The blending tank must be equipped with a high shear colloidal mixer. The holding tank must be kept agitated and at least partially full at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct.

Water shall be added during the initial mixing by use of a flow meter or calibrated water reservoir with a measuring accuracy equal to one percent of the total water volume.

- (3) Grout Pumping Equipment. Grout pumping equipment capable of continuous operation shall be provided which will include a system for circulating the grout when actual grouting is not in progress.

The equipment will be capable of maintaining pressure on completely grouted ducts and will be fitted with a valve that can be closed off without loss of pressure in the duct.

Grout pumps will be positive displacement type and will provide a continuous flow of grout and will be able to maintain a discharge pressure of at least 145 psi.

Pumps will have seals adequate to prevent oil, air or other foreign substances entering the grout and to prevent loss of grout or water. The capacity will be such that an optimal rate of grouting can be achieved.

A pressure gauge having a full scale reading of no more than 300 psi will be placed at the duct inlet. If long hoses (in excess of 100 feet) are used, two gauges shall be provided,



one at the pump and one at the inlet.

The diameter and rated pressure capacity of the grout hoses must be compatible with the pump output.

- (4) Vacuum Grouting Equipment. Vacuum grouting equipment and experienced operators shall be provided at the job site within 48 hours' notice and consists of the following:

- (a) Volumeter for the measurement of void volume.
- (b) Vacuum pump with a minimum capacity of 10 cfm and equipped with a flow-meter capable of measuring amount of grout being injected.
- (c) Manual colloidal mixers and/or dissolvers (manual high speed shear mixers), for voids less than 20 liters in volume.
- (d) Standard colloidal mixers, for voids 20 liters and greater in volume.

Tests shall be performed to confirm the accuracy of the volume-measuring component of the vacuum grouting equipment each day before using the vacuum grouting equipment. Either water or grout shall be used for testing standard testing devices with volumes of 0.5 gal and 6.5 gal and an accuracy of equal to or less than 4 oz. One test shall be performed with each device. The results must verify the accuracy of the void volume-measuring component of the vacuum grouting equipment within 1% of the test device volume and must verify the accuracy of the grout volume component of the vacuum grouting equipment within 5% of the test device volume. The QAM shall be present when any tests are performed.

- (5) Availability of Testing Equipment. Equipment for field-testing shall be available at the job site.
- (6) Stand-by Equipment. During grouting operations, a stand-by grout mixer and pump shall be provided.

(d) Field Trial and Mockup Tests.

- (1) General. The Design-Builder shall perform field trial tests and field mockup tests at the same time using the same materials, personnel, and equipment used in production grouting. The Design-Builder shall submit to the QAM at least 4 weeks before scheduled start of the field mockup tests, a detailed written plan covering test setup, materials, ducts, inlets, outlets, anchorages, prestressing element, grouting, and dissection procedures. The QAM shall be present when any tests are performed.

- (2) Field Trail Tests. The following tests shall be performed on the grout as described in Table 1 of this Specification:

- Strength test (ASTM C942).
- Volume change test (ASTM C1090)
- Pumpability and fluidity test (ASTM C939 Modified)
- Schupack pressure bleed test (ASTM C1741)

- (3) Field Mockup Tests. The field mockup should follow the inclined tube test setup per EN 445, "Grout for Prestressing Tendons - Test Methods", American National Standards Institute. Not less than 3 days after grouting, the Design-Builder shall dissect the test specimen for a thorough examination of grout, prestressing steel, and the duct. Special attention shall be given to the examination of the tendon high points for bleed pockets, soft grout, segregation, or corrosion. A report describing the trial test (including any variations from the test plan) and its findings shall be submitted to the QAM for approval a maximum of 2 weeks after dissection. The report shall document all voids in the grout with respect to size, location, and any presence of free moisture or corrosion.
  - (4) Test Acceptance. The QAM shall determine whether the results of the mockup test satisfy the acceptance requirements. Additional tests may be required by the VTrans.
- (e) Grouting Operations.
- (1) General. Tendons shall be grouted in accordance with the procedures set forth in the approved grouting operation plan. All empty ducts shall also be grouted.
  - (2) Temperature Considerations. The maximum grout temperature must not exceed 90°F at the grout inlet. Chilled water and/or pre-cooling of the bagged material to maintain mixed grout temperature below the maximum allowed temperature shall be used. Grouting operations shall be prohibited when the temperature of the grout is below 45°F. Grouting operations shall be prohibited when the ambient temperature is below 40°F or is 40°F and falling. Grouting operations shall be prohibited if freezing temperatures are forecasted within the next two days and it is expected the concrete temperature surrounding the duct will fall below 40°F. When it is anticipated that the ambient temperature will fall below 32°F, ducts shall be kept free of water so as to avoid freeze damage to ducts.
  - (3) Mixing and Pumping. The grout shall be mixed with a metered amount of water to produce a uniformly blended, homogeneous grout. The mix shall be continuously agitated until grouting is complete.
  - (4) Injecting Grout. All grout outlets shall be opened before starting the grouting operation. Tendons shall be grouted in accordance with the Grouting Operations Plan.

Grout shall be pumped at a rate of 16 feet to 50 feet of duct per minute. Normal grouting operations shall be conducted at a pressure range of 10 psi to 50 psi measured at the grout inlet; the maximum pumping pressure of 145 psi at the grout inlet for round ducts and 75 psi for flat ducts in deck slabs shall not be exceeded.

Grout pumping methods shall ensure complete filling of the ducts and complete encasement of the steel. Grout must flow from the first and subsequent outlets until any residual water

or entrapped air has been removed prior to closing the outlet.

Grout shall be pumped through the duct and continuously discharged at the anchorage and grout cap outlets until all free water and air has been discharged and the consistency of the grout is equivalent to that of the grout being pumped into the inlet. The anchorage outlet shall be closed and a minimum of 2 gallons of grout shall be discharged from the grout cap into a clean receptacle. The grout cap outlet shall then be closed.

After all outlets have been bled and sealed, the grout pressure shall be raised to not less than 50 psi and no more than 75 psi and the inlet valve sealed. Wait two minutes to determine if any leaks exist. If leaks are present, they shall be fixed using methods approved by the QAM. The above process shall be repeated until no leaks are present. If no leaks are present, the pressure shall be reduced to  $50 \pm 10$  psi and a minimum of five minutes shall elapse for any entrapped air to flow to the high points. After the minimum five minutes period has expired, the pressure shall be raised as needed to discharge grout at each high point outlet to eliminate any entrapped air or water. The process shall be completed by locking-off at a pressure of 30 psi.

If the actual grouting pressure exceeds the maximum allowed, the inlet will be closed and the grout will be pumped at the next outlet, which has just been, or is ready to be closed as long as a one-way flow is maintained. Grout will not be pumped into a succeeding outlet from which grout has not yet flowed. If this procedure is used, the outlet/inlet, which is to be used for pumping will be fitted with a positive shut-off and pressure gage.

When complete grouting of the tendon cannot be achieved by the steps stated herein, the grouting operation shall stop. After waiting 48 hours, the tendon shall be filled with grout in accordance with the procedure outlined in Section (i) below.

All waste grout and liquids shall be captured and disposed of properly.

- (f) Grout Testing During Grouting Operations. Acceptance testing for grout physical properties shall be performed during grouting operations.

The following minimum number of production tests shall be carried out in the field in accordance with Table 1 in Section "Grout Materials and Properties" above:

- (1) One pressure bleeding test per day (ASTM C1741). The sample shall be taken at the mixer.
- (2) Two wet density (mud balance) tests per day or when there is a visual or apparent change in the characteristics of the grout at the mixer and one at the duct outlet (API Recommended Practice 13B-1).
- (3) One strength test per day (ASTM C942).

- (4) Two fluidity test (flow cone) - one at the mixer and one at the duct outlet (ASTM C939 Modified), repeat testing every 2 hours of grouting operations. The efflux time shall be within 5 seconds of the values established during laboratory testing.

Grout materials shall be conditioned as required to limit the grout temperature at the inlet end of the grout hose to 90°F. Prior to performing repair grouting operations, grout materials shall be conditioned as required to limit the grout temperature at the inlet end of the grout hose to 85°F. The temperature of the grout at the inlet end of the grout hose shall be checked hourly.

- (g) Vertical Grouting. All vertical tendons that have strands as the prestressing steel shall be fitted with a standpipe at the upper end of the tendon to store bleed water and grout and maintain the grout level above the level of the post-tensioning plate and anchorage. The standpipe will be designed and sized to maintain the level of the grout at an elevation which will assure that bleeding will at no time cause the level of the grout to drop below the highest point of the upper anchorage device. The standpipe shall be designed to allow all bleed water to rise into the standpipe, not into the uppermost part of the tendon and anchorage device.

As grouting is completed, the standpipe shall be filled with grout to a level, which will assure that, as settlement of grout occurs, the level of grout will not drop below the highest point in the upper anchorage device. If the level of grout drops below the level of the highest point in the anchorage device, additional grout shall immediately be added to the standpipe. After the bleed water is absorbed and the grout has hardened, the standpipe shall be removed. In the presence of the QAM, visually inspect for voids using an endoscope or probe. All voids found in the duct shall be filled using volumetric measuring vacuum grouting processes.

For vertical tendons in excess of 100 feet or if the grouting pressure exceeds the maximum recommended pumping pressure specified in Section (e) above, then the grout shall be injected at increasingly higher vents (which become injection locations) which have been or are ready to be closed as long as a one-way flow of grout is maintained. Grout will be allowed to flow from each outlet until all air and water have been purged prior to using that outlet for pumping.

- (h) Construction Traffic and Operations Causing Vibrations. During grouting and for a period of 4 hours upon completion of grouting, eliminate vibrations from all sources such as moving vehicles, jackhammers, compressors, generators, pile driving operations, soil compaction, etc., that are operating within 300 feet down-station and 300 feet up-station of the ends of the span in which grouting is taking place.
- (i) Post-Grouting Inspection. Grout vents (inlets and outlets) shall not be opened or removed until the grout has cured for 24 to 48 hours. Inspections shall be performed within one hour after the removal of the inlet/outlet.

After the grout has cured, all outlets located at anchorages and

high points along the tendon shall be opened to facilitate inspection. All high points along the tendon as well as inlets or outlets located at the anchorages shall be drilled and inspected. Depending on the geometry of the grout inlets, drilling may be required to penetrate to the inner surface of the trumpet or duct. Drilling equipment shall automatically shut-off when steel is encountered. Unless grout caps are determined to have voids by sounding, caps shall not be drilled. Inspection of grout shall be performed in the presence of the QAM using endoscopes or probes. Within 48 hours of completion of the inspections, all voids shall be filled using the vacuum injection grouting process.

All anchorage and inlet/outlet voids that are produced by drilling for inspection purposes shall be sealed and repaired as specified in Section (j) below. The inlet/outlet shall be removed to a minimum depth of 2 inches. An injection tube extending to the bottom of the drilled holes shall be used for backfilling with epoxy.

Post grouting inspection of tendons having a length of less than 150 feet shall be based on the following statistical frequency for inspection:

- (1) For the first 20 tendons, all outlets located at anchors and tendon high points shall be inspected by drilling and probing with an endoscope or probe. If one or more of the inspection locations are found to contain a defect (void), testing all tendons shall continue until 20 consecutive tendons have been inspected and no voids have been found.
- (2) When no defects are detected as defined in No. 1 above, the frequency of inspection can be reduced to inspect every other tendon (50%). If a defect is located, the last five tendons grouted shall be inspected and Step 1 repeated for a new cycle of 100% tendon inspection.

If tendon grouting operations were prematurely terminated prior to completely filling the tendon, then the duct shall be drilled into and voided areas explored with an endoscope. Probing shall not be allowed. The location and extent of all voided areas shall be determined. Grout inlets shall be installed as needed and the voids filled using volumetric measuring vacuum grouting equipment.

- (j) Post-Grouting Sealing of Grout Vents. Shut off valves shall not be opened at injection or evacuation vent pipes, nor shall pipes or caps be removed until the grout has set and inspection of vents has been accepted.

Intermediate grout vent pipes (inlets and outlets) along an internal tendon (including rigid steel pipes in diaphragms) shall be installed straight to facilitate possible drilling and inspection for complete grout filling using, if necessary, an endoscope. Place threaded plastic caps in all inlet/outlet locations required in the plans. The inlet/outlet locations shall be repaired as shown on the design plans using the same approved epoxy grout as used for the anchorage pour-backs. The surface to receive the epoxy material shall be prepared in strict compliance with the manufacturer's recommendations.

- (k) Record of Grouting Operations. The Design-Builder shall keep a record of all grouting operations for each tendon installed, stressed and grouted. This shall include, but shall not necessarily be limited to the following:
- (1) Tendon or group of tendons grouted in one continuous operation.
  - (2) Date grouted.
  - (3) Number of days from stressing to grouting, per tendon.
  - (4) Type of grout mix and additives.
  - (5) Fluidity of grout (flow-cone) per batch for both newly mixed and 30 minute, rested grout.
  - (6) Density of grout per batch of fresh mix.
  - (7) Location of injection vent and direction of grout flow (note; injection vent may not necessarily be at an end anchorage).
  - (8) Applied grouting pressure during normal pumping and maximum pressure sustained for two minutes after closing all vents grouting.
  - (9) Theoretical volume of grout anticipated in order to fill the duct or ducts.
  - (10) Actual quantity of grout in place in the duct(s) after grouting (for one grout mixing and injection operation, this is the quantity mixed less the quantity wasted at the vents, less the quantity remaining in the mixer and injection equipment).
  - (11) Summarize any difficulties encountered and corrective action taken.
  - (12) Witnesses to grouting operation (Design-Builder, QAM, VTrans).

Within 72 hours, the Design-Builder shall provide the QAM with a complete copy of all tendon stressing and grouting operations.

238. PROTECTION OF POST-TENSIONING ANCHORAGES. After acceptance of grouting, all miscellaneous material (tie wire, tape, plastic, etc.) used for temporary protection or sealing shall be removed prior to carrying out further work to protect anchorages.

Details for anchor protection shall be shown on the Working Drawings in accordance with the plans and the following requirements.

- (a) Installation of Anchor Protection. Permanent anchorage protection shall be installed within fourteen days from the satisfactory completion of the grouting. If permanent anchorage protection is not installed after seven days, protect the anchorages as described under "INSTALLATION OF DUCTS, GROUT INJECTION PORTS AND OUTLET VENTS", paragraph (e). The application of the elastomeric coating may be delayed for up to 90 days after grouting. Use plastic or stainless steel threaded caps to plug all grout inlets/outlets.
- (1) Pour-Backs. An approved epoxy grout compound meeting the requirements of the Section "Epoxy Grout for Anchorage Pour-Backs" above shall be used to construct pour-backs at anchorages.

All laitance, grease, curing compounds, surface treatments, coatings and oils shall be removed by grit blasting or water blasting the substrate surface using a minimum 10,000 psi nozzle pressure. Surfaces shall be flushed with potable water

and blown dry. Surfaces must be clean, sound and without any standing water. In case of dispute, ACI 503 shall be used for substrate testing and a minimum of 175 psi tension (pull-off value) shall be attained.

The epoxy shall be mixed and placed per manufacturer's current standard technical guidelines. All pour-backs shall be constructed with leak proof forms to create neat lines. The epoxy compound may require pumping for proper installation. Forms shall be constructed so as to maintain a liquid head to insure intimate contact with the concrete surface. Vents shall be provided as needed to allow for the escape of air to insure complete filling of the forms. Pour-backs shall provide a minimum cover over the grout cap of 1-1/2 inches for anchors in the superstructure and 3 inches for anchors in the substructure.

- (2) Elastomeric Coating. Exposed surfaces of pour-backs (after the epoxy grout pour-back has cured per the manufacturer's recommendations) or grout caps shall be coated with an approved elastomeric coating system meeting the requirements of the Section "Elastomeric Coating System" above. The coating thickness shall be 30 to 45 mils. The application of the elastomeric coating may be delayed up to 90 days after grouting; however, surface cleaning shall be performed immediately prior to application with sufficient time to allow for drying. Pour-backs located on the visible exterior surface of the bridge superstructure shall not receive an elastomeric coating.

Elastomeric coating shall have a final, cured color to the approval of the QAM.

Concrete surfaces, grout caps or other substrates shall be structurally sound, clean and dry. Concrete must be a minimum of 28 days old. All laitance, grease, curing compounds, surface treatments, coatings and oils shall be removed by grit blasting or water blasting using a minimum 10,000 psi nozzle pressure to establish the anchor pattern. Blow the surface with compressed air to remove the dust or water. For elastomeric coated pour-backs which are to receive a Class V coating, apply a manufacture's approve primer over the elastomeric coating before applying the Class V coating.

A concrete test block 2 x 4 feet with a similar surface texture to the surfaces to be coated shall be constructed. A vertical face shall be coated with the elastomeric coating system chosen. The number of coats required for a finished coating thickness of 30 to 45 mils without runs and drips shall be determined. The elastomeric coating shall be mixed and applied per manufacturer's current standard technical specifications. Spray or roller application is permitted (spray application preferred). Have the coating manufacturer representative on site to supervise and comment on the application of the elastomeric coating onto the test block. Coatings shall be applied by personnel with a minimum of three years experience applying similar polyurethane systems. Credentials of these persons shall be submitted to the QAM for review and consideration for approval.

- (b) Anchors inside a Hollow Box. In particular, this applies to anchors at interior diaphragms, deviator ribs or anchor blisters. Providing that the structure is otherwise sealed from all sources of leaks through the bridge deck into the hollow core, and is drained at all low spots, against blisters, ribs or diaphragms, so water, from any source including condensation, cannot accumulate against an anchorage, the protection of the anchors shall be as follows:
  - (1) Permanent grout cap.
  - (2) Elastomeric coating system that shall be applied over the grout cap and overlapping onto adjacent structural concrete by a minimum of 6 inches all around the extremities of the anchor plate.
- (c) Anchors at Surfaces Exposed to Weather Action. The following applies to anchors in expansion joint diaphragms, at ends of girders under expansion joint devices or strip seals, substructures or other similar surfaces directly exposed to weather or potential run-off or leakage. The protection of the anchors at these locations shall be as follows:
  - (1) Permanent grout cap.
  - (2) Encapsulating epoxy grout pour-back.
  - (3) Elastomeric coating system that shall be applied over the grout cap and overlapping onto adjacent structural concrete by a minimum of 12 inches all around the extremities of the anchor plate.

