

COMPILATION OF APPROVED SPECIFICATIONS

**RHODE ISLAND DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS FOR
ROAD AND BRIDGE CONSTRUCTION**

**REVISIONS
SUPPLEMENTAL SPECIFICATIONS
SPECIAL PROVISIONS**

APRIL 2016

**THIS SPECIFICATION COMPILATION REPLACES THE FOLLOWING
DOCUMENTS**

<u>Document</u>	<u>Release Date</u>
Compilation of Approved Specifications (Revised 01/24/2011) [Replaced Supplement Nos. 1 – 10]	01/24/2011
Compilation of Approved Specifications – Supplement No. 11	05/18/2011
Compilation of Approved Specifications – Supplement No. 12	12/23/2011
Compilation of Approved Specifications – Supplement No. 13	04/17/2012
Compilation of Approved Specifications – Supplement No. 14	08/02/2013
Compilation of Approved Specifications – Supplement No. 15	04/28/2015
Compilation of Approved Specifications – Supplement No. 16	05/07/2015

NOTES:

- 1. ALL THE MATERIAL CONTAINED IN THIS DOCUMENT HAS BEEN PREVIOUSLY RELEASED IN THE SPECIFICATION COMPILATIONS LISTED ABOVE.**
- 2. DIVISION I, PART 100 – GENERAL REQUIREMENTS AND COVENANTS, INCLUDING REVISIONS; DIVISION II, CONSTRUCTION DETAILS AND DIVISION III, MATERIALS, OF THE 2004 EDITION OF THE RI STANDARD SPECIFICATIONS ARE REPLACED WITH THE RI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, AMENDED AUGUST 2013.**

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
109	Measurement and Payment.....	AC-1
201	Load and Haul Solid Waste & Disposal of Solid Waste	AC-5
202	Excavation and Embankment.....	AC-7
203	Structure Excavation and Backfill.....	AC-11
206	Perimeter Erosion Controls.....	AC-12
207	Check Dams.....	AC-17
212	Maintenance and Cleaning of Erosion and Pollution Controls.....	AC-19
300	Aggregate and Gravel Base and Subbase Courses.....	AC-21
401	Dense Graded Hot Mix Asphalt (HMA) Pavements.....	AC-23
402.03.2	Friction Courses – Production and Placement	AC-47
403	Asphalt Emulsion Tack Coat.....	AC-48
408.0100 & 408.0200	Cleaning and Sealing Cracks in Bituminous Concrete Pavement: Cracks Less than 1-Inch and 1-Inch and Over in Width	AC-50
410	Temporary Patching of Potholes and Trenches	AC-55
411.0100	Paver-Placed Elastomeric Surface Treatment.....	AC-57
412.0100	Rubberized Asphalt Chip Sealing.....	AC-61
414	Warm Mix Additive	AC-67
601	Portland Cement Concrete	AC-68
602.03	Mineral Additives for Portland Cement Concrete.....	AC-98
604	Class HP(AE) Portland Cement Concrete.....	AC-99
605	Concrete with Calcium Nitrite Based Corrosion Inhibitor.....	AC-100
606	Self-Consolidating Concrete (SCC).....	AC-101
607	Mass Concrete.....	AC-103

<u>Section</u>	<u>Title</u>	<u>Page</u>
701	Culverts and Storm Drains	AC-115
714	Post Type Hydrants.....	AC-119
803.0300	Partial Removal and Disposal of Existing Concrete Masonry.....	AC-121
803.0400	Cleaning Bridge Beam Seats.....	AC-125
803.0500	Temporary Deck Underside and Side Protective Shielding.....	AC-127
804	Driven Piles.....	AC-129
805.05.7	Earth Retaining Systems – Ground Anchors.....	AC-131
808.03.9	Curing Concrete	AC-132
808.1860	Concrete Architectural Treatment – Form Liner Finish.....	AC-133
809	Precast/Prestressed Structure Concrete Masonry.....	AC-135
810	Reinforcing Steel.....	AC-145
812	Water Stops.....	AC-150
813	Waterproofing and Dampproofing.....	AC-152
814.03	Placement of Concrete Bridge Decks.....	AC-157
815	Latex Modified Concrete for Bridge Overlays.....	AC-160
817	Repairs to Structure Concrete Masonry.....	AC-161
818	Portland Cement Concrete Bridge Deck Repair.....	AC-163
820.02	Concrete Surface Treatment Protective Coating – Materials	AC-166
820.0200	High-Pressure Water Cleaning of Concrete Surfaces.....	AC-167
820.0300	High-Pressure Water Cleaning of Bridge Structures.....	AC-168
823	Roadway Joints – Expansion and Fixed.....	AC-170
823.1755	Asphaltic Expansion Joint System – Materials and Workmanship Warranty	AC-171
824.03.11	Surface Preparation for Weathering Steel – Final Cleaning.....	AC-183
825	Painting Structural Steel.....	AC-184