Concrete details under the expansion joint shall incorporate a drip flange (not a v-groove) to provide a positive, protective edge for the top of the elastomeric seal coat.

#### RAILROAD BALLAST

239. DESCRIPTION. This work shall consist of furnishing and installing railroad ballast and geotextile under railroad ballast as shown on the Plans and as directed by the Engineer.

240. MATERIALS.

- (a) Ballast. Ballast shall meet the requirements of Chapter 1 Roadway and Ballast, Sections 2.3 "Materials" and 2.4 "Property Requirements", of the AREMA Manual. The ballast shall be Size No. 4 or larger as defined in Table 1-2-2 in Chapter 1, Section 2.4.4 "Gradations" of the AREMA Manual, and shall be limited to crushed granites, trap rocks, or quartzites, and shall contain no carbonates or slags.
- (b) Geotextile. Geotextile shall meet the requirements of Section 649 for Geotextile Under Railroad Ballast.

241. CONSTRUCTION REQUIREMENTS.

- (a) Production and Handling. Production and handling shall meet the requirements of AREMA Chapter 1, Section 2.5.



- (b) Sampling and Testing. Sampling and testing shall meet the requirements of AREMA Chapter 1, Section 2.8.
  - (c) Installation. Installation shall be performed in accordance with Chapter 5 - Track, Section 4.1 "Specifications for Track Construction" of the AREMA Manual. Railroad ballast shall be installed and tamped in the cribs and shoulders to the depths shown on the Plans.
  - (d) Grading. Grading shall meet the requirements of AREMA Chapter 1, Section 2.6.
242. METHOD OF MEASUREMENT. The quantity of Special Provision (Railroad Ballast) to be measured will be the number of cubic meters (cubic yards) placed in the complete and accepted work, as determined by vehicle loads using three-dimensional measurement. All loads designated shall be leveled at the point of delivery as directed by the Engineer. A load ticket shall be furnished to the Engineer for each load delivered to the job site.

#### REMOVAL AND REPLACEMENT OF CROSS TIES

243. DESCRIPTION. This work shall consist of removing existing cross ties, properly disposing of all removed existing cross ties, and installing new timber cross ties, including tie plates and tie attachment hardware, as detailed in the Plans and as directed by the Engineer.
244. MATERIALS. Unless otherwise specified, all materials shall conform to the requirements of the AREMA Manual, current edition. References to the "Railroad" in the AREMA Manual shall mean the Vermont Agency of Transportation.

A Type A Certification shall be furnished in accordance with Subsection 700.02 for the cross ties.

A Type D Certification shall be furnished in accordance with Subsection 700.02 for the preservative treatment.

245. CROSS TIES. Dimensions of timber ties shall be as shown on the Plans and as defined by Figure 30-3-1 of the AREMA Specifications. All cross ties must be sawn, no hewn ties will be accepted. All species of oak, hard maple, birch, cherry, and beech may be used.

Dimensions for replacement timber cross ties shall match existing as specified in the Plans.

All cross ties shall have nail plate anti-splitting devices applied at the end of each tie. Anti-splitting devices shall be manufactured from a single heavy gauge galvanized steel plate punched in such a manner as to produce nail like projections which will serve to hold the plate to the end of the tie and prevent splitting when applied. The plates shall be manufactured from a minimum 18 gauge galvanized steel conforming to ASTM A525. The plate shall be at least six (6) inches by seven (7) inches for use with seven (7) by nine (9) inch ties. Anti-splitting devices shall comply with the requirements of the AREMA Manual, Chapter 30.

Ties shall be handled and seasoned in accordance with the requirements of the AREMA Manual, Chapter 30, Part 5.

Ties shall be preservative treated in accordance with the AREMA Manual, Chapter 30, Part 6 and Part 7, using a coal tar creosote mixture.

Preservative treatment shall be by pressure process, in accordance with the requirements specified in the AREMA Manual, Chapter 30, Section 7, as applicable to the grades of wood being treated.

The Contractor shall inspect the ties after treatment and shall indicate, by stamp in one end of each tie, that it has been inspected and determined to comply with the requirements of this Section.

246. TIE PLATES FOR TIMBER TIES. Tie plates shall be installed on all new ties. The standard rail fastening for timber ties shall be double shoulder tie plates with cut track spikes. Tie plates shall conform to the requirements of the AREMA Manual, Chapter 5, Specifications for Steel Tie Plates. Tie Plates shall utilize the appropriate design for tie plates as given in the AREMA Manual, Chapter 5, Section 1, Design of Tie Plates for use with AREMA Rail Sections. Tie plates for use with 115 lb. rail shall be per AREMA Plan No. 8, Punching A. Tie plates for use with 136 lb. rail shall be per AREMA Plan No. 12, Punching A.

Tie plates shall be new unless otherwise shown on the Plans or specified in the Special Provisions. Relay tie plates must be designed to fit the rail with which used, and meet the design requirements for new tie plates. Corrosion, substantial losses of material (particularly at the spike holes), substantial wear of the rail seat, and shoulders and lack of flatness will not be permitted.

247. OTHER TRACK MATERIALS. Cut track spikes shall be used to secure rail and tie plates. For new track construction, two spikes per plate shall be installed in each tie plate for tangent track and curves less than 1°30'.

For curves greater than 1°30' but less than 6°, three spikes per plate shall be installed. For curves greater than 6°, four spikes

per plate shall be installed. The spiking pattern shall be as directed by the Railroad. Individual ties installed in existing track shall have the same number of spikes installed in accordance with the existing spiking pattern.

Cut track spikes shall conform to the requirements of the AREMA Manual, Chapter 5, Specifications for High-Carbon Steel Track Spikes, 6 in. length, 5/8 in. reinforced throat design.

Rail anchors will be new spring type, such as Wooding, Verona, Unit, or approved equal. Anchors shall conform to the requirements of the AREMA Manual, Chapter 5, Specifications for Rail Anchors and be applied as specified.

New rail anchors must firmly grip the bottom of the rail to which they are applied, to provide longitudinal rail restraint. Rail anchors shall not be installed at ties which support rail joints, where they will interfere with bond wire, boot legs, insulated joints, and other signal or track appliances or within 2 inches from the edge of any weld to prevent nicks or gouges within the heat affected zones of the welds. Rail anchors shall be capable of application and removal without requiring

special tools, requiring only a sledge. Rail anchors shall be applied in the pattern as shown in AREMA Chapter 5, Section 5.4.

Each tie within 200 feet of the edge of a bridge, turnout, and highway grade crossing; and ties within the area of a highway grade crossing shall be box anchored.

Provide new, treated soft wood tie plugs in accordance with current AREMA Chapter 7, Article 7-1-29 specification for tie plugs. Treat tie plugs with a 60/40 creosote petroleum solution.

248. METHOD OF MEASUREMENT. The quantity of Special Provision (Removal and Replacement of Cross Ties) for the replacement size specified to be measured will be the number of existing cross ties removed and replaced in the complete and accepted work.

#### REMOVE AND RESET RAILROAD TRACKS

249. DESCRIPTION. This work shall consist of removing and resetting existing rail as shown on the Plans and as directed by the Engineer. The work shall include furnishing all labor, materials, and equipment for removing and resetting the existing rail, including but not limited to re-installing existing rail anchors, joint bars, and tie plates. The Contractor shall supply new joint bar bolts, washers, nuts, and track spikes; and joint bars and rail anchors if the existing hardware is not suitable for re-installation.

The work shall also consist of surfacing and aligning track beyond the limits of rail removal and resetting as necessary to achieve adequate superelevation and profile, as determined by the Engineer in coordination with the Railroad. The Contractor shall supply new steel shim plates as necessary to achieve adequate superelevation and profile.

250. MATERIALS. Unless otherwise specified, all new materials shall conform to the requirements of the AREMA Manual as follows:

- (a) Rail, joint bars, track bolts, nuts, and washers shall meet the requirements of Chapter 4 - Rail, Part 1 "Design" and Part 2 "Specifications". The Contractor shall supply all new track bolts, nuts, and washers for the joint bars.
- (b) Tie plates shall meet the requirements of Chapter 5, Part 1 "Tie Plates".
- (c) Track spikes shall meet the requirements of Chapter 5 Track, Part 2 "Track Spikes". The Contractor shall supply all new track spikes of the size specified in the Plans.
- (d) Rail anchors shall meet the requirements of Chapter 5 - Track, Part 7 "Rail Anchors". The Contractor shall supply all new rail anchors of the same type as the existing if the existing hardware is not suitable for re-installation. Use of a type different from the existing is acceptable if approved by the Railroad.
- (e) Shim plates for use under tie plates shall be ASTM A36 or ASTM A709 Grade 36 steel, and shall have the same plan area and spike hole configuration as the tie plates.

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251. CONSTRUCTION REQUIREMENTS.

- (a) Track construction shall meet the requirements of Chapter 5, Sections 4 and 5 of the AREMA Manual.
- (b) Track shall be raised and ballast shall be installed and tamped in the cribs and shoulders as required to align the track to the existing profile.
- (c) As directed by the Engineer, defective track spikes, rail anchors, joint bars, tie plates, and shim plates shall be removed and replaced. No additional compensation for installation of new materials will be paid.
- (d) Existing rail shall be removed within the limits shown on the Plans and stockpiled and protected from damage due to construction operations.
- (e) All track hardware removed that will not be reset, and any waste material, shall become the property of the Contractor and shall be removed from the site at the Contractor's expense.
- (f) The track shall be re-tamped after rail has been installed and rail has been back in service for 4 or 5 days. The track shall be monitored for an additional 30 days and, if necessary as directed by the Engineer, re-tamped.

252. METHOD OF MEASUREMENT. The quantity of Special Provision (Remove and Reset Railroad Tracks) to be measured will be the number of meters (linear feet) of rail removed, reset, and realigned within the limits shown on the Plans in the complete and accepted work.

DESIGN-BUILD PROJECT

253. DESCRIPTION. This work shall consist of furnishing all labor and materials necessary to complete all of the work as required in the Contract and as Proposed by the Design/Builder in the response to the Request for Proposals. The work under this item shall be performed in accordance with all Contract Provisions.

254. METHOD OF MEASUREMENT. The quantity of Special Provision (Design Build Project) to be measured for payment will be to the nearest hundredth of a dollar for the complete and accepted work.

255. BASIS OF PAYMENT. The accepted quantity of Special Provision (Design Build Project) will be paid for at the Contract unit price. Payment will be full compensation to complete all of the work in the Contract and as proposed by the Design/Builder in response to the Request for Proposal.

Payment will be made under:

| <u>Pay Item</u>   | <u>Pay Unit</u> |
|---|-----------------|
| 900.615 Special Provision (ROCKINGHAM IM 091-1(66)<br>Design-Build Project) | Dollar          |

MAINTENANCE OF RAILROAD TRAFFIC

256. DESCRIPTION. This work shall consist of maintaining railroad traffic and coordinating with the Agency and the Railroad for inspection and review of the Contractor's work in conjunction with construction operations to be performed within the Railroad right-of-way, in accordance with the Contract Documents and as directed by the Engineer.
257. GENERAL REQUIREMENTS. When, as stipulated in the Contract Documents, or in the opinion of the Engineer and the Chief Engineering Officer of the Railroad, the construction work would cause hazard to the safe operation of trains and other facilities of the Railroad, including signal and communication lines, the Railroad will furnish the necessary qualified employees to protect their trains and other facilities.

Protection services will be required whenever the Contractor is performing work over, under, or adjacent to the railroad tracks or right-of-way such as excavation, sheeting, shoring, erection, or removal of forms; handling material; using equipment which by swinging or by failure could foul the track; and when any other type of work being performed, in the opinion of the Railroad, requires such service.

The Contractor is advised that although the cost for protective services will be paid for on a lump unit basis by the Agency, the Contractor shall be required to plan, coordinate, and organize the work effort in a way that shall absolutely minimize the use and number of railroad protective personnel required. The Agency and a Railroad representative will review and approve all Contractor work schedules prior to the commencement of work and prior to the assignment of protective personnel. Misuse of these protective services by the Contractor due to inadequate work procedures will not be allowed and shall be sufficient cause for the Agency to require the Contractor to bear all inappropriate costs.

Railroad train crews necessary for the operation of Contractor scheduled work trains or Contractor owned or leased locomotive equipment shall not be paid by the Agency under this Section; all such costs will be considered incidental to the Contractor's work and therefore shall be entirely borne by the Contractor.

All existing signs, markers, and other informational indicators associated with the operations of the Agency or the Railroad that are removed by the Contractor in the performance of this work shall be preserved and reinstalled as soon as possible. Reinstallation shall precede any train operation at the same locations as they are removed. Any sign, marker, or other information indicator that is damaged by the Contractor's operations shall be considered a charge against the Contractor and shall be paid for by the Contractor or deducted from any monies due or that may become due the Contractor under this Contract.

Railroad traffic shall be maintained at all times with safety and continuity, and the Contractor shall conduct all operations on or over the railroad right-of-way fully within the rules, regulations, and requirements of the Agency and the Railroad. The Contractor shall be responsible for becoming acquainted with such requirements as the Railroad and/or Agency demands.

Existing train operations may include, but are not limited to, the

following:

- (a) Regularly scheduled passenger trains.
- (b) Regularly scheduled freight trains.
- (c) Other unscheduled trains or equipment being moved by the various Railroads.

258. SUBMITTALS.

- (a) At the preconstruction meeting, the Contractor shall submit for approval by the Agency a detailed description of proposed methods for accomplishing the construction work required under the Contract, to include methods for protecting Railroad traffic. Approval by the Agency shall not serve in any way to relieve the Contractor of complete responsibility for the adequacy and safety of the proposed methods.
- (b) Prior to beginning work, the Contractor shall submit for the approval of the Engineer a detailed description of the procedure(s) for work to be performed over, under, within, or adjacent to the Railroad right-of-way. Work shall not proceed until the proposed procedure(s) have been approved by the Agency.

259. CONSTRUCTION REQUIREMENTS. The Contractor shall obtain verification of the time and schedule of track occupancy from the Railroad before proceeding with any construction or demolition work over, under, within, or adjacent to the Railroad right-of-way.

All work to be done under, upon, or over the Railroad right-of-way shall be performed by the Contractor in a manner satisfactory to the Engineer and shall be performed at such times and in such manner as to not interfere with the movement of trains or traffic upon the tracks. The Contractor shall use all necessary care and precaution to avoid accidents, delay, or interference with the trains or other property.

The Contractor shall give notice to the Railroad at least fifteen (15) days prior to the commencement of any work, or any portion of the work, over or adjacent to the Railroad right-of-way, so that necessary arrangements can be made promptly by the Railroad to protect railroad traffic.

The Contractor shall conduct the work and handle equipment and materials so that no part of any equipment should foul an operated track or wire line without the written permission of the Railroad.

When it is noted that the work will foul an operating track, the Contractor shall give the Railroad written notice fifteen (15) days in advance so that, if approved, arrangements can be made for proper protection of the railroad.

Cranes, shovels, or any other equipment shall be considered to be fouling the track when located in such position that failure of same, with or without load, brings the equipment within the fouling limit.

Equipment of the Contractor to be used adjacent to the tracks shall be in first-class condition so as to fully prevent failures of defective equipment that might cause delay in the operation of trains or damage to

Railroad facilities. The Contractor's equipment shall not be placed or put into operation adjacent to tracks without first obtaining permission from the Railroad. Under no circumstance shall any equipment or materials be placed or stored within 25 feet from the centerline of the track, unless otherwise directed.

Materials and equipment belonging to the Contractor shall not be stored adjacent to tracks without first obtaining permission from the Railroad. The Agency and/or Railroad will not be liable for damage to such materials and equipment from any cause. The Contractor shall keep the tracks adjacent to the site clear of all refuse and debris and shall leave the property in the condition existing before the start of construction operations.

The Contractor shall consult with the Railroad to determine the type of protection required to ensure safety and continuity of Railroad traffic incidental to the particular methods of operation and equipment to be used in the work. Any Construction Inspectors, track foremen or track watchmen, signalmen, or other employees deemed necessary for protective services by the Railroad, or its duly authorized representative to ensure the safety of trains contingent upon the Contractor's operations, shall be obtained from the Railroad by the Contractor.

The providing of such watchmen and other precautionary measures shall not, however, relieve the Contractor from liability for payment of damages caused by the Contractor's operations.

260. FLAGGING AND PROTECTIVE SERVICES. The Contractor shall make all arrangements with the Agency and the Railroad, as applicable, for railroad employees required for flagging and protective services.

Railroad flaggers shall be furnished in accordance with Section 630.

261. METHOD OF MEASUREMENT. The quantity of Special Provision (Maintenance of Railroad Traffic) (N.A.B.I.) to be measured for payment will be on a lump unit basis for the specified railroad flagging and protective services provided.

262. BASIS OF PAYMENT. Payment for Special Provision (Maintenance of Railroad Traffic) (N.A.B.I.) will be as follows:

- (a) A lump unit of twenty thousand dollars (\$20,000) has been included in the bid proposal for flagging and protective services. Payment will be for reimbursing the Contractor for the actual invoice amounts paid to the Railroad by the Contractor for flagging and protective services. The Contractor shall submit four copies of paid receipted itemized bills from the Railroad for the flagging and protective services charges to the Agency for review and approval. The Contractor's overhead will not be reimbursed.
- (b) The lump unit will be adjusted to the actual amount paid to the Railroad for flagging and protective services, after review and approval of paid invoices.

No additional payment will be made under this Contract item. All other costs for coordination and maintenance of rail traffic in accordance with these provisions will be considered incidental to Special Provision (Maintenance of Railroad Traffic) (N.A.B.I.).

Special Provisions for:

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If the Contract is not completed within the specified time limit for completion of the Contract (or authorized extended time), no payment will be made for any costs incurred beyond the specified time of completion.

Payment will be made under:

| <u>Pay Item</u>   | <u>Pay Unit</u> |
|---|-----------------|
| 900.630 Special Provision (Maintenance of Railroad Traffic)<br>(N.A.B.I.) | Hour            |



GENERAL SPECIAL PROVISIONS FOR ALL PROJECTS  
2011 STANDARD SPECIFICATIONS

SECTION 101 - DEFINITIONS AND TERMS

1. 101.01 ABBREVIATIONS, is hereby modified by adding the following new abbreviation directly after "ABS":

ACL                                      Advanced Certification List

2. 101.01 ABBREVIATIONS, is hereby further modified by adding the following new abbreviation directly after "ANSI":

APL                                      Approved Products List

3. 101.01 ABBREVIATIONS, is hereby still further modified by adding the following new abbreviation directly after "CPM":

CPPP                                      Corrugated Polypropylene Pipe

4. 101.02 DEFINITIONS, HOLIDAYS, is hereby modified by deleting the ninth row in the listing (for "Columbus Day").

5. 101.02 DEFINITIONS, HOLIDAYS, is hereby further modified by adding the following as the twelfth row in the listing (directly after "Thanksgiving Day"):

Day After Thanksgiving                                      Fourth Friday in November

SECTION 103 - TAXES AND INSURANCE

6. 103.04 INSURANCE REQUIREMENTS, part (e) General Insurance Conditions, is hereby modified by deleting the second paragraph in its entirety.

SECTION 105 - CONTROL OF THE WORK

7. 105.03 PLANS AND WORKING DRAWINGS, part (a) Contract Plans, is hereby modified by deleting the second paragraph in its entirety.

8. 105.03 PLANS AND WORKING DRAWINGS, part (a) Contract Plans, is hereby further modified by deleting the first sentence of the third paragraph.

9. 105.03 PLANS AND WORKING DRAWINGS, part (a) Contract Plans, is hereby still further modified by adding the phrase "in an accessible format" at the end of the third paragraph.

10. 105.03 PLANS AND WORKING DRAWINGS, part (b) Working Drawings, subpart (4) List of Working Drawings, is hereby modified by deleting the phrase "Roadway, Traffic, and Safety Engineer" and replacing it with the phrase "Project Manager" in the twenty-third row (beginning "641").

11. 105.14 SUNDAY AND HOLIDAY WORK, part (b) Holidays, is hereby corrected by deleting punctuation "," at the end of the paragraph and replacing it with punctuation ".".

12. 105.16 LOAD RESTRICTIONS, part (a) General, is hereby modified by being deleted in its entirety and replaced with the following:
- (a) General. All Contractors, subcontractors, suppliers, or others involved in any project-related activities shall comply with all legal load restrictions specified in Title 23 VSA § 1392 in the hauling of equipment or material on public roads, including that beyond the limits of the project. The application for and possession of any hauling or related permit will not relieve the Contractor or others involved in any project-related activities of any liability that may arise due to any damage resulting from the use or moving of equipment, vehicles, or any other project-related activity.
13. 105.16 LOAD RESTRICTIONS, part (b) Limitations on Use of Equipment and Vehicles, is hereby modified by being deleted in its entirety and replaced with the following:
- (b) Limitations on Use of Equipment and Vehicles. Use of equipment and vehicles is subject to the following:
- (1) No vehicle or equipment exceeding the load restrictions cited in Title 23 VSA § 1392 will be permitted on any structure as defined by the Engineer.
- (2) The operation of any equipment or vehicle of such mass (weight) or any other project-related equipment loaded so as to cause damage to structures, the roadway, or to any other type of active construction will not be permitted, regardless of the limits set forth in Title 23.
- (3) Hauling or operation of said vehicles or equipment over any permanent course of any bituminous pavement or any structure during active construction will not be permitted.
- (4) No loads of any category will be permitted on a concrete pavement or concrete structure prior to expiration of the curing period and until the concrete reaches its specified 28-day compressive strength.
- (5) Notwithstanding those restrictions above, the Contractor shall be responsible for any and all damages incurred to any public roadway as defined in Title 23 due to the use of any equipment or vehicles related to project activities.
14. 105.26 OPENING WASTE, BORROW, AND STAGING AREAS, part (f), is hereby corrected by deleting punctuation "." at the end of the paragraph.

SECTION 108 - PROSECUTION AND PROGRESS

15. 108.09 TEMPORARY SUSPENSION OF THE WORK, part (d) Seasonal Closure, is hereby modified by deleting the phrase "of the Engineer, and only under such conditions as specified therein" and replacing it with the phrase "from the Regional Construction Engineer".

16. 108.09 TEMPORARY SUSPENSION OF THE WORK, part (d) Seasonal Closure, is hereby further modified by adding the following:

Permission will only be granted for work which will result in a direct benefit to the State or the traveling public. Items which may be considered as a benefit include but are not limited to shorter Contract duration, a cost savings, increased safety for the traveling public, and an ability to ensure the quality of work. The Contractor shall request permission in writing, detailing what Contract items may be affected, a schedule of work, and the benefits to the State or traveling public.

17. 108.11 DETERMINATION OF EXTENSION OF CONTRACT TIME FOR COMPLETION, part (b) Determination of Contract Completion Date Extension, subpart (8), is hereby modified by deleting the phrase ", delays in submittals, errors in submittals, and the Contractor's means and methods of construction".
18. 108.11 DETERMINATION OF EXTENSION OF CONTRACT TIME FOR COMPLETION, part (b) Determination of Contract Completion Date Extension, subpart (9), is hereby modified by deleting the phrase ", including but not limited to the Contractor's means and methods of construction".
19. 108.11 DETERMINATION OF EXTENSION OF CONTRACT TIME FOR COMPLETION, part (b) Determination of Contract Completion Date Extension, subpart (11), is hereby modified by being deleted in its entirety.
20. 108.11 DETERMINATION OF EXTENSION OF CONTRACT TIME FOR COMPLETION, part (b) Determination of Contract Completion Date Extension, subpart (13), is hereby modified by adding the following as the first sentence:
- Industry-wide material or supply shortages not reasonably anticipated by the Contractor at the time the Contract was entered.
21. 108.11 DETERMINATION OF EXTENSION OF CONTRACT TIME FOR COMPLETION, part (b) Determination of Contract Completion Date Extension, subpart (13), is hereby further modified by changing the word "Delay" to the word "Delays" at the beginning of the first sentence.
22. 108.12 FAILURE TO COMPLETE WORK ON TIME, part (c) Liquidated Damages; General; Days Charged, is hereby modified by deleting the DAILY CHARGE FOR LIQUIDATED DAMAGES FOR EACH WORKING DAY OF DELAY table in its entirety and replacing it with a new table as follows:

DAILY CHARGE FOR LIQUIDATED DAMAGES  
FOR EACH WORKING DAY OF DELAY

| Original Contract Amount |                       |                                    |
|--------------------------|-----------------------|------------------------------------|
| From More Than (\$)      | To And Including (\$) | Daily Charge Per Day of Delay (\$) |
| 0                        | 500,000               | 1,200.00                           |
| 500,000                  | 1,000,000             | 1,300.00                           |
| 1,000,000                | 1,500,000             | 1,400.00                           |
| 1,500,000                | 3,000,000             | 1,800.00                           |
| 3,000,000                | 5,000,000             | 2,300.00                           |
| 5,000,000                | 10,000,000            | 3,500.00                           |
| 10,000,000               | 20,000,000            | 5,900.00                           |
| 20,000,000+              | -----                 | 10,700.00                          |

SECTION 109 - MEASUREMENT AND PAYMENT

23. SECTION 109 - MEASUREMENT AND PAYMENT, is hereby corrected by deleting pages 1-141 and 1-142 in their entirety.

SECTION 203 - EXCAVATION AND EMBANKMENTS

24. 203.01 DESCRIPTION, is hereby modified by adding the phrase "performing test borings for the purpose of determining areas of roadway and embankment subsurface voids;" after the phrase "trimming and shaping of slopes;" in the first sentence of the first paragraph.

25. 203.01 DESCRIPTION, is hereby further modified by adding the following new part (1):

(1) Test Borings. Test Borings shall consist of an investigative and planned approach to determining areas of roadway and embankment subsurface voids and repairing bored areas.

26. 203.02 MATERIALS, is hereby modified by adding the following to the Subsection listing:

PVC Plastic Pipe.....710.06

27. 203.02 MATERIALS, is hereby further modified by adding the following paragraphs:

Concrete for backfilling subsurface voids shall meet the requirements of Controlled Density (Flowable) Fill of Section 541.

Bituminous concrete pavement shall conform to the requirements of Section 406 or 490, as applicable for the Contract, with the exception that the mix design submittal and plant inspection requirements set forth in Section 406 or 490 will not apply.

28. 203.03 GENERAL CONSTRUCTION REQUIREMENTS, is hereby modified by adding the following as the eighth paragraph:

Prior to the construction of Test Borings and the placement of Controlled Density (Flowable) Fill, the Contractor shall submit to the Engineer site-specific plans, detailing the schedule of work (for these two items), type and location of drilling, sleeve installation, pumping system, confirmatory boring operation, method of filling bore hole (with or without voids being encountered), and repair of the roadway section (sand, gravel, and pavement).

29. 203.11 EMBANKMENTS, is hereby modified by adding the following new part (e):

(e) Test Borings. Test borings shall be performed at the approximate locations indicated in the Plans and/or as directed by the Engineer.

When used adjacent to culverts, test borings shall extend to a depth equal to the bottom of the culvert using casing advanced drilling methods. Alternate drilling equipment that provides a suitably clean, open hole may be submitted to the Engineer for approval.

If void(s) are encountered, Controlled Density (Flowable) Fill shall be placed to completely fill the void(s). Confirmatory borings shall be performed in these locations as directed by the Engineer.

The roadway surface at boring hole locations shall be backfilled and then patched using Bituminous Concrete Pavement.

30. 203.13 METHOD OF MEASUREMENT, is hereby modified by adding the following new part (e):

(e) Test Borings. The quantity of Test Borings to be measured for payment will be the number of meters (linear feet) of test boring performed in the complete and accepted work.

31. 203.14 BASIS OF PAYMENT, is hereby modified by adding the phrase "and Test Borings" after the phrase "Shoulder Berm Removal" in the first sentence of the first paragraph.

32. 203.14 BASIS OF PAYMENT, is hereby further modified by adding the phrase "submitting site-specific plans as required, performing test borings, installing sleeves, backfilling, patching with bituminous concrete pavement," after the phrase "work specified," in the second sentence of the first paragraph.

33. 203.14 BASIS OF PAYMENT, is hereby corrected by adding a period at the end of the sixth paragraph.

34. 203.14 BASIS OF PAYMENT, is hereby still further modified by adding the following paragraph and pay item:

Filling of subsurface voids encountered in performing Test Borings will be paid for under Contract item 541.45.

Payment will be made under:

| <u>Pay Item</u>     | <u>Pay Unit</u>     |
|---------------------|---------------------|
| 203.45 Test Borings | Meter (Linear Foot) |

SECTION 310 - RECLAIMED STABILIZED BASE

35. 310.04 CONSTRUCTION, is hereby modified by deleting the phrase "or dust control" after the word "stabilizing" in the third paragraph.

36. 310.04 CONSTRUCTION, is hereby further modified by adding the following sentence to the third paragraph:

When a dust control agent is not exclusively specified on the Plans, water and/or Calcium Chloride shall be used as that agent to meet all requirements of this Section.

37. 310.10 BASIS OF PAYMENT, is hereby modified by adding the following as the fourth paragraph:

Calcium Chloride used for dust control after the reclamation will not be paid for directly, but will be considered incidental to the Reclaimed Stabilized Base item.

SECTION 406 - MARSHALL BITUMINOUS CONCRETE PAVEMENT

38. 406.03 COMPOSITION OF MIXTURE, part (d) Control of Mixtures, TABLE 406.03D - MINIMUM QUALITY CONTROL GUIDELINES, is hereby modified by deleting footnote designation "(1)" after "Cold Feed Gradation" in the fourth row.
39. 406.03 COMPOSITION OF MIXTURE, part (d) Control of Mixtures, TABLE 406.03D - MINIMUM QUALITY CONTROL GUIDELINES, is hereby further modified by adding the following as the fifth row:

|   |  |                          |
|---|--|--------------------------|
| Cold Feed % Fractured Face &<br>Thin and Elongated Particles <sup>(1)</sup> | Day of initial paving<br>and 1 per week <sup>(4)</sup> | ASTM D5821<br>ASTM D4791 |
|---|--|--------------------------|

40. 406.03 COMPOSITION OF MIXTURE, part (d) Control of Mixtures, TABLE 406.03D - MINIMUM QUALITY CONTROL GUIDELINES, is hereby still further modified by deleting footnote 1 in its entirety and replacing it as follows:

1 - "Fractured faces" (for gravel sources only). "Thin and elongated" of particles retained on the No. 4 (4.75 mm) sieve and above.

41. 406.03 COMPOSITION OF MIXTURE, part (f) Boxed Samples, is hereby corrected by adding the word "Engineer" to the end of the second (last) sentence.
42. 406.05 BITUMINOUS MIXING PLANT AND TESTING, part (a) Requirements for All Plants, subpart (12) Testing Facilities, is hereby modified by adding the following as the fourth paragraph:

The laboratory shall be equipped with a monitoring system readout that provides real-time access to active Agency project(s) production status. The system shall accumulate and provide the following information via digital display: Project name and number, truck number, ticket number, product description, and accumulated project daily quantity and load quantity accurate to the nearest metric ton (ton). The display shall be continually updated by the plant's recording system. Waivers may be considered for plants with production capacities not capable of exceeding 150 metric tons (tons) per hour.

43. 406.16 SURFACE TOLERANCE, is hereby modified by adding the phrase ", with the exception of all limited access highway on and off ramps," after the phrase "miscellaneous mix" in the second (last) sentence of the sixth (last) paragraph.

SECTION 490 - SUPERPAVE BITUMINOUS CONCRETE PAVEMENT

44. 490.03 COMPOSITION OF MIXTURE, part (b) Design Criteria, TABLE 490.03B - DESIGN CRITERIA is hereby modified by deleting the fourth row (for "Dust Proportion") in its entirety and replacing it with the following:

|   |  |
|---|--|
| Dust Proportion<br>(Filler/Asphalt Ratio) | 0.60 - 1.20 (Wet Sieve)<br>(Dry Sieve for Production -<br>Types IS and IIS: 0.50 - 1.20<br>Types IIIS, IVS, and VS: 0.50 - 1.00) |
|---|--|

45. 490.03 COMPOSITION OF MIXTURE, part (b) Design Criteria, TABLE 490.03B - DESIGN CRITERIA is hereby further modified by deleting the sixth row (for "Voids in Mineral Aggregate") in its entirety and replacing it with the following:

|                                      |              |              |             |              |              |              |
|--------------------------------------|--------------|--------------|-------------|--------------|--------------|--------------|
| Voids in Mineral Aggregate<br>(VMA)% | 12.5<br>min. | 13.5<br>min. | 14.5<br>min | 15.5<br>min. | 16.5<br>min. | 17.5<br>min. |
|--------------------------------------|--------------|--------------|-------------|--------------|--------------|--------------|

46. 490.03 COMPOSITION OF MIXTURE, part (b) Design Criteria, TABLE 490.03B - DESIGN CRITERIA is hereby still further modified by deleting the ninth row (for "Voids Filled With Asphalt") in its entirety.
47. 490.03 COMPOSITION OF MIXTURE, part (b) Design Criteria, TABLE 490.03B - DESIGN CRITERIA is hereby still further modified by deleting footnotes (3), (4), and (5) in their entirety.
48. 490.03 COMPOSTION OF MIXTURE, part (b) Design Criteria, is hereby modified by deleting the heading "Voids Filled With Asphalt (VFA)" and the equation " $VFA = 100 \times ((VMA - V_a)/VMA)$ " in the second paragraph.
49. 490.03 COMPOSITION OF MIXTURE, part (c) Mix Design, is hereby modified by deleting the phrase ", and a single percentage for VFA" in the first sentence of the third paragraph.
50. 490.03 COMPOSITION OF MIXTURE, part (d) Control of Mixtures, TABLE 490.03C - PRODUCTION TESTING TOLERANCES is hereby modified by deleting the seventh (last) row (for "VFA") in its entirety.
51. 490.03 COMPOSITION OF MIXTURE, part (d) Control of Mixtures, TABLE 490.03C - PRODUCTION TESTING TOLERANCES is hereby further modified by deleting footnote 2 in its entirety.
52. 490.03 COMPOSITION OF MIXTURE, part (d) Control of Mixtures, TABLE 490.03D - MINIMUM QUALITY CONTROL GUIDELINES, is hereby modified by deleting footnote designation "(1)" after "Cold Feed Gradation" in the fourth row.
53. 490.03 COMPOSITION OF MIXTURE, part (d) Control of Mixtures, TABLE 490.03D - MINIMUM QUALITY CONTROL GUIDELINES, is hereby further modified by adding the following as the fifth row:

|   |  |                          |
|---|--|--------------------------|
| Cold Feed % Fractured Face &<br>Thin and Elongated Particles <sup>(1)</sup> | Day of initial paving<br>and 1 per week <sup>(4)</sup> | ASTM D5821<br>ASTM D4791 |
|---|--|--------------------------|

54. 490.03 COMPOSITION OF MIXTURE, part (d) Control of Mixtures, TABLE 490.03D - MINIMUM QUALITY CONTROL GUIDELINES, is hereby still further modified by deleting footnote 1 in its entirety and replacing it as follows:

- 1 - "Fractured faces" (for gravel sources only). "Thin and elongated" of particles retained on the No. 4 (4.75 mm) sieve and above.