<u>Section</u>	<u>Title</u>	<u>Page</u>
841	Pre- and Post-Construction Condition Surveys	AC-197
842	Anti-Graffiti Coating	AC-200
901.0198	Guardrail End Treatment – Non-Energy Absorbing Terminal.....	AC-202
901.0199	Guardrail End Treatment – Energy Absorbing Terminal.....	AC-202
903	Fences – Temporary Chain Link Fence	AC-203
903	Fences – Split Rail Fence	AC-205
905	Sidewalks and Driveways.....	AC-207
905.1000	Sidewalks – Failure to Comply.....	AC-211
906	Curbing for Roadways.....	AC-212
913	Trafficpersons.....	AC-216
914.02	Flagpersons - Qualifications.....	AC-217
918	Rural Mailboxes Postmaster Approved	AC-218
926	Anchored and Unanchored Precast Concrete Barrier for..... Temporary Traffic Control	AC-219
927	Remove and Relocate Precast Concrete Median Barrier for..... Temporary Traffic Control	AC-222
929	Field Offices and Materials Laboratory.....	AC-223
929.1000	Field Offices and Materials Laboratory	AC-226
930	Plant Field Laboratory.....	AC-228
930.1000	Plant Field Laboratory.....	AC-236
934	Field Control and Construction Layout.....	AC-237
935	Removing Bituminous Pavement by Micro Milling.....	AC-242
936	Mobilization and Demobilization	AC-243
937	Maintenance and Movement of Traffic Protective Devices.....	AC-245
938.03	Price Adjustment.....	AC-247

<u>Section</u>	<u>Title</u>	<u>Page</u>
942	Detectable Warning Panel	AC-248
943.0200	On-the-Job Training.....	AC-249
944	Diesel Emissions Reduction Program	AC-253
T.01	Electrical Work.....	AC-257
T.02	Highway Lighting.....	AC-259
T.03	Ground Rods and Bare or Insulated Ground Wire.....	AC-260
T.04	Wire and Cable.....	AC-261
T.05	Handholes and Pull Boxes.....	AC-263
T.06	Conduit.....	AC-265
T.07	Luminaires.....	AC-268
T.08	Aluminum Lighting Standards and Foundations.....	AC-270
T.09	Service Pedestal.....	AC-271
T.13	Detectors and Relays	AC-272
T.15.03.5	Post Holes.....	AC-273
M.01	Borrow and Aggregates.....	AC-274
M.02.08	Latex Emulsion Admixture.....	AC-276
M.03	Bituminous Pavements.....	AC-277
M.04	Drainage.....	AC-279
M.05	Metals.....	AC-280
M.06	Paint.....	AC-283
M.07	Sheet Piling and Piles.....	AC-286
M.12	Waterproofing, Dampproofing and Sealers.....	AC-287
M.15	Traffic Control Systems	AC-292
M.17.01	Glass Beads – Dual Gradation.....	AC-312

<u>Section</u>	<u>Title</u>	<u>Page</u>
M.17.04	Epoxy Resin Pavement Markings.....	AC-314
M.18	Landscaping Materials.....	AC-315
M.19	Anti-Graffiti Systems	AC-316

Replace **Subsection 109.04, Measurement and Payment – Differing Site Conditions, Changes, Extra Work and Force Account Work**, pages 1-80 to 1-82 of the RI Standard Specifications for Road and Bridge Construction in its entirety with the following.