55. 490.05 BITUMINOUS MIXING PLANT AND TESTING, part (a) Requirements for All Plants, subpart (12) Testing Facilities, is hereby modified by adding the following as the third paragraph:

The laboratory shall be equipped with a monitoring system readout that provides real-time access to active Agency project(s) production status. The system shall accumulate and provide the following information via digital display: Project name and number, truck number, ticket number, product description, and accumulated project daily quantity and load quantity accurate to the nearest metric ton (ton). The display shall be continually updated by the plant's recording system. Waivers may be considered for plants with production capacities not capable of exceeding 150 metric tons (tons) per hour.

56. 490.14 COMPACTION, part (c) Coring Protocol, is hereby corrected by deleting text "0" and replacing it with text ")" in the first sentence of the seventh paragraph.
57. 490.16 SURFACE TOLERANCE, is hereby modified by adding the phrase ", with the exception of all limited access highway on and off ramps," after the phrase "miscellaneous mix" in the second (last) sentence of the sixth (last) paragraph.

SECTION 501 - HPC STRUCTURAL CONCRETE

58. 501.03 CLASSIFICATION AND PROPORTIONING, TABLE 501.03A (Metric), is hereby modified by deleting the fourth column (with header "Max. Slump (mm)") in its entirety and replacing it with the following:

| Max. <sup>7</sup><br>Slump<br>(mm) |
|------------------------------------|
| ---                                |
| ---                                |
| ---                                |
| N/A                                |
| ---                                |

59. 501.03 CLASSIFICATION AND PROPORTIONING, TABLE 501.03A (Metric), is hereby further modified by adding the following footnote:

<sup>7</sup> The mix shall not exhibit segregation at the slump/spread used at placement. If the Engineer suspects there is segregation, the Engineer will require a slump/spread test be performed by the Contractor to visually observe the characteristics of the mix. If in the opinion of the Engineer the mix does exhibit segregation, the load will be rejected and subsequent load(s) shall be tested, at a minimum of 3 loads or until the problem is corrected.

If the Contractor needs a concrete with a slump greater than 200 mm, the Contractor shall propose to the Engineer to use an SCC mix, which shall be submitted to the Engineer for review and acceptance.



60. 501.03 CLASSIFICATION AND PROPORTIONING, TABLE 501.03A (English), is hereby modified by deleting the fourth column (with header "Max. Slump (in)") in its entirety and replacing it with the following:

|                                    |
|------------------------------------|
| Max. <sup>7</sup><br>Slump<br>(mm) |
| ---                                |
| ---                                |
| ---                                |
| N/A                                |
| ---                                |

61. 501.03 CLASSIFICATION AND PROPORTIONING, TABLE 501.03A (English), is hereby corrected by deleting text "700 mm" and replacing it with text "28 inches" in footnote 4.
62. 501.03 CLASSIFICATION AND PROPORTIONING, TABLE 501.03A (English), is hereby further modified by adding the following footnote:

<sup>7</sup> The mix shall not exhibit segregation at the slump/spread used at placement. If the Engineer suspects there is segregation, the Engineer will require a slump/spread test be performed by the Contractor to visually observe the characteristics of the mix. If in the opinion of the Engineer the mix does exhibit segregation, the load will be rejected and subsequent load(s) shall be tested, at a minimum of 3 loads or until the problem is corrected.

If the Contractor needs a concrete with a slump greater than 8 inches, the Contractor shall propose to the Engineer to use an SCC mix, which shall be submitted to the Engineer for review and acceptance.

63. 501.03 CLASSIFICATION AND PROPORTIONING, ninth paragraph (beginning "A minimum of thirty (30)..."), is hereby corrected by deleting the phrase "1716 Barre-Montpelier Rd., Berlin, Vermont 05602" and replacing it with the phrase "2178 Airport Road Unit B, Berlin, Vermont 05641" in the second sentence.
64. 501.11 DEPOSITING CONCRETE UNDERWATER, part (a) General, subpart (1), is hereby corrected by deleting the phrase "1716 Barre-Montpelier Rd., Berlin, Vermont 05602" and replacing it with the phrase "2178 Airport Road Unit B, Berlin, Vermont 05641" in the second sentence of the second paragraph.

#### SECTION 505 - PILING

65. 505.09 BASIS OF PAYMENT, is hereby modified by adding the following pay item:

| <u>Pay Item</u>                               | <u>Pay Unit</u>     |
|---|---------------------|
| 505.12 Steel Piling, HP 250 x 85 (HP 10 x 57) | Meter (Linear Foot) |

SECTION 506 - STRUCTURAL STEEL

66. 506.19 BOLTING AND CONNECTIONS, part (c) Installation, is hereby modified by deleting the tenth paragraph (Beginning "Bolts shall be tightened...") in its entirety and replacing it with the following:
- Bolts shall be tightened to develop a tension not less than 5 percent in excess of the minimum bolt tension specified in Table 506.19A. Bolts shall not be tightened to more than the maximum tension specified in Table 506.19A.
67. 506.19 BOLTING AND CONNECTIONS, part (c) Installation, is hereby further modified by deleting subparts (1) Calibrated Wrench Method, (2) Turn of the Nut Method, and (3) Torque Method in their entirety.
68. 506.19 BOLTING AND CONNECTIONS, part (c) Installation, subpart (4) Tension Control Assembly Method, is hereby modified by being re-designated as part (1).
69. 506.19 BOLTING AND CONNECTIONS, part (c) Installation, subpart (5) Direct Tension Indicator Method, is hereby modified by being re-designated as part (2).
70. 506.19 BOLTING AND CONNECTIONS, part (c) Installation, is hereby still further modified by deleting TABLE 506.19B (including associated paragraphs) in its entirety.
71. 506.19 BOLTING AND CONNECTIONS, part (d) Acceptance of Bolt Tensioning, is hereby modified by deleting the second and third sentences of the first paragraph.
72. 506.19 BOLTING AND CONNECTIONS, part (d) Acceptance of Bolt Tensioning, is hereby further modified by deleting the fourth, fifth, ninth, eleventh, and twelfth paragraphs in their entirety.

SECTION 507 - REINFORCING STEEL

73. 507.01 DESCRIPTION, is hereby modified by adding the phrase "of the level specified" after the phrase "bar reinforcement".
74. 507.01 DESCRIPTION, is hereby further modified by adding the following paragraphs:

Levels and associated types of reinforcing steel are specified as follows:

- (a) Level I (Limited Corrosion Resistance). Level I reinforcing includes plain, low alloy, and epoxy coated reinforcing steel.
- (b) Level II (Improved Corrosion Resistance). Level II reinforcing includes stainless clad and dual-coated reinforcing steel.
- (c) Level III (Exceptional Corrosion Resistance). Level III reinforcing includes solid stainless reinforcing steel.

The location, level, and when specified, type of reinforcing shall be as indicated in the Plans. Reinforcing supplied shall meet the requirements of the level specified or any higher level. Only one type of reinforcing steel shall be used for each level for the Contract work, unless permitted in writing by the Engineer.

75. 507.02 MATERIALS, is hereby modified by deleting the sixth (final) entry in the Subsection listing.
76. 507.03 FABRICATION AND SHIPMENT, part (a) General, is hereby modified by adding the phrase "deformed bar" after the phrase "shall be" in the first paragraph.
77. 507.03 FABRICATION AND SHIPMENT, part (a) General, is hereby corrected by deleting punctuation ".." and replacing it with punctuation "." at the end of the first paragraph.
78. 507.04 PROTECTION OF MATERIAL, is hereby modified by adding the following as the second sentence in the first paragraph:

When multiple levels of reinforcing steel are used on a project, they shall be stored separately, including during transport in order that there is no direct contact between the bars.

79. 507.04 PROTECTION OF MATERIAL, is hereby further modified by deleting the phrase "The epoxy coating" and replacing it with the word "Coatings" in the third sentence of the third paragraph.
80. 507.04 PROTECTION OF MATERIAL, is hereby still further modified by deleting the phrase "as required for damaged areas" and replacing it with the phrase "per the coating manufacturer's recommendations and to the satisfaction of the Engineer" in the third sentence of the fifth (last) paragraph.
81. 507.04 PROTECTION OF MATERIAL, is hereby still further modified by adding the following paragraph:

Ends of Level II reinforcing steel where the mild steel is exposed shall be repaired in the following manner:

- (a) Cut ends of dual-coated reinforcing steel shall be coated with a two-part epoxy patching material as specified by the coating manufacturer. The materials and procedures shall be approved by the Engineer prior to the repairs being performed.
- (b) Cut ends of stainless clad reinforcing steel shall be epoxied and capped in accordance with the manufacturer's recommendations with either stainless steel caps or plastic caps. Caps shall be sealed to prevent the intrusion of moisture.

82. 507.05 PLACING AND FASTENING REINFORCING STEEL, is hereby modified by deleting the sixth paragraph in its entirety and replacing it with the following:

Tie wires and supports used for installation of reinforcement shall be composed of the same material as any steel being contacted or shall be plastic. When forms are to be removed in their entirety, uncoated steel chairs equipped with snug-fitting, high-density, polyethylene tips which provide 3 mm (1/4 inch) clearance between the metal and any exposed surface may be used.

83. 507.10 METHOD OF MEASUREMENT, is hereby modified by deleting the phrase ", Epoxy Coated Reinforcing Steel, and Galvanized Reinforcing Steel" and replacing it with the phrase "of the type and size specified" in the first paragraph.

84. 507.10 METHOD OF MEASUREMENT, is hereby further modified by adding the phrase "of the type specified" at the end of the second paragraph (beginning "The quantity of Drilling and Grouting Dowels...").
85. 507.11 BASIS OF PAYMENT, is hereby modified by deleting the following pay items:

| <u>Pay Item</u>                       | <u>Pay Unit</u>  |
|---------------------------------------|------------------|
| 507.15 Reinforcing Steel              | Kilogram (Pound) |
| 507.17 Epoxy Coated Reinforcing Steel | Kilogram (Pound) |
| 507.18 Galvanized Reinforcing Steel   | Kilogram (Pound) |

86. 507.11 BASIS OF PAYMENT, is hereby further modified by adding the following pay items:

| <u>Pay Item</u>                     | <u>Pay Unit</u>  |
|-------------------------------------|------------------|
| 507.11 Reinforcing Steel, Level I   | Kilogram (Pound) |
| 507.12 Reinforcing Steel, Level II  | Kilogram (Pound) |
| 507.13 Reinforcing Steel, Level III | Kilogram (Pound) |

#### SECTION 509 - LONGITUDINAL DECK GROOVING

87. 509.03 CONSTRUCTION DETAILS, is hereby modified by deleting the last line of the second paragraph (beginning "Depth: 4 mm...") and replacing it with the following:

Depth: 6 mm ( $\pm 2$  mm)((1/4")( $\pm 1/16$ ")

#### SECTION 510 - PRESTRESSED CONCRETE

88. 510.12 INSTALLATION, part (a) Prestressed Concrete, subpart (2) Initial Post-tensioning, is hereby modified by deleting the first sentence in its entirety.

#### SECTION 516 - EXPANSION DEVICES

89. 516.01 DESCRIPTION, is hereby modified by adding the phrase ", or partially removing and modifying," after the word "installing".
90. 516.05A PARTIAL REMOVAL AND MODIFICATION, is hereby made a new Subsection of the Standard Specifications as follows:

516.05A PARTIAL REMOVAL AND MODIFICATION. The Contractor shall partially remove and modify the existing bridge joint at the locations indicated in the Plans and as directed by the Engineer.

Steel for new joint plates shall meet the requirements of Subsection 714.02.

The Contractor shall remove and dispose of existing joint plates, drain troughs, and associated hardware.

The Contractor shall grind existing steel plates and/or shoulder concrete to the configuration shown on the Plans. The final surface shall be to the satisfaction of the Engineer.

91. 516.06 METHOD OF MEASUREMENT, is hereby modified by adding the following paragraph:

The quantity of Partial Removal and Modification of Bridge Joint to be measured for payment will be the number of meters (linear feet) of bridge joint removed and modified in the complete and accepted work, measured along its centerline.

92. 516.07 BASIS OF PAYMENT, is hereby modified by adding the following paragraph and pay item:

The accepted quantity of Partial Removal and Modification of Bridge Joint will be paid for at the Contract unit price per meter (linear foot). Payment will be full compensation for partially removing and modifying the existing joint as specified and as detailed in the Plans, and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

| <u>Pay Item</u>   | <u>Pay Unit</u>     |
|---|---------------------|
| 516.20 Partial Removal and Modification of Bridge Joint | Meter (Linear Foot) |

SECTION 525 - BRIDGE RAILINGS

93. 525.02 MATERIALS, is hereby modified by adding the following as the third entry in the Subsection listing:

Structural Steel.....714.02

94. 525.06 INSTALLATION, part (a) General, is hereby modified by adding the following as the sixth (last) paragraph:

Concrete railing shall receive an aesthetic finish in accordance with Subsection 501.16. Cracks in concrete railing shall be repaired by a method approved by the Engineer. Cracks in concrete greater than 0.25 mm (0.01 inch) may be cause for rejection.

95. 525.08 BASIS OF PAYMENT, is hereby modified by adding the phrase "for furnishing all forms, joint filler, admixtures, trial batches, and connection plates for approach railing terminal connectors; for satisfactory completion of any necessary repairs, surface finishing, and curing;" after the phrase "for all work necessary for verifying and adjusting post height and/or bolt spacing of existing posts;" in the second (last) sentence of the third paragraph.

96. 525.08 BASIS OF PAYMENT, is hereby further modified by adding the following pay item:

| <u>Pay Item</u>   | <u>Pay Unit</u>        |
|---|------------------------|
| 525.45 Bridge Railing, Galvanized Steel Tubing/<br>Concrete Combination | Meter<br>(Linear Foot) |

SECTION 531 - BRIDGE BEARING DEVICES

97. 531.04 FABRICATION, part (b) Surface Protection, is hereby corrected by deleting punctuation “,” at the end of the paragraph and replacing it with punctuation “.”.

SECTION 540 - PRECAST CONCRETE

98. 540.02 MATERIALS, is hereby modified by deleting the fourteenth entry (beginning “Coated Bar Reinforcement...” ) in the Subsection listing.
99. 540.02 MATERIALS, is hereby further modified by adding the following as the twenty-ninth entry in the Subsection listing:

Sheet Membrane Waterproofing, Preformed Sheet.....726.11

100. 540.07 FABRICATION, part (e) Placing Concrete, is hereby modified by deleting the phrase “done with care” and replacing it with the phrase “performed in accordance with Subsection 501.10(f)” in the third (last) sentence.
101. 540.10 INSTALLATION, is hereby modified by adding the following new part (c):

- (c) Sheet Membrane Waterproofing. A reinforced asphalt, synthetic resin, or coal-tar based preformed sheet membrane shall be placed over the joints of precast concrete units in accordance with the Contract Documents. All work performed shall be in accordance with the manufacturer’s recommendations.

Material for membrane shall meet the requirements of Subsection 726.11.

Waterproofing shall not be performed in wet weather or when the temperature is below 5°C (40°F), without the authorization of the Engineer.

The concrete surfaces that are to be waterproofed shall be reasonably smooth and free from projections or holes and shall be cleaned of dust and loose material. The surfaces shall be visibly dry prior to and during application of the membrane system.

102. 540.14 BASIS OF PAYMENT, is hereby modified by adding the following paragraph:

Furnishing and placing preformed sheet membrane waterproofing, including primer, mastic, polyurethane membrane sealant, and surface preparation, is considered incidental to the work for Precast Concrete Structure.

SECTION 541 - STRUCTURAL CONCRETE

103. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (Metric), is hereby modified by deleting footnote designation “\*” in the first and fourth entries of the third row (for “Class A” concrete).
104. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (Metric), is hereby further modified by deleting footnote “\*” and associated text (beginning “\* When this class of concrete...”).

105. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (Metric), is hereby still further modified by deleting the fourth (with header "Range in Slump (mm)") and fifth (with header "Air Cont. (%)") columns in their entirety and replacing them with the following:

| Range*<br>in Slump<br>(mm) | Air<br>Content<br>(%) |
|----------------------------|-----------------------|
| ---                        | 7.0 ±<br>1.5          |
| ---                        | 7.0 ±<br>1.5          |
| ---                        | 7.0 ±<br>1.5          |
| ---                        | 5.5 ±<br>1.5          |
| ---                        | 5.5 ±<br>1.5          |
| ---                        | 7.0 ±<br>1.5          |

106. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (Metric), is hereby still further modified by adding the following footnote:

\* The mix shall not exhibit segregation at the slump/spread used at placement. If the Engineer suspects there is segregation, the Engineer will require a slump/spread test be performed by the Contractor to visually observe the characteristics of the mix. If in the opinion of the Engineer the mix does exhibit segregation, the load will be rejected and subsequent load(s) shall be tested, at a minimum of 3 loads or until the problem is corrected.

If the Contractor needs a concrete with a slump greater than 200 mm, the Contractor shall propose to the Engineer to use an SCC mix, which shall be submitted to the Engineer for review and acceptance.

107. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (Metric) is hereby still further modified by adding the following as the eighth (bottom) row with the included footnotes:

|   |                          |                           |                            |            |                               |                       |     |
|---|--------------------------|---------------------------|----------------------------|------------|-------------------------------|-----------------------|-----|
| Controlled<br>Density<br>(Flowable)<br>Fill | To be<br>designed<br>*** | To be<br>designed<br>**** | To be<br>designed<br>***** | 10<br>min. | 704.01<br>(Fine<br>Aggregate) | 0.85<br>max.<br>***** | --- |
|---|--------------------------|---------------------------|----------------------------|------------|-------------------------------|-----------------------|-----|

\*\*\* A mineral admixture may be used to replace a portion of the cement.

\*\*\*\* The minimum amount of water shall be used to produce the desirable flow for the intended use without showing segregation.

\*\*\*\*\* The slump (flowability) shall be such that material is able to completely fill the voids or area as needed without segregation.

\*\*\*\*\*A minimum of 3 cylinders per test age required to constitute a test. If average strength at 28 days exceeds 115% of max. strength, then payment for Contract item 541.45 will be 85% of the Contract bid price.

108. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (English), is hereby modified by deleting footnote designation "\*" in the first and fourth entries of the third row (for "Class A" concrete).
109. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (English), is hereby further modified by deleting footnote "\*" and associated text (beginning "\* When this class of concrete...").
110. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (English), is hereby still further modified by deleting the fourth (with header "Range in Slump (in.)") and fifth (with header "Air Cont. (%)") columns in their entirety and replacing them with the following:

| Range*<br>in Slump<br>(mm) | Air<br>Content<br>(%) |
|----------------------------|-----------------------|
| ---                        | 7.0 ±<br>1.5          |
| ---                        | 7.0 ±<br>1.5          |
| ---                        | 7.0 ±<br>1.5          |
| ---                        | 5.5 ±<br>1.5          |
| ---                        | 5.5 ±<br>1.5          |
| ---                        | 7.0 ±<br>1.5          |

111. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (English), is hereby still further modified by adding the following footnote:

\* The mix shall not exhibit segregation at the slump/spread used at placement. If the Engineer suspects there is segregation, the Engineer will require a slump/spread test be performed by the Contractor to visually observe the characteristics of the mix. If in the opinion of the Engineer the mix does exhibit segregation, the load will be rejected and subsequent load(s) shall be tested, at a minimum of 3 loads or until the problem is corrected.

If the Contractor needs a concrete with a slump greater than 8 inches, the Contractor shall propose to the Engineer to use an SCC mix, which shall be submitted to the Engineer for review and acceptance.



112. 541.03 CLASSIFICATION AND PROPORTIONING, TABLE 541.03A (English) is hereby modified by adding the following as the eighth (bottom) row with the included footnotes:

|   |                          |                           |                            |            |                               |                      |     |
|---|--------------------------|---------------------------|----------------------------|------------|-------------------------------|----------------------|-----|
| Controlled<br>Density<br>(Flowable)<br>Fill | To be<br>designed<br>*** | To be<br>designed<br>**** | To be<br>designed<br>***** | 10<br>min. | 704.01<br>(Fine<br>Aggregate) | 125<br>max.<br>***** | --- |
|---|--------------------------|---------------------------|----------------------------|------------|-------------------------------|----------------------|-----|

\*\*\* A mineral admixture may be used to replace a portion of the cement.

\*\*\*\* The minimum amount of water shall be used to produce the desirable flow for the intended use without showing segregation.

\*\*\*\*\* The slump (flowability) shall be such that material is able to completely fill the voids or area as needed without segregation.

\*\*\*\*\*A minimum of 3 cylinders per test age required to constitute a test. If average strength at 28 days exceeds 115% of max. strength, then payment for Contract item 541.45 will be 85% of the Contract bid price.

113. 541.10 PLACING CONCRETE, part (c) Placement Limitations, is hereby modified by adding the following paragraphs:

Flowable fill shall be applied to voids and other locations as specified in the Contract Documents and as directed by the Engineer. Flowable fill shall be able to completely fill the existing voids.

If voids are discovered, the Engineer may direct the Contractor to submit a plan for filling the remaining voids. This work, including preparing and submitting the plan and filling any remaining voids, will be at the Contractor's expense.

114. 541.11 DEPOSITING CONCRETE UNDERWATER, part (a) General, subpart (1), is hereby corrected by deleting the phrase "1716 Barre-Montpelier Rd., Berlin, Vermont 05602" and replacing it with the phrase "2178 Airport Road Unit B, Berlin, Vermont 05641" in the second sentence of the second paragraph.

115. 541.19 METHOD OF MEASUREMENT, is hereby modified by deleting the phrase "or LW" and replacing it with the phrase "LW, or Flowable Fill" in the first sentence of the first paragraph.

116. 541.20 BASIS OF PAYMENT, is hereby modified by adding the following pay item:

Payment will be made under:

| <u>Pay Item</u>                           | <u>Pay Unit</u>          |
|---|--------------------------|
| 541.45 Controlled Density (Flowable) Fill | Cubic Meter (Cubic Yard) |

SECTION 580 - STRUCTURAL CONCRETE REPAIR

117. 580.02 MATERIALS, is hereby modified by adding the following to the Subsection listing:

Polymer Concrete Repair Material.....780.05

118. 580.03 PROPORTIONING AND MIXING, is hereby modified by deleting the last sentence of the first paragraph in its entirety and replacing it with the following:

The product shall not be extended with sand or gravel, except for Rapid Setting Concrete Repair Material with Coarse Aggregate and Polymer Concrete Repair Material when mixed with approved aggregates in conformance with the manufacturer's recommendations.

119. 580.04 SURFACE PREPARATION FOR REPAIRS, OVERLAYS AND MEMBRANES, is hereby modified by adding the word "abrasive" after the phrase "shall be" and before the phrase "blast cleaned" in the first sentence of the third paragraph.

120. 580.04 SURFACE PREPARATION FOR REPAIRS, OVERLAYS AND MEMBRANES, is hereby further modified by adding the phrase ", or Polymer Concrete Repair Material," after the word "Aggregate" in the sixth paragraph.

121. 580.08 METHOD OF MEASUREMENT, is hereby modified by deleting the phrase "and not for new patches, which will be the responsibility of the Contractor" and replacing it with the phrase ", with no deductions made for areas of new patches" in the second sentence of the ninth paragraph.

122. 580.08 METHOD OF MEASUREMENT, is hereby further modified by adding the phrase ", and Polymer Concrete Repair Material" after the word "Aggregate" in the first sentence of the tenth paragraph.

123. 580.09 BASIS OF PAYMENT, is hereby modified by adding the phrase ", and Polymer Concrete Repair Material" after the word "Aggregate" in the seventh paragraph.

124. 580.09 BASIS OF PAYMENT, is hereby further modified by adding the following pay item:

Payment will be made under:

| <u>Pay Item</u>                         | <u>Pay Unit</u>          |
|---|--------------------------|
| 580.21 Polymer Concrete Repair Material | Cubic Meter (Cubic Yard) |

SECTION 601 - CULVERTS AND STORM DRAINS

125. 601.02 MATERIALS, is hereby modified by adding the following as the sixth entry in the Subsection listing:

Corrugated Polypropylene Pipe.....710.07

126. 601.07 JOINING PIPE, is hereby modified by adding the following new part (d) as follows:

(d) Corrugated Polypropylene Pipe. Corrugated Polypropylene pipe shall be joined by a system designed and approved by the pipe manufacturer. Couplings and fittings shall provide sufficient longitudinal strength to preserve pipe alignment and prevent separation at the joints.

127. 601.11 BASIS OF PAYMENT, is hereby modified by changing the end of the pay item number range for CPEP Elbow from 601.5999 to 601.5899.

128. 601.11 BASIS OF PAYMENT, is hereby further modified by adding the following pay items:

Payment will be made under:

| <u>Pay Item</u>                 | <u>Pay Unit</u>     |
|---------------------------------|---------------------|
| 601.2800 to 601.2999 CPPP(SL)   | Meter (Linear Foot) |
| 601.5900 to 601.5999 CPPP Elbow | Each                |
| 601.7100 to 601.7199 CPPPES     | Each                |

SECTION 608 - EQUIPMENT RENTAL

129. 608.02 GENERAL REQUIREMENTS, is hereby modified by adding the following new part (i):

(i) Truck-Mounted Attenuator, Advanced Warning Vehicle/Protection Vehicle (AWV/PV). Truck-Mounted Attenuator, AWV/PV shall consist of a Truck-Mounted Attenuator meeting the requirements of Subsection 608.02(h) and be equipped with a Changeable Message Sign in accordance with the MUTCD. The Changeable Message Sign shall be mounted so as to be clearly visible to the traveling public and shall be capable of being controlled from inside the cab of the vehicle, with capable controls including but not limited to turning the sign on and off, changing between preset messages, and inserting new messages when approved by the Engineer. Phases of signing shall have the ability to change automatically when required.

130. 608.04 BASIS OF PAYMENT, is hereby modified by changing the word "item" to "items" and by adding the phrase "and Truck-Mounted Attenuator, AWV/PV" after the phrase "Truck-Mounted Attenuator" in the second (last) paragraph.

131. 608.04 BASIS OF PAYMENT, is hereby further modified by adding the following pay item:

Payment will be made under:

| <u>Pay Item</u>                         | <u>Pay Unit</u> |
|---|-----------------|
| 608.50 Truck-Mounted Attenuator, AWV/PV | Hour            |

SECTION 613 - STONE FILL, RIPRAP, AND SLOPE PAVING

132. 613.02 MATERIALS, is hereby modified by adding the following to the Subsection listing:

|                            |        |
|----------------------------|--------|
| Rock Fill for Gabions..... | 706.06 |
| Gabion Baskets.....        | 712.04 |

133. 613.04 PLACING, is hereby modified by adding the following new part (d):

- (d) Rock Fill for Gabions. The furnishing and installing of gabion baskets shall be performed in accordance with the manufacturer's recommendations.

The Contractor should expect to perform some manual stone placement to minimize voids and to create a neat, flat vertical surface of gabions.

134. 613.05 METHOD OF MEASUREMENT, is hereby modified by adding the following paragraph:

The quantity of Gabion Wall to be measured for payment will be the number of cubic meters (cubic yards) of Rock Fill for Gabions placed in the complete and accepted work.

135. 613.06 BASIS OF PAYMENT, is hereby modified by adding the phrase "and Gabion Wall" after the word "specified" in the first sentence of the first paragraph.

136. 613.06 BASIS OF PAYMENT, is hereby modified by adding the phrase ", including gabion baskets," after the word "material" in the third (last) sentence of the first paragraph.

137. 613.06 BASIS OF PAYMENT, is hereby still further modified by adding the phrase "or rock" after the word "stone" in the first sentence of the second paragraph.

138. 613.06 BASIS OF PAYMENT, is hereby still further modified by adding the following paragraph:

Geotextile fabric and bedding material for Gabion Wall will be paid for under the appropriate Contract items.

139. 613.06 BASIS OF PAYMENT, is hereby still further modified by adding the following pay item:

Payment will be made under:

| <u>Pay Item</u>    | <u>Pay Unit</u>          |
|--------------------|--------------------------|
| 613.25 Gabion Wall | Cubic Meter (Cubic Yard) |

SECTION 616 - CURBS AND GUTTERS

140. 616.05 REPOINTING GRANITE BRIDGE CURB, is hereby made a new Subsection of the Standard Specifications as follows:

616.05 REPOINTING GRANITE BRIDGE CURB. The existing mortar bed and vertical curb joints shall be repointed as shown on the Plans. Mortar shall meet the requirements of Subsection 707.01.

141. 616.14 METHOD OF MEASUREMENT, is hereby modified by adding the following as the second paragraph:

The quantity of Repointing Granite Bridge Curb to be measured for payment will be the number of liters (gallons) of mortar applied in the completed and accepted work, measured to the nearest liter (gallon).

142. 616.14 METHOD OF MEASUREMENT, is hereby corrected by changing the word "portland" to "Portland" in the fifth (last) paragraph.

143. 616.15 BASIS OF PAYMENT, is hereby modified by adding the following as the second paragraph:

The accepted quantity of Repointing Granite Bridge Curb will be paid for at the Contract unit price per liter (gallon). Payment will be full compensation for furnishing, transporting, handling, and placing the material specified and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

144. 616.15 BASIS OF PAYMENT, is hereby corrected by changing the word "portland" to "Portland" in the fourth paragraph.

145. 616.15 BASIS OF PAYMENT, is hereby further modified by adding the following pay item:

Payment will be made under:

| <u>Pay Item</u>                        | <u>Pay Unit</u> |
|--|-----------------|
| 616.225 Repointing Granite Bridge Curb | Liter (Gallon)  |

SECTION 621 - TRAFFIC BARRIERS

146. 621.01 DESCRIPTION, is hereby modified by adding the phrase "repairing," after the phrase "removing,".

147. 621.02 MATERIALS, is hereby modified by adding the following as the fifth entry in the Subsection listing:

Wire Rope or Cable.....713.03

148. 621.13 REPLACEMENT, ADJUSTMENT, REMOVAL, AND DISPOSAL OF GURADRAIL OR GUIDE POSTS, is hereby modified by deleting the phrase "post assemblies and panel units" and replacing it with the phrase "guardrail components" in the second sentence of the first paragraph.

149. 621.13 REPLACEMENT, ADJUSTMENT, REMOVAL, AND DISPOSAL OF GURADRAIL OR GUIDE POSTS, is hereby further modified by deleting the first sentence of the second paragraph in its entirety and replacing it with the following:

Those sections in which height over an extensive portion of the section is greater than 760 mm (30 inches) or less than 675 mm (26 ½ inches) shall be adjusted to a nominal height of 735 mm ±25 mm (29 inches ± 1 inch).

150. 621.13 REPLACEMENT, ADJUSTMENT, REMOVAL, AND DISPOSAL OF GUARDRAIL OR GUIDE POSTS, is hereby still further modified by deleting the phrase "post assembly replacement or guardrail beam replacement occur" and replacing it with the phrase "guardrail component replacement occurs" in the fourth paragraph.

151. 621.13 REPLACEMENT, ADJUSTMENT, REMOVAL, AND DISPOSAL OF GURADRAIL OR GUIDE POSTS, is hereby still further modified by adding the following as the sixth and seventh paragraphs:

Offset blocks designated for replacement shall be replaced in-kind. Materials shall be in conformance with the applicable requirements of Subsection 728.01 for either wood, steel, or alternative blockouts.

Cable guardrail repair shall be performed in accordance with VTrans Standard Drawing G-6 and as directed by the Engineer.

152. 621.14 METHOD OF MEASUREMENT, is hereby modified by adding the following as the fourth and fifth paragraphs of the Subsection text:

The quantities of Cable Guardrail J-Bolt, Galvanized and Cable Guardrail Splice Unit to be measured for payment will be the number of units installed in the complete and accepted work.

The quantity of Replacement of Guardrail Cable to be measured for payment will be the number of meters (linear feet) installed in the complete and accepted work.

153. 621.14 METHOD OF MEASUREMENT, is hereby further modified by adding the following as the sixth paragraph of the Subsection text:

The quantities of Steel Beam Guardrail Delineator and Steel Beam Guardrail Offset Block to be measured for payment will be the number of each component replaced in the complete and accepted work.

154. 621.15 BASIS OF PAYMENT, is hereby modified by adding the following as the second, third, and fourth paragraphs of the Subsection text:

The accepted quantities of Cable Guardrail J-Bolt, Galvanized and Cable Guardrail Splice Unit will be paid for at the Contract unit price for each.

The accepted quantity of Replacement of Cable Guardrail will be paid for at the Contract unit price per meter (linear foot).

The accepted quantities of Steel Beam Guardrail Delineator and Steel Beam Guardrail Offset Block will be paid for at the Contract unit price for each.

155. 621.15 BASIS OF PAYMENT, is hereby further modified by adding the phrase "removing and disposing of damaged guardrail component(s)," after the phrase "specified," in the first sentence of the seventh paragraph.

156. 621.15 BASIS OF PAYMENT, is hereby still further modified by adding the following pay items:

Payment will be made under:

| <u>Pay Item</u>  | <u>Pay Unit</u>     |
|--|---------------------|
| 621.173 Cable Guardrail J-Bolt, Galvanized   | Each                |
| 621.174 Cable Guardrail Splice Unit  | Each                |
| 621.175 Replacement of Guardrail Cable   | Meter (Linear Foot) |
| 621.218 Steel Beam Guardrail Delineator  | Each                |
| 621.219 Steel Beam Guardrail Offset Block  | Each                |
| 621.70 Guardrail Approach Section, Galvanized<br>Type I                                | Each                |
| 621.71 Guardrail Approach Section, Galvanized<br>Type II                               | Each                |
| 621.726 Guardrail Approach Section, Galvanized<br>3 Rail Box Beam w/Curb               | Each                |
| 621.735 Guardrail Approach Section, Steel Beam   | Each                |
| 621.736 Guardrail Approach Section, Steel Beam<br>w/2.4 m (8 feet) Posts               | Each                |
| 621.737 Guardrail Approach Section, Galvanized<br>HD Steel Beam                        | Each                |
| 621.738 Guardrail Approach Section, Galvanized<br>HD Steel Beam w/2.4 m (8 feet) Posts | Each                |
| 621.748 Guardrail Approach Section to Concrete<br>Combination Bridge Railing, TL-3     | Each                |

SECTION 630 - UNIFORMED TRAFFIC OFFICERS AND FLAGGERS

157. 630.03 CLOTHING AND EQUIPMENT, part (b) For Flaggers, subpart (1), is hereby modified by replacing the phrase "ANSI 107-1999" with the phrase "ANSI 107-2004" in the first sentence.
158. 630.03 CLOTHING AND EQUIPMENT, part (d) For All Traffic Control Personnel, subpart (2), is hereby modified by deleting the word "The" and replacing it with the phrase "When deemed necessary by the Engineer, or when noted in the Plans, the" at the beginning of the first sentence.

SECTION 641 - TRAFFIC CONTROL

159. 641.02 GENERAL CONSTRUCTION REQUIREMENTS, is hereby modified by adding the phrase "implement that plan or" after the phrase "the Contractor may" in the first sentence of the fourth paragraph.

160. 641.02 GENERAL CONSTRUCTION REQUIREMENTS, is hereby further modified by adding the following as the second sentence of the fourth paragraph:

When the Contractor will implement an Agency-designed traffic control plan, written certification shall be submitted to the Engineer indicating that traffic control will be performed in accordance with the Agency design.

161. 641.02 GENERAL CONSTRUCTION REQUIREMENTS, is hereby still further modified by changing the word "This" to the word "An" in the second sentence of the fourth paragraph.