SECTION 109

MEASUREMENT AND PAYMENT

109.04 DIFFERING SITE CONDITIONS, CHANGES, EXTRA WORK AND FORCE ACCOUNT WORK.

a. Methods of Payment. Differing site conditions, changes, extra work, and significant changes in the character of the work, all performed in accordance with **SECTION 104; SCOPE OF WORK**, will be paid for in accordance with the following methods as appropriate:

1. Contract unit prices.
2. Unit prices agreed upon in the order authorizing the work.
3. An agreed upon lump sum amount.
4. If directed by the Department, on a Force Account Basis to be compensated in the following manner:

(a) Labor. For all labor and foremen in direct charge of the specific operations, the Contractor shall receive the rate of wage actually paid as shown by its certified payroll, which rate shall be at least the prevailing rate of wage (or scale), for each and every hour that said labor and foremen are actually engaged in the work.

No part of the salary or expenses of anyone connected with the Contractor's forces above the grade of foreman, and having general supervision of the work, shall be included in the labor item as specified above.

The Engineer reserves the right to determine the number and type of labor employed.

The Contractor shall receive the actual costs paid to, or in behalf of, workers by reason of subsistence and travel allowances, health and welfare benefits, pension fund benefits or other benefits, when such amounts are required by collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the work.

An amount equal to 20 percent of the sum of the above items will also be paid the Contractor.

(b) Bond, Insurance and Tax. For bonds, property damage and liability insurance premiums, unemployment insurance contributions, and social security taxes incurred on force account work, the

Contractor shall receive the actual cost, to which cost a surcharge of 6-percent will be added. For Worker's Compensation Insurance Premiums, the Contractor shall receive the actual cost of the worker's compensation costs incurred, which shall be calculated net of all applicable credits, rebates, refunds and allowances. A surcharge will be added to the actual costs incurred. The surcharge amount is calculated from the Experience Modification Factor (MOD Factor) as follows:

1. For MOD factors greater than 1.0 the surcharge is 6%
2. For MOD factors greater than .80 and less than or equal to 1.0 the surcharge is 8%.
3. For MOD factors less than or equal to .80 the surcharge is 10%.

The Contractor shall furnish satisfactory evidence of the rate or rates paid for such bonds, insurances and taxes. In addition, the Contractor shall submit a copy of their Worker's Compensation policy showing the current MOD factors.

(c) Materials. For materials accepted by the Engineer and used in the work, the Contractor shall receive the actual cost of such materials delivered to the site, including transportation charges paid (exclusive of machinery rentals as hereinafter set forth), to which cost a surcharge of 15 percent will be added. The Contractor will not be reimbursed for any penalty or carrying charge incurred due to late or delayed payment for materials used in the work.

(d) Equipment. For any machinery or special equipment (other than small tools) including transportation cost, the use of which has been authorized by the Engineer, the Contractor shall receive either the "hourly rental rates" as prescribed herein by the Department, or the actual documented cost plus an amount equal to 10 percent of said actual documented cost, whichever is less. Under no circumstance will the payment exceed the replacement cost of the equipment.

All rental rates shall include the estimated operating cost as indicated for that equipment in either the Rental Rate Blue Book or the Rental Rate Blue Book for Older Equipment, including the Rate Adjustment Tables approved for projects wholly or partially funded by the Federal Highway Administration (FHWA). Operators' wages are not included in the estimated operating cost and are paid separately, except for certain specified equipment in which the operator's wages are included.

The "hourly rental rate" for an individual piece of equipment shall be determined by dividing the associated monthly rate, modified by the Rate Adjustment Tables, as contained in the Rental Rate Blue Book by one hundred seventy-six (176). There will be no adjustment to the hourly rate for the period of use.

For rented equipment, the cost shall be based on the actual documented cost plus an amount equal to 10-percent of said actual documented cost, subject to the conditions set forth below. The actual documented cost shall consist of the paid invoice for rented equipment plus other documented operating costs (i.e. fuel, maintenance, repairs, etc.).

Actual documented costs plus 10 percent of said costs shall not exceed the cost as calculated from the RENTAL RATE BLUE BOOK or the RENTAL RATE BLUE BOOK FOR OLDER CONSTRUCTION EQUIPMENT. The Contractor shall submit documentation for both the hourly rental rates and actual documented costs to determine that the actual documented costs plus 10 percent of said

costs does not exceed the calculated rental rate costs. No percentage surcharges will be added to the "Blue Book" rates as prescribed herein for rented equipment.