162. 641.02 GENERAL CONSTRUCTION REQUIREMENTS, is hereby still further modified by adding the following paragraph:

When the Contract Documents specify that a site-specific traffic control plan be submitted by the Contractor, Construction Drawings shall be submitted in accordance with Section 105. The submitted site-specific plan shall include, for each phase of construction requiring a significant change in temporary traffic control, a narrative description of the proposed temporary traffic control for each phase (including pedestrian accommodations where appropriate) and the major work activities to be completed in each phase; and a layout for each phase of construction showing existing lane configurations, existing traffic control devices (signs, signals, and pavement markings), driveways, ramps, and highway intersections, and the location of all proposed temporary traffic control devices, flaggers, and UTO's. All pertinent dimensions, such as taper lengths, sign spacing, temporary lane widths, and distance(s) from existing traffic control devices shall be labeled.

163. 641.03 TRAFFIC CONTROL DEVICES, is hereby modified by deleting the phrase "have three (3) lines of eight (8) characters per line and conform to Section 6F.55 of the MUTCD" and replacing it with the phrase "be used with a maximum of two phases, each consisting of a maximum of 3 lines of 8 characters" in the sixth paragraph.

164. 641.03 TRAFFIC CONTROL DEVICES, is hereby further modified by deleting the phrase "requirements in Section 6F.56 of" and replacing it with the phrase "Portable Arrow Board requirements in" in the seventh paragraph.



SECTION 646 - RETROREFLECTIVE PAVEMENT MARKINGS

165. 646.02 MATERIALS, is hereby modified by deleting the Subsection listing in its entirety and replacing it with the following:

|  |           |
|--|-----------|
| Polyurea Pavement Markings.....                | 708.08(a) |
| Low VOC Chlorinated Rubber Traffic Paint.....  | 708.08(b) |
| Low VOC Acetone Based Traffic Paint.....       | 708.08(b) |
| Epoxy Paint.....                               | 708.08(c) |
| Waterborne Traffic Paint.....                  | 708.08(d) |
| Methyl-methacrylate Paint.....                 | 708.08(e) |
| Glass Beads.....                               | 708.09(a) |
| Premium Optics.....                            | 708.09(b) |
| Wet Recoverable and Wet Reflective Optics..... | 708.09(c) |
| Thermoplastic Pavement Markings, Type A.....   | 708.10(a) |
| Thermoplastic Pavement Markings, Type B.....   | 708.10(b) |
| Raised Pavement Markers, Type I.....           | 708.11    |
| Pavement Marking Tape, Type A.....             | 708.12(a) |
| Pavement Marking Tape, Type B.....             | 708.12(b) |
| Pavement Marking Tape, Type C.....             | 708.12(c) |
| Pavement Marking Tape, Type D.....             | 708.12(d) |
| Line Striping Targets.....                     | 708.13(a) |
| Raised Pavement Markers, Type II.....          | 708.13(b) |
| Temporary Pavement Marking Tape.....           | 708.13(c) |
| Pavement Marking Mask.....                     | 708.13(d) |

166. 646.04 APPLICATION OF MARKINGS, GENERAL, part (a) Placement of Markings, is hereby modified by deleting the first paragraph in its entirety.
167. 646.04 APPLICATION OF MARKINGS, GENERAL, part (a) Placement of Markings, is hereby further modified by deleting the seventh paragraph in its entirety.
168. 646.04 APPLICATION OF MARKINGS, GENERAL, part (a) Placement of Markings, is hereby still further modified by deleting the word "interim" and replacing it with the phrase "permanent or temporary" in the first sentence of the eighth paragraph.
169. 646.04 APPLICATION OF MARKINGS, GENERAL, part (a) Placement of Markings, is hereby still further modified by adding the phrase "edgeline," after the phrase "centerlines," in the first sentence of the eighth paragraph.
170. 646.04 APPLICATION OF MARKINGS, GENERAL, part (a) Placement of Markings, is hereby still further modified by deleting the ninth paragraph in its entirety.

171. 646.04 APPLICATION OF MARKINGS, GENERAL, part (c) Weather Limitations, subpart (2), is hereby modified by being deleted in its entirety and replaced as follows:
- (2) At the time of application of durable pavement markings, the pavement surface and ambient air temperatures shall be as per the manufacturer's published specified application temperatures, and the dew point shall be 5°F or more below the ambient air temperature. If the manufacturer's published recommendations are unavailable, the pavement surface and ambient air temperatures shall be a minimum of 10°C (50°F).
172. 646.04 APPLICATION OF MARKINGS, GENERAL, part (c) Weather Limitations, subpart (3), is hereby modified by being the word "October" and replacing it with the word "November".
173. 646.04 APPLICATION OF MARKINGS, GENERAL, part (d) Layout and Control, subpart (1) Centerline Markings, is hereby modified by deleting the number "100" and replacing it with the phrase "the same width as the lines" in the fourth sentence of the first paragraph.
174. 646.04 APPLICATION OF MARKINGS, GENERAL, part (d) Layout and Control, subpart (1) Centerline Markings, is hereby further modified by deleting the second (last) paragraph in its entirety.
175. 646.04 APPLICATION OF MARKINGS, GENERAL, part (d) Layout and Control, subpart (2) Edgeline Markings, is hereby modified by deleting the second (last) paragraph in its entirety.
176. 646.04 APPLICATION OF MARKINGS, GENERAL, part (d) Layout and Control, subpart (3) Dotted Line, is hereby modified by deleting the second (last) paragraph in its entirety.
177. 646.06 PAINT PAVEMENT MARKINGS, is hereby modified by being re-named WATERBORNE AND LOW VOC CHLORINATED RUBBER AND ACETONE BASED PAINT PAVEMENT MARKINGS.
178. 646.06 WATERBORNE AND LOW VOC CHLORINATED RUBBER AND ACETONE BASED PAINT PAVEMENT MARKINGS, is hereby modified by changing the word "Retroflective" to "Retroreflective" in the first sentence of the first paragraph.
179. 646.06 WATERBORNE AND LOW VOC CHLORINATED RUBBER AND ACETONE BASED PAINT PAVEMENT MARKINGS, is hereby further modified by deleting the phrase "shall have a dry film thickness of 380 ±25 µm (15 ±1 mil) for paint, unless otherwise specified, and" in the third (last) sentence of the first paragraph.

180. 646.06 WATERBORNE AND LOW VOC CHLORINATED RUBBER AND ACETONE BASED PAINT PAVEMENT MARKINGS, is hereby still further modified by adding the following as the third paragraph:

The markings shall be applied at a rate to create a uniform wet film thickness of 558.8  $\mu\text{m}$  (22 mils) with an allowable range of  $\pm 50.8 \mu\text{m}$  ( $\pm 2$  mils) unless otherwise specified in the Contract Documents. Minimum application rates are 1.7 square meters per liter (70 square feet per gallon) with glass beads applied at a rate of 960 grams per liter (8.0 lb per gallon) of paint. The Contractor shall provide the Engineer and the Materials Section with the optic drop on rates of all optic materials and daily binder application rates.

181. 646.06 WATERBORNE AND LOW VOC CHLORINATED RUBBER AND ACETONE BASED PAINT PAVEMENT MARKINGS, is hereby still further modified by deleting the fourth and fifth (last) paragraphs in their entirety.

182. 646.07 DURABLE PAVEMENT MARKINGS, is hereby modified by adding the following as the third sentence of the first paragraph:

Durable pavement markings shall be installed within two weeks of the placement of the wearing course.

183. 646.07 DURABLE PAVEMENT MARKINGS, is hereby further modified by changing punctuation at the end of the third sentence of the first paragraph from ":" to ".".

184. 646.07 DURABLE PAVEMENT MARKINGS, is hereby still further modified by adding the following at the end of the first paragraph:

The Contractor shall select optics that conform with Subsections 708.09(a), 708.09(b), and 708.09(c). The Contractor shall provide the Engineer and the Materials Section with the daily optic drop on rates of all optic materials and daily binder application rates. The Contractor shall perform all quality control activities and provide to the Engineer on a daily basis all retroreflectivity measurements collected. The Agency will perform all acceptance testing activities. The Engineer will select an evaluation section(s) for the purpose of collecting pavement marking retroreflectivity measurements. Retroreflectivity measurements shall be performed in accordance with ASTM D7585, as modified by Table 646.07A.

TABLE 646.07A - EVALUATION SECTION CRITERIA

| PAVEMENT MARKING TYPE | EVALUATION SECTION(S) REQUIRED* | EVALUATION SECTION LENGTH<br>m (feet) | MEASUREMENTS REQUIRED  |
|-----------------------|---------------------------------|---------------------------------------|------------------------|
| Long Lines            | 1 per 3.2 km (2 miles)          | 120 (400)                             | 20                     |
| Dashed Lines          | 1 per 3.2 km (2 miles)          | 120 (400)                             | 20 (2 per dashed line) |

\*Projects less than 3.2 km (2 miles) in length shall have a minimum of one (1) evaluation section.

Each spot measurement for all yellow centerline retroreflectivity shall be performed in both directions at each spot location and averaged for acceptance. For long lines and dashed lines, if the average retroreflectivity as determined in accordance with ASTM D7585 fails to meet the minimum retroreflectivity requirements, or if 25% of the individual tests fail to meet the minimum retroreflectivity requirements, the entire length represented by the evaluation section shall be re-marked and re-tested until in compliance, at no additional cost to the Agency.

185. 646.07 DURABLE PAVEMENT MARKINGS, part (a) Pavement Marking Tape, Type I, is hereby modified by being deleted in its entirety and replaced as follows:

- (a) Pavement Marking Tape, Type A. Type A tape for pavement markings is classified as high performance or high durable, and non-removable. Type A tape shall conform to the requirements of Subsection 708.12(a).

Type A tapes, when used as a final durable marking, shall be applied only by being inlaid in the bituminous pavement during the rolling operation or in a recess as defined in Subsection 646.09, and shall be applied in accordance with the manufacturer's requirements. Initial dry retroreflectivity minimums shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings.

186. 646.07 DURABLE PAVEMENT MARKINGS, part (b) Epoxy Paint, is hereby modified by being re-designated as part (e).

187. 646.07 DURABLE PAVEMENT MARKINGS, part (c) Thermoplastic, is hereby modified by being re-designated as part (f) Extruded Thermoplastic.

188. 646.07 DURABLE PAVEMENT MARKINGS, part (d) Polyurea Paint, is hereby modified by being re-designated as part (h).

189. 646.07 DURABLE PAVEMENT MARKINGS, part (e) Methyl-methacrylate Paint, is hereby modified by being re-designated as part (i).

190. 646.07 DURABLE PAVEMENT MARKINGS, is hereby further modified by adding the following new parts (b), (c), and (d):

- (b) Pavement Marking Tape, Type B. Type B tape for pavement markings is classified as non-removable, used in long line applications. Type B tape shall conform to the requirements of Subsection 708.12(b).

Type B tapes, when used as a final durable marking, shall be applied only by being inlaid in the bituminous pavement during the rolling operation or in a recess as defined in Subsection 646.09, and shall be applied in accordance with the manufacturer's requirements. Initial dry retroreflectivity minimums shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings.

- (c) Pavement Marking Tape, Type C. Type C tape for pavement markings is classified as non-removable, used in intersection applications. Type C tape shall conform to the requirements of Subsection 708.12(c).

Type C tapes, when used as a final durable marking, shall be applied only by being inlaid in the bituminous pavement during the rolling operation or in a recess as defined in Subsection 646.09, and shall be applied in accordance with the manufacturer's requirements.

- (d) Pavement Marking Tape, Type D. Type D tape for pavement markings is classified as non-removable, used for symbols and legends applications. Type D tape shall conform to the requirements of Subsection 708.12(d).

Type D tapes, when used as a final durable marking, shall be applied only by being inlaid in the bituminous pavement during the rolling operation or in a recess as defined in Subsection 646.09, and shall be applied in accordance with the manufacturer's requirements. Initial dry retroreflectivity minimums shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings.

191. 646.07 DURABLE PAVEMENT MARKINGS, part (e) Epoxy Paint, is hereby modified by deleting the fifth (last) sentence in its entirety.

192. 646.07 DURABLE PAVEMENT MARKINGS, part (e) Epoxy Paint, is hereby further modified by adding the following sentences:

Epoxy paint shall be applied at a rate to create a uniform wet film in place thickness of 558.8 µm (22 mils) with an allowable range of ±50.8 µm (±2 mils) unless otherwise specified in the Contract Documents. Minimum application rates are 1.7 square meters per liter (70 square feet per gallon). Initial dry retroreflectivity minimums shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings.

193. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, is hereby modified by replacing the phrase "708.10" with the phrase "708.10(a)" at the end of the first paragraph.

194. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, is hereby further modified by adding the following as the third paragraph:

Thermoplastic markings shall be applied at a rate to create a uniform hot film in place thickness of 2667 µm (105 mils) with an allowable range of ± 127 µm (±5 mils) unless otherwise specified in the Contract Documents. Minimum application rates are 0.36 square meters per liter (15 square feet per gallon).

195. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, subpart (1) Thermoplastic Application Equipment, a. Mobile Applicator Equipment, is hereby modified by deleting the phrase ", between 2.4 and 2.5 mm (96 and 100 mils) thick" and replacing it with the phrase "with a uniform hot film in place thickness of 2667 µm (105 mils), with an allowable range of ± 127 µm (±5 mils)" in the second sentence of the second paragraph.

196. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, subpart (1) Thermoplastic Application Equipment, b. Portable Applicator Equipment, is hereby modified by deleting the phrase "between 2 and 2.5 mm (80 and 100 mils) thick" and replacing it with the phrase "with a uniform hot film in place thickness of 2667 µm (105 mils) with an allowable range of ± 127 µm (±5 mils)" in the fourth sentence.

197. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, subpart (2) Application Requirements, b. Thermoplastic Composition, is hereby modified by replacing the phrase "708.10" with the phrase "708.10(a)".
198. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, subpart (2) Application Requirements, d. Extruded Markings, is hereby modified by deleting the phrase "thickness between 2.4 and 2.5 mm (96 and 100 mils)" and replacing it with the phrase "uniform hot film in place thickness between 2.54 and 2.794 mm (100 and 110 mils)".
199. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, subpart (2) Application Requirements, e. Beads, is hereby modified by being re-named Optics.
200. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, subpart (2) Application Requirements, e. Optics, subpart 1., is hereby modified by adding the phrase "shall be" after the phrase "Type I".
201. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, subpart (2) Application Requirements, e. Optics, subpart 1., is hereby further modified by adding the phrase "intermix of the" after the phrase "incorporated into the".
202. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, subpart (2) Application Requirements, e. Optics, subpart 1., is hereby still further modified by deleting the numbers "28" and "30" and replacing them with the numbers "30" and "40", respectively.
203. 646.07 DURABLE PAVEMENT MARKINGS, part (f) Extruded Thermoplastic, subpart (2) Application Requirements, e. Optics, subpart 2., is hereby modified by being deleted in its entirety and replaced as follows:
  2. Initial dry retroreflectivity minimums shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings.
204. 646.07 DURABLE PAVEMENT MARKINGS, is hereby still further modified by adding the following new part (g):
  - (g) Preformed Thermoplastic. Approved preformed thermoplastic marking materials shall be one of the preformed thermoplastic markings listed on the Approved Products List on file with the Agency's Research and Development Section under Subsection 708.10(b).
205. 646.07 DURABLE PAVEMENT MARKINGS, part (h) Polyurea Paint, is hereby modified by deleting the second sentence in its entirety.

206. 646.07 DURABLE PAVEMENT MARKINGS, part (h) Polyurea Paint, is hereby further modified by adding the following sentences:

Polyurea paint shall be applied at a rate to create a uniform wet film in place thickness of 558.8  $\mu\text{m}$  (22 mils) with an allowable range of  $\pm 50.8 \mu\text{m}$  ( $\pm 2$  mils) unless otherwise specified in the Contract Documents. Minimum application rates are 1.7 square meters per liter (70 square feet per gallon). Initial dry retroreflectivity minimums for surface-applied polyurea shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings. Initial dry retroreflectivity minimums for recessed polyurea shall be 600 mcdl/lx/m<sup>2</sup> for yellow markings and 800 mcdl/lx/m<sup>2</sup> for white markings.

207. 646.07 DURABLE PAVEMENT MARKINGS, part (i) Methyl-methacrylate Paint, is hereby modified by deleting the second sentence in its entirety.

208. 646.07 DURABLE PAVEMENT MARKINGS, part (i) Methyl-methacrylate Paint, is hereby further modified by adding new subpart (1) as follows:

(1) Application Requirements.

- a. Spray Applied Markings. All spray applied markings shall be applied at a rate to create a uniform wet film in place thickness of 762  $\mu\text{m}$  (30 mils) with an allowable range of  $\pm 50.8 \mu\text{m}$  ( $\pm 2$  mils) unless otherwise specified in the Contract Documents. Minimum application rates are 1.4 square meters per liter (55 square feet per gallon). Initial dry retroreflectivity minimums for surface spray applied methyl-methacrylate shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings. Initial dry retroreflectivity minimums for recessed methyl-methacrylate shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings.
  - b. Extruded Markings. All extruded markings shall be applied at a rate to create a uniform wet film in place thickness of 2286  $\mu\text{m}$  (90 mils) with an allowable range of  $\pm 127 \mu\text{m}$  ( $\pm 5$  mils) unless otherwise specified in the Contract Documents. Minimum application rates are 0.45 square meters per liter (18.3 square feet per gallon). Initial dry retroreflectivity minimums shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings.
  - c. Structured Markings. All structured markings shall be applied at a rate to create a uniform wet film in place thickness as per the manufacturer's recommendations unless otherwise specified in the Contract Documents. Initial dry retroreflectivity minimums shall be 300 mcdl/lx/m<sup>2</sup> for yellow markings and 400 mcdl/lx/m<sup>2</sup> for white markings.
209. 646.08 TEMPORARY PAVEMENT MARKINGS, is hereby modified by deleting the phrase "Type II" (first entry) and replacing it with the phrase "Temporary Pavement Marking" in the first sentence.
210. 646.08 TEMPORARY PAVEMENT MARKINGS, part (a) Pavement Marking Tape, Type II, is hereby modified by being re-named Temporary Pavement Marking Tape.

211. 646.08 TEMPORARY PAVEMENT MARKINGS, part (a) Temporary Pavement Marking Tape, is hereby modified by deleting the first sentence in its entirety and replacing it as follows:

This tape for pavement markings is classified as temporary and is removable.

212. 646.08 TEMPORARY PAVEMENT MARKINGS, part (a) Temporary Pavement Marking Tape, second sentence, is hereby modified by deleting the phrase "Type II" and replacing it with the word "The" and by deleting the phrase "Subsection 708.12(b)" and replacing it with the phrase "Subsection 708.13(c)".

213. 646.08 TEMPORARY PAVEMENT MARKINGS, part (b) Pavement Marking Mask, is hereby modified by deleting the phrase "Subsection 708.12(c)" and replacing it with the phrase "Subsection 708.13(d)" in the second sentence.

214. 646.08 TEMPORARY PAVEMENT MARKINGS, part (c) Raised Pavement Markers, Type II, is hereby modified by adding the following sentence to the second (last) paragraph:

They shall conform to the requirements of Subsection 708.13(b) and shall be installed in accordance with the manufacturer's requirements.

215. 646.08 TEMPORARY PAVEMENT MARKINGS, part (d) Line Striping Targets, is hereby modified by being deleted in its entirety and replaced as follows:

- (d) Line Striping Targets. Line striping targets are intended to be substitutes for pavement markings for not longer than 14 calendar days. Line striping targets shall be maintained and replaced as needed or as directed by the Engineer, until replaced by a temporary or permanent pavement marking.

Line striping targets of the color shown on the Plans or directed by the Engineer shall be installed as described below or as directed by the Engineer.

For solid longitudinal pavement markings, line striping targets shall be placed at 3 m (10 foot) intervals. For double centerline markings, line striping targets shall be paired. For dashed pavement markings, line striping targets shall be placed in groups of 3 spaced at 1.5 m (5 feet), with the groups separated by 10 m (30 foot) spaces, or as determined by the Engineer.

Line striping targets shall not be used to delineate passing zones on two lane non-divided highways.

Line striping targets shall conform to the requirements of Subsection 708.13(a) and shall be installed in accordance with the manufacturer's requirements.



216. 646.08 TEMPORARY PAVEMENT MARKINGS, is hereby further modified by deleting the first sentence of the last paragraph in its entirety and replacing it as follows:

Temporary markings on the wearing course of pavement that remain in place for fewer than fourteen calendar days shall be Temporary Pavement Marking Tape, Type II raised pavement markers, or line striping targets.

217. 646.08 TEMPORARY PAVEMENT MARKINGS, is hereby still further modified by deleting the word "seven" and replacing it with the word "fourteen" in the second (last) sentence of the last paragraph.

218. 646.09 OTHER RELATED MARKINGS, part (a) Pavement Marking Recess, is hereby modified by deleting the phrase "provided is 125% of the material marking thickness" and replacing it with the phrase "meets the requirements of Table 646.09A" in the first sentence.

219. 646.09 OTHER RELATED MARKINGS, part (a) Pavement Marking Recess, is hereby further modified by deleting the last sentence in its entirety.

220. 646.09 OTHER RELATED MARKINGS, part (a) Pavement Marking Recess, is hereby still further modified by adding the following paragraphs and Table:

The bottom of the recess shall have a smooth, flat finished surface. The use of gang stacked Diamond cutting blades is required for asphalt pavement surfaces. The spacers between blade cuts shall be such that there will be less than a 254  $\mu$ m (10 mil) rise in the finished groove between the blades.

Recesses shall be clean, dry, and free of laitance, oil, dirt, grease, paint, or other foreign contaminants prior to application of the pavement markings. The Contractor shall re-clean grooves, as necessary, prior to application of any primer or permanent markings. Depth plates shall be provided by the Contractor to assure that desired groove depth is achieved.

TABLE 646.09A - PAVEMENT MARKING RECESS DEPTH

| MARKING MATERIAL  | STANDARD GLASS BEAD RECESS DEPTH<br>$\mu\text{m}$ (mils) | PREMIUM OPTIC RECESS DEPTH<br>$\mu\text{m}$ (mils) |
|---|--|--|
| Permanent Waterborne Paint  | 762-1016<br>(30-40)                                      | 762-1016<br>(30-40)                                |
| Spray Applied Methyl-methacrylate   | 1016-1270<br>(40-50)                                     | 1778-2286<br>(70-90)                               |
| Extruded Methyl-methacrylate  | 2540-2794<br>(100-110)                                   | 2540-2794<br>(100-110)*                            |
| Structured Methyl-methacrylate  | As recommended by manufacturer                           | As recommended by manufacturer*                    |
| Thermoplastic   | 2540-2794<br>(100-110)                                   | 2540-2794<br>(100-110)*                            |
| Polyurea  | 762-1270<br>(30-50)                                      | 1778-2286<br>(70-90)                               |
| Epoxy   | 762-1270<br>(30-50)                                      | 1778-2286<br>(70-90)                               |
| Permanent Tape  | As recommended by manufacturer                           | As recommended by manufacturer                     |
| *Thermoplastic and Methyl-methacrylate with wet recoverable or wet reflective elements shall have a recess depth of 3048-3302 $\mu\text{m}$ (120-130 mils). |  |  |

221. 646.14 BASIS OF PAYMENT, part (a) Paint Pavement Markings, is hereby modified by adding the following pay item ranges:

|  |                     |
|--|---------------------|
| 646.200 to 646.209 100 mm (4 inch) White Line    | Meter (Linear Foot) |
| 646.2110 to 646.2119 100 mm (4 inch) Yellow Line | Meter (Linear Foot) |
| 646.2140 to 646.2149 150 mm (6 inch) White Line  | Meter (Linear Foot) |
| 646.2150 to 646.2159 150 mm (6 inch) Yellow Line | Meter (Linear Foot) |
| 646.221 to 646.229 200 mm (8 inch) White Line    | Meter (Linear Foot) |
| 646.231 to 646.239 200 mm (8 inch) Yellow Line   | Meter (Linear Foot) |
| 646.241 to 646.249 300 mm (12 inch) White Line   | Meter (Linear Foot) |
| 646.251 to 646.259 300 mm (12 inch) Yellow Line  | Meter (Linear Foot) |
| 646.261 to 646.269 600 mm (24 inch) Stop Bar     | Meter (Linear Foot) |
| 646.300 to 646.309 Letter or Symbol              | Each                |
| 646.311 to 646.319 Crosswalk Marking             | Meter (Linear Foot) |
| 646.321 to 646.329 Railroad Crossing Symbol      | Each                |

SECTION 653 - EROSION PREVENTION AND SEDIMENT CONTROL MEASURES

222. 653.15 BIOTECHNICAL SLOPE PROTECTION, part (a) Erosion Logs, is hereby modified by being deleted in its entirety and replaced with the following:

- (a) Erosion Logs. Erosion logs shall be installed to intercept water flow and collect sediment and associated pollutants by settling and filtering. Erosion logs may be placed over bare or mulched soils or rolled erosion control products; around inlet and outlets; as check dams in unvegetated ditches, slope interrupters on steep slopes, and perimeter control; and along stream banks as a base for plantings. Some types of erosion logs (typically those with a heavier filtering medium such as compost) can be used in applications where underlying conditions are unsuitable (frozen ground, paved surfaces, sensitive plantings areas, etc.) for trenching.

Prior to placing erosion logs, the ground surface shall be properly graded and compacted and free of depressions or obstructions such as tree roots, protruding stones, or other foreign matter.

Erosion logs shall be installed in accordance with the manufacturer's installation guidelines, staking pattern guide, and details based upon the intended use on the construction site.

The Contractor shall remove accumulated sediment when it has reached 1/2 of the effective height of the log, or as directed by the Engineer. Alternatively, a new erosion log may be placed on top of and slightly behind the original one creating more sediment storage capacity. Erosion logs shall be maintained until disturbed area above the device has been permanently stabilized and construction activity has ceased.

When used as a temporary erosion prevention and sediment control measure, erosion logs may be cut open and left in place, but only if the fill material and netting are 100% biodegradable and the material is spread or graded flat so as to not cause concentration of future surface runoff.

SECTION 656 - PLANTING TREES, SHRUBS, AND VINES

223. 656.02 MATERIALS, is hereby modified by deleting the first entry in the Subsection listing (for "Barrier Fence") in its entirety.
224. 656.02 MATERIALS, is hereby further modified by adding the following as the second paragraph (directly below the Subsection listing):

Barrier Fence shall meet the requirements of Section 653.

SECTION 677 - OVERHEAD TRAFFIC SIGN SUPPORTS

225. 677.01 DESCRIPTION, is hereby modified by adding the phrase "and removing and disposing of existing overhead traffic sign supports," after the phrase "supports,".

226. 677.03 GENERAL, is hereby modified by adding the following paragraph:

Where existing overhead traffic sign supports are to be removed, the Contractor shall remove and dispose of the entire sign assembly, including concrete footings, to a depth of 450 mm (18 inches) below existing grade. Areas of ground disturbance shall be restored to the satisfaction of the Engineer.

227. 677.05 METHOD OF MEASUREMENT, is hereby modified by adding the following paragraph:

The quantity of Remove Existing Overhead Sign Assembly of the type specified to be measured for payment will be the number of each assembly removed in the complete and accepted work.

228. 677.06 BASIS OF PAYMENT, is hereby modified by adding the following paragraphs and pay items:

The accepted quantity of Remove Existing Overhead Sign Assembly of the type specified will be paid for at the Contract unit price per each. Payment will be full compensation for removing and disposing of assembly components, including concrete footings; for performing any excavation necessary; for restoring areas of ground disturbance; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Costs associated with providing traffic control and/or flaggers for performing the work will be paid under the appropriate Contract item(s).

Payment will be made under:

| <u>Pay Item</u>   | <u>Pay Unit</u> |
|---|-----------------|
| 677.30 Remove Existing Overhead Sign Assembly, Cantilever       | Each            |
| 677.35 Remove Existing Overhead Sign Assembly,<br>Multi-Support | Each            |

SECTION 678 - TRAFFIC CONTROL SIGNALS

229. 678.01 DESCRIPTION, is hereby modified by adding the phrase ", and removing existing traffic control systems" after the word "system" in the first paragraph.
230. 678.02 MATERIALS, is hereby corrected by deleting "convers" and replacing it with the word "covers" in the second sentence of the last paragraph of the Subsection text.
231. 678.07 - DETECTORS AND CONTROLLERS, is hereby corrected by deleting "maufacturer" and replacing it with the word "manufacturer" in the first sentence of the second (last) paragraph.
232. 678.11 INSTALLATION, sixteenth paragraph, part (a), is hereby modified by adding the following:

The Contractor shall remove any equipment to be salvaged or reused in such a manner that the equipment is not damaged.

233. 678.13 METHOD OF MEASUREMENT, is hereby modified by adding the following paragraph:

The quantity of Removal of Existing Traffic Control Signal System to be measured for payment will be for each traffic control signal system removed in the complete and accepted work.

234. 678.14 BASIS OF PAYMENT, is hereby modified by adding the phrase "all removal, disposal, and salvage and/or reuse of existing system equipment and components," after the phrase "Electrical Wiring," in the second sentence of the first paragraph.

235. 678.14 BASIS OF PAYMENT, is hereby further modified by adding the following paragraph and pay item:

The accepted quantity of Removal of Existing Traffic Control Signal System will be paid for at the Contract unit price per each. Payment will be full compensation for removing and handling the existing traffic control signal system components as specified in the Contract Documents and for furnishing all labor, materials, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

| <u>Pay Item</u>  | <u>Pay Unit</u> |
|--|-----------------|
| 678.45 Removal of Existing Traffic Control Signal System | Each            |

#### SECTION 700 GENERAL

236. 700.01 GENERAL STATEMENT, is hereby corrected by deleting punctuation "...," at the end of the first sentence of the fourth paragraph and replacing it with punctuation ".".

237. 700.02 MATERIALS CERTIFICATIONS, part (a) General, is hereby modified by deleting subpart (3) in its entirety.

238. 700.02 MATERIALS CERTIFICATIONS, part (a) General, is hereby further modified by adding the following as the seventh paragraph:

All certifications shall be forwarded to the Vermont Agency of Transportation Materials Section.

#### SECTION 702 - BITUMINOUS MATERIALS

239. 702.02 PERFORMANCE-GRADED ASPHALT BINDER (PREPARED FROM PETROLEUM), part (a) Properties, is hereby modified by adding the abbreviation "(PGB)" after the word "binder" in the first sentence.

240. 702.02 PERFORMANCE-GRADED ASPHALT BINDER (PREPARED FROM PETROLEUM), part (a) Properties, is hereby further modified by deleting the second sentence of the first paragraph in its entirety and replacing it with the following:

PGB shall be asphalt prepared solely by the refining of crude petroleum and shall meet the requirements of AASHTO M 320 from facilities compliant with AASHTO R 29 without the addition of modifiers.

241. 702.02 PERFORMANCE-GRADED ASPHALT BINDER (PREPARED FROM PETROLEUM), part (a) Properties, is hereby still further modified by adding the following as the third and fourth (last) sentences of the second paragraph:

If additives are used for the modification of asphalt, preapproval is required. The addition of any material not normally obtained during the initial refining process shall constitute modified asphalt and shall be labeled appropriately.

242. 702.02 PERFORMANCE-GRADED ASPHALT BINDER (PREPARED FROM PETROLEUM), part (a) Properties, is hereby still further modified by adding the following as the third (last) paragraph:

The performance graded binder shall be manufactured in accordance with the approved Quality Control Plan. The manufacturer shall remain in compliance with the plan, including all notifications, sampling, testing, and reporting requirements.

243. 702.02 PERFORMANCE-GRADED ASPHALT BINDER (PREPARED FROM PETROLEUM), part (b) Pretest, is hereby modified by being re-designated as part (c).

244. 702.02 PERFORMANCE-GRADED ASPHALT BINDER (PREPARED FROM PETROLEUM), part (c) Certification, is hereby modified by being re-designated as part (d).

245. 702.02 PERFORMANCE-GRADED ASPHALT BINDER (PREPARED FROM PETROLEUM), is hereby modified by adding the following new part (b):

(b) Effect of Approval. VTrans reserves its right to remove its approval of any PGB lot if, in the sole discretion of the Agency, such approval was based on a material non-disclosure by the PGB supplier.

#### SECTION 704 - AGGREGATES

246. 704.10 AGGREGATE FOR BITUMINOUS CONCRETE PAVEMENT, part (a) Aggregate for Marshall Bituminous Concrete Pavement, subpart (1) Grading, c. Recycled Asphalt Pavement (RAP), is hereby modified by deleting the word "four" and replacing it with the word "two" in the seventh sentence of the fifth paragraph.

247. 704.10 AGGREGATE FOR BITUMINOUS CONCRETE PAVEMENT, part (b) Aggregate for Superpave Bituminous Concrete Pavement, subpart (1) Grading, c. Recycled Asphalt Pavement (RAP), is hereby modified by deleting the word "four" and replacing it with the word "two" in the seventh sentence of the sixth paragraph.

#### SECTION 708 - PAINTS, STAINS, AND TRAFFIC MARKING MATERIALS

248. 708.01 GENERAL REQUIREMENTS, part (c) Sampling, Testing, and Certification, subpart (2) Testing, is hereby modified by adding the following:

All other materials may be required to be tested on a cold weather AASHTO National Transportation Product Evaluation Program (NTPEP) pavement marking test deck.

249. 708.08 PAINT FOR PAVEMENT MARKINGS, part (b) Low VOC Traffic Paint, is hereby modified by adding the following as the first paragraph:

Ready-mixed Low VOC Chlorinated Rubber Traffic Paint shall consist of 100% chlorinated rubber type, fast drying traffic paint that shall contain properly formulated pigment and vehicle to give the desired results.

250. 708.08 PAINT FOR PAVEMENT MARKINGS, part (b) Low VOC Traffic Paint, subpart (1) Materials, is hereby modified by adding the following new subpart d.:

- d. The paint shall contain a maximum of 0.005% w/w (50 ppm w/w) lead. The EPA Method 1311 (TCLP) extract of the paint shall not contain amounts of cadmium, mercury, hexavalent chromium, or other toxic heavy metals in excess of the limits specified in SW-846.

251. 708.08 PAINT FOR PAVEMENT MARKINGS, part (b) Low VOC Traffic Paint, subpart (2) Composition, is hereby modified by deleting the phrase "and shall be a 100% acrylic binder" in the first sentence.

252. 708.08 PAINT FOR PAVEMENT MARKINGS, part (b) Low VOC Traffic Paint, subpart (2) Composition, is hereby further modified by deleting the phrase "Table 708.08A" and replacing it with the phrase "the following:" in the second (last) sentence.

253. 708.08 PAINT FOR PAVEMENT MARKINGS, part (b) Low VOC Traffic Paint, subpart (2) Composition, is hereby still further modified by deleting TABLE 708.08A in its entirety and replacing it with the following:

TABLE 708.08A - LOW VOC CHLORINATED RUBBER TRAFFIC PAINT COMPOSITION

| PERFORMANCE CHARACTERISTIC   | WHITE  | YELLOW/BLUE/<br>GREEN                            |
|--|--|--|
| Pigment Content, %<br>by Mass<br>(Weight) (ASTM<br>D3723)            | 55% min.<br>59% max.                                 | 55% min<br>59% max.                              |
| Vehicle Content, %<br>by Mass<br>(Weight)                            | 38% min.<br>42% max.                                 | 38% min.<br>42% max.                             |
| VOC Content, Mass<br>(Weight )<br>per Unit Volume<br>(ASTM D3960)    | 150 g/L<br>(1.25<br>lb/gal)<br>max.                  | 150 g/L<br>(1.25 lb/gal)<br>max.                 |
| Lead Content, %  | 0.005%<br>max.                                       | 0.005% max.                                      |
| Yellow Pigment   | N/A  | Yellow #65 or<br>#75                             |
| Titanium Dioxide,<br>Rutile Type II,<br>(ASTM D1394)                 | 120 g/L<br>(1.00<br>lb/gal)<br>max.                  | 25 g/L<br>(0.21 lb/gal)<br>max.                  |
| Total Non-Volatile<br>Content, %<br>by Mass (Weight)<br>(ASTM D2369) | 70.0%<br>min.  | 69.0% min.                                       |
| Density,<br>(ASTM D1475)   | 1.50 ±<br>0.04<br>kg/L<br>(12.5 ±<br>0.33)<br>lb/gal | 1.46 ± 0.04<br>kg/L<br>(12.2 +/-<br>0.33 lb/gal) |
| Close Cup Flash<br>Point<br>(ASTM D 3278)                            | 4°C (39<br>°F) min.                                  | 4°C (39°F)<br>min.                               |



TABLE 708.08B - LOW VOC ACETONE BASED TRAFFIC PAINT COMPOSITION

| PERFORMANCE CHARACTERISTIC   | WHITE   | YELLOW/BLUE/<br>GREEN                             |
|--|---|---|
| Pigment Content, %<br>by Mass<br>(Weight) (ASTM<br>D3723)            | 53% min.<br>57% max.                                  | 51% min<br>56% max.                               |
| Vehicle Content, %<br>by Mass<br>(Weight)                            | 37% min.<br>42% max.                                  | 37% min.<br>42% max.                              |
| VOC Content, Mass<br>(Weight )<br>per Unit Volume<br>(ASTM D3960)    | 150 g/L<br>(1.25<br>lb/gal)<br>max.                   | 150 g/L<br>(1.25 lb/gal)<br>max.                  |
| Lead Content, %  | 0.005%<br>max.  | 0.005% max.                                       |
| Yellow Pigment   | N/A   | Yellow #65 or<br>#75                              |
| Titanium Dioxide,<br>Rutile Type II,<br>(ASTM D1394)                 | 120 g/L<br>(1.00<br>lb/gal)<br>max.                   | 25 g/L<br>(0.21 lb/gal)<br>max.                   |
| Total Non-Volatile<br>Content, %<br>by Mass (Weight)<br>(ASTM D2369) | 70.0%<br>min.   | 69.0% min.  |
| Density,<br>(ASTM D1475)   | 1.415 ±<br>0.04<br>kg/L<br>(11.8 ±<br>0.33)<br>lb/gal | 1.367 ± 0.04<br>kg/L<br>(11.4 +/-<br>0.33 lb/gal) |
| Close Cup Flash<br>Point<br>(ASTM D 3278)                            | -20°C (-<br>4°F)<br>min.                              | -20°C (-4°F)<br>min.                              |

254. 708.08 PAINT FOR PAVEMENT MARKINGS, part (b) Low VOC Traffic Paint, subpart (3) Laboratory Tests, subpart a. Viscosity, is hereby modified by being deleted in its entirety and replaced as follows:

a. Viscosity.

1. Chlorinated Rubber Traffic Paint. The paint viscosity shall not be less than 74 nor more than 90 Krebs units at 25°C (77°F) when tested according to ASTM D562.
2. Acetone Based Traffic Paint. The paint viscosity shall not be less than 70 nor more than 88 Krebs units at 25°C (77°F) when tested according to ASTM D562.

255. 708.08 PAINT FOR PAVEMENT MARKINGS, part (b) Low VOC Traffic Paint, subpart (4) Sampling and Testing, subpart a. Sampling Size, is hereby modified by deleting the phrase "per batch of each type and color of traffic paint" and replacing it with the phrase "of each traffic paint per batch," in the first sentence.
256. 708.08 PAINT FOR PAVEMENT MARKINGS, part (b) Low VOC Traffic Paint, subpart (4) Sampling and Testing, subpart c. Sample Delivery, is hereby modified by deleting the first paragraph in its entirety and replacing it as follows:

All samples shall be delivered to the Materials Engineer, Vermont Agency of Transportation, Materials Section, 2178 Airport Road Unit B, Berlin, Vermont 05641.

257. 708.08 PAINT FOR PAVEMENT MARKINGS, part (d) Waterborne Traffic Paint, subpart (3) Laboratory Tests, d. Drying Time (No Pick Up Time), is hereby modified by deleting the phrase "380 microns" and replacing it with the phrase "381  $\mu$ m".
258. 708.08 PAINT FOR PAVEMENT MARKINGS, part (d) Waterborne Traffic Paint, subpart (3) Laboratory Tests, e. No Track Time (Field Test), is hereby modified by deleting the phrase "508 microns" and replacing it with the phrase "508  $\mu$ m" in the second sentence.
259. 708.08 PAINT FOR PAVEMENT MARKINGS, part (d) Waterborne Traffic Paint, subpart (4) Sampling and Testing, c. Sample Delivery, is hereby corrected by deleting the phrase "1716 Barre-Montpelier Road, Berlin, VT 05602" and replacing it with the phrase "2178 Airport Road Unit B, Berlin, Vermont 05641" in the first paragraph.
260. 708.09 GLASS BEADS, is hereby modified by being re-named OPTICS.
261. 708.09 OPTICS, is hereby modified by adding new part (a) heading Glass Beads.
262. 708.09 OPTICS, part (a) Properties, is hereby modified by being re-designated as subpart (1) under part (a) heading Glass Beads.
263. 708.09 OPTICS, part (b) Certification, is hereby modified by being re-designated as subpart (2) under part (a) heading Glass Beads.
264. 708.09 OPTICS, is hereby further modified by adding the following new parts (b) and (c):
- (b) Premium Optics. Approved premium optics shall be one of the premium optics listed on the Approved Products List on file with the Agency's Research and Development Section.
  - (c) Wet Recoverable and Wet Reflective Optics. Approved wet recoverable and wet reflective optics shall be one of the wet recoverable and wet reflective optics listed on the Approved Products List on file with the Agency's Research and Development Section.

265. 708.10 THERMOPLASTIC PAVEMENT MARKINGS, is hereby modified by being deleted in its entirety and replaced as follows:

708.10 THERMOPLASTIC PAVEMENT MARKINGS.

- (a) Thermoplastic Pavement Markings, Type A. Type A Thermoplastic Pavement Markings shall be one of the Thermoplastic Pavement Markings on the Approved Products List on file with the Agency's Research and Development Section. These markings shall be used in long line applications or as specified in the Contract Documents. Thermoplastic composition shall comply with Table 708.10A.

TABLE 708.10A - THERMOPLASTIC PAVEMENT MARKING COMPOSITION  
(by mass (weight))

|             |             |
|-------------|-------------|
| Binder      | 18% Minimum |
| Filler      | 40% Maximum |
| Glass Beads | 30 ±5-40%   |

- (b) Thermoplastic Pavement Markings, Type B. Type B Thermoplastic Pavement Markings shall be one of the Preformed Thermoplastic Pavement Markings on the Approved Products List on file with the Agency's Research and Development Section. These markings shall be used in intersection applications for legends, stopbars, or symbols or as specified in the Contract Documents.
266. 708.11 RAISED PAVEMENT MARKERS, is hereby modified by being re-named RAISED PAVEMENT MARKERS, TYPE I.
267. 708.12 PAVEMENT MARKING TAPE, is hereby modified by deleting parts (a) Pavement Marking Tape, Type I, (b) Pavement Marking Tape, Type II, and (c) Pavement Marking Mask in their entirety and replacing them as follows:
- (a) Pavement Marking Tape, Type A. Type A Pavement Marking Tape shall be one of the non-removable permanent pavement marking tapes on the Approved Products List on file with the Agency's Research and Development Section that exhibit high adhesion, high durability, and high retroreflectivity. These markings shall be used in high AADT locations in long line applications as specified in the Contract Documents.
- (b) Pavement Marking Tape, Type B. Type B Pavement Marking Tape shall be one of the non-removable pavement marking tapes on the Approved Products List on file with the Agency's Research and Development Section. These markings shall be used in lower AADT locations in long line applications as specified in the Contract Documents.
- (c) Pavement Marking Tape, Type C. Type C Pavement Marking Tape shall be one of the non-removable pavement marking tapes on the Approved Products List on file with the Agency's Research and Development Section. These markings shall be used at intersection locations only as specified in the Contract Documents.

268. 708.12 PAVEMENT MARKING TAPE, is hereby further modified by adding the following new part (d):

- (d) Pavement Marking Tape, Type D. Type D Pavement Marking Tape for legends and symbols shall be one of the non-removable pavement marking tapes on the Approved Products List on file with the Agency's Research and Development Section. These markings shall be used for preformed traffic markings made of the same material as that of an approved permanent Type A, B, or C tape.

269. 708.13 PREFORMED TRAFFIC MARKINGS AND SYMBOLS, is hereby modified by being deleted in its entirety and replaced as follows:

708.13 TEMPORARY DELINEATION SYSTEMS.

- (a) Line Striping Targets. Line Striping Targets shall be one of the Line Striping Targets on the Approved Products List on file with the Agency's Research and Development Section.
- (b) Raised Pavement Markers, Type II. Acceptable Raised Pavement Markers shall be one of the Raised Pavement Markers on the Approved Products List on file with the Agency's Research and Development Section.
- (c) Temporary Pavement Marking Tape. Pavement Marking Tape shall be one of the removable pavement marking tapes on the Approved Products List on file with the Agency's Research and Development Section.
- (d) Pavement Marking Mask. Pavement Marking Mask shall be one of the Masking Marking Tapes on the Approved Products List on file with the Agency's Research and Development Section.

270. 708.14 LINE STRIPING TARGETS, is hereby modified by being deleted in its entirety.

SECTION 710 - CULVERTS, STORM DRAINS, AND SEWER PIPES, NONMETAL

271. 710.03 CORRUGATED POLYETHYLENE PIPE, is hereby modified by adding the following as the last sentence:

In order to maintain approval status, polyethylene pipe manufacturers must participate in, and maintain compliance with, the AASHTO National Transportation Product Evaluation Program (NTPEP), which audits producers of the pipe.

272. 710.07 CORRUGATED POLYPROPYLENE PIPE, is hereby made a new Subsection of the Standard Specifications as follows:

273. 710.07 CORRUGATED POLYPROPYLENE PIPE. Corrugated polypropylene pipe and fittings shall conform to the latest revisions of AASHTO M 330, Type S. Acceptable corrugated polypropylene pipe shall be one of the corrugated polypropylene pipe products on the Approved Products List on file with the Agency's Materials and Research Section. In order to maintain approval status, polypropylene pipe manufacturers must participate in, and maintain compliance with, the AASHTO National Transportation Product Evaluation Program (NTPEP), which audits producers of the pipe.

SECTION 712 - CRIBBING MATERIALS

274. 712.04 GABION BASKETS, part (a) Wire for Gabion Baskets, is hereby modified by changing the word "shall" to the word "may" and by adding the phrase "or welded panels" after the phrase "woven wire mesh" in the first sentence of the first paragraph.

275. 712.04 GABION BASKETS, part (a) Wire for Gabion Baskets, is hereby further modified by adding the following as the third sentence of the first paragraph:

Welded panels shall be coated by hot dip galvanizing after fabrication.

276. 712.04 GABION BASKETS, part (b) PVC Coating for Gabion Baskets, is hereby modified by adding the following new subpart (7):

(7) Punch Test. The mesh shall achieve satisfactory performance on the Punch Test, as described in ASTM A975 13.1.4. This requirement applies to both woven and welded gabion baskets.

SECTION 713 - REINFORCING STEEL, WELDED WIRE REINFORCEMENT, AND  
REINFORCING STRAND

277. 713.01 BAR REINFORCEMENT, is hereby modified by deleting the phrase "conforming to AASHTO M 31M/M 31, including supplementary requirements" and replacing it with the phrase ", unless otherwise specified in the Contract Documents" in the first paragraph.

278. 713.01 BAR REINFORCEMENT, is hereby further modified by adding the following new parts (a)-(f) and associated paragraphs:

(a) Plain Reinforcing Steel. Plain reinforcing steel shall conform to AASHTO M 31M/M 31, including supplementary requirements.

(b) Low Alloy Reinforcing Steel. Low alloy reinforcing steel shall conform to ASTM A 706/A 706M.

(c) Epoxy Coated Reinforcing Steel. Epoxy coated reinforcing steel shall have an electrostatically applied organic epoxy protective coating, which has been prequalified, fabricated, tested, and installed in accordance with AASHTO M 284M/M 284.

(d) Stainless Clad Reinforcing Steel. Stainless clad reinforcing steel shall meet the requirements of AASHTO M 329M/M 329.

(e) Dual-Coated Reinforcing Steel. Dual-coated reinforcing steel shall meet the requirements of ASTM A 1055/A 1055M.

(f) Solid Stainless Reinforcing Steel. Solid stainless reinforcing steel shall meet the requirements of ASTM A 955/A 955M with one of the following UNS designations: S24100, S30400, S31603, S31653, S32101, S32201, S32205, or S32304. Different designations shall not be mixed within the same project.

Where no core steel requirements are specified in the above specifications, the steel core of the bar reinforcement shall meet the requirements of plain reinforcing steel.

Certification. A Type D Certification shall be furnished in accordance with Subsection 700.02. Certification for Epoxy Coated Reinforcing Steel shall include the coating and coating process.

279. 713.07 COATED BAR REINFORCEMENT, is hereby modified by being deleted in its entirety.
280. 713.02 MECHANICAL SPLICES FOR BAR REINFORCEMENT, is hereby modified by adding the phrase ", except that epoxy coated mechanical splices shall be allowed when Level II reinforcing steel is required" after the phrase "intended to splice" in the second sentence of the first paragraph.

#### SECTION 714 - STRUCTURAL STEEL

281. 714.08 ANCHOR BOLTS, BEARING DEVICES, is hereby corrected by deleting ".F" and replacing it with "F" in the first sentence of the first paragraph.
282. 714.08 ANCHOR BOLTS, BEARING DEVICES, is hereby further corrected by deleting punctuation ".,," and replacing it with punctuation "." at the end of the second sentence of the first paragraph.

#### SECTION 726 - PROTECTIVE COATINGS AND WATERPROOFING MATERIALS

283. 726.10 CONCRETE STAINING AND SEALING SYSTEMS, is hereby made a new Subsection of the Standard Specifications as follows:

726.10 CONCRETE STAINING AND SEALING SYSTEMS. Approved Concrete Staining and Sealing Systems shall be one of the Concrete Staining and Sealing Systems on the Approved Products List on file with the Agency's Materials and Research Section.

284. 726.11 SHEET MEMBRANE WATERPROOFING, PREFORMED SHEET, is hereby made a new Subsection of the Standard Specifications as follows:

726.11 SHEET MEMBRANE WATERPROOFING, PREFORMED SHEET. Approved Preformed Sheet Membrane Waterproofing Systems shall be one of the Preformed Sheet Membrane Waterproofing Systems on the Approved Products List on file with the Agency's Materials and Research Section.

#### SECTION 731 - BEARING PADS FOR STRUCTURES

285. 731.03 ELASTOMERIC MATERIAL, is hereby modified by deleting the second and third paragraphs in their entirety and replacing them with the following:

Unless noted otherwise, elastomer shall have a design hardness of 50 points and a design shear modulus of 0.8 MPa (110 psi).

Testing of elastomeric material shall be waived for bearings that will be encased in concrete in the final work. All other bearings shall be tested in accordance with the following table:

TABLE 731.03A - REQUIRED TESTS

| Material Property              | Test Method                                   | Required Result                 |
|--------------------------------|---|---------------------------------|
| Hardness                       | ASTM D 2240                                   | design hardness<br>+/- 5 points |
|                                | or  |                                 |
| Shear Modulus                  | ASTM D 412 with AASTHO M<br>251 Section 8.8.4 | design shear<br>modulus +/- 15% |
| Low Temperature<br>Brittleness | ASTM D 746 Procedure B                        | Pass Grade 4 test               |
| Shear Bond Strength            | AASHTO M 251 Annex A2 or<br>Appendix X2       | Pass                            |
| Min Tensile Strength           | ASTM D 412                                    | 15.6 MPa (2250<br>psi)          |
| Min Ultimate<br>Elongation     | ASTM D 412                                    | (650 - 5 X design<br>hardness)% |

SECTION 755 - LANDSCAPING MATERIALS

286. 755.17 EROSION LOGS, is hereby modified by being deleted in its entirety and replaced with the following:

Erosion logs are available in varying diameters. The Contractor shall follow the manufacturer's recommendations for the material type and size based on the intended use.

Erosion logs shall be composed of weed-seed-free coir, straw, excelsior, compost, or other biodegradable filtering medium encased in a photo-degradable and/or biodegradable netting or mesh.

Netting shall have openings of 13 to 25 mm (1/2 to 1 inch), with the exception of compost filled logs which should be 3 to 10 mm (1/8 to 3/8 inch) or as recommended by the manufacturer and accepted by the Engineer.

Anchors for erosion logs shall be wooden stakes, U-shaped wire or earth anchors, or rebar stakes; the size and length shall be as recommended by the manufacturer.

Compost shall meet the requirements of Table 755.05A, with the exception that particle size shall be 99% < 50 mm (2 inches) and maximum 30% < 10 mm (3/8 inch).

SECTION 780 - CONCRETE REPAIR MATERIALS

287. 780.05 POLYMER CONCRETE REPAIR MATERIAL, is hereby made a new Subsection of the Standard Specifications as follows:

780.05 POLYMER CONCRETE REPAIR MATERIAL. Approved Polymer Concrete Repair Materials shall be one of the Polymer Concrete Repair Materials on the Approved Products List on file with the Agency's Materials and Research Section.