For equipment which is already on the project, the rental period shall start when such equipment is ordered to work by the Engineer, and shall continue until ordered to stop work.

For equipment which has to be brought to the project specifically for use on force account work, the State will pay all loading and unloading costs, and all transportation costs to and from the project, including assembling and dismantling, provided, however, that the cost of return transportation shall not exceed that of moving the equipment to the project. Loading, unloading and transportation costs will not be paid if the equipment is used for work other than force account work while on the project. The rental period shall start at the time the equipment is ready for operation, and shall extend during the period of time the equipment is actually utilized on force account work. The rental period shall end when the equipment is released by the Engineer.

All equipment, including trucks, shall, in the judgment of the Engineer, be in good working condition and suitable for the purpose intended. The Engineer reserves the right to determine the number of units of the various types of equipment to be employed on force account work. The manufacturer's model identification shall be the basis for identifying the type of equipment for payment purposes. Certification for the model year of the equipment will be required.

(e) Subcontracting. For work performed by a subcontractor, the Contractor shall accept as full payment an amount equal to the actual cost to the Contractor of such work performed by the subcontractor, as determined by the Engineer, plus 10 percent of said cost.

(f) Miscellaneous. No payment will be made for general superintendence, the use of small tools, or other costs for which no specific allowance is herein provided.

(g) Compensation. The Contractor's representative and the Engineer shall daily compare records of work completed on a force account basis. The Engineer will then prepare the daily work sheets and said sheets shall be signed by the Contractor's representative no later than noon of the next working day.

(h) Statements. No payment will be made for work performed on a force account basis until the Contractor has furnished the Engineer with six copies of itemized statements of the cost of such work, incurred on a daily basis, and detailed as follows:

(1) Name, classification, date, daily hours, total hours, rate and extension for each laborer and foreman.

(2) Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.

(3) Quantities of materials, prices, and extensions.

(4) Transportation of materials.

(5) Cost of property damage, liability and worker's compensation insurance premiums, unemployment insurance contributions, and social security taxes.

Statements shall be accompanied and supported by certified payrolls, and receipted invoices for all materials used and transportation charges. However, if materials used on the force account work are not specifically purchased for such work but are taken from the Contractor's stock, then in lieu of the invoices, the Contractor shall furnish an affidavit certifying that such materials were taken from its stock, that the quantity claimed was actually used, and that the price and transportation claimed represent the actual cost to the Contractor.

Add the following subsections to **Section 201, Site Preparation**, pages 2-1 through 2-11 of the RI Standard Specifications for Road and Bridge Construction.

SECTION 201

LOAD AND HAUL SOLID WASTE DISPOSAL OF SOLID WASTE

201.01 DESCRIPTION.

201.01.13 Load and Haul Solid Waste and Disposal of Solid Waste. This work consists of collecting, loading, hauling and disposing of on-site solid waste material, including but not limited to trash, litter, household appliances, tires, vegetative and other on-site debris.

Unless otherwise provided for in the contract documents, this item of work shall not include the removal and disposal of solid waste material or debris generated by the Contractor's construction operations, including soil and rock excavation, the removal of pavement, sidewalks and other highway infrastructure, clearing and grubbing operations and/or the removal and disposal of contaminated soils.

201.02 MATERIALS.

201.02.1 Load and Haul Solid Waste and Disposal of Solid Waste: Regulatory Provisions. The Contractor shall ensure that the removal of all debris is conducted in a manner consistent with the requirements of the Rhode Island Building Code and OSHA standard 29 CFR 1926: Safety and Health Regulations for Construction.

Solid waste materials shall be disposed of in accordance with EPA regulations (40 CFR 239 – 259, including latest revisions) and RIDEM solid waste regulations (DEM OWM-SW-04-01, including latest revisions), and any and all other applicable regulations.

The Contractor shall obtain all required permits for hauling and disposal of waste materials, and shall be responsible for payment of tipping and other required fees.

201.03 CONSTRUCTION METHODS.

201.03.13 Load and Haul Solid Waste and Disposal of Solid Waste. The removal of solid waste material from the project site shall be performed with the necessary labor, tools and equipment in a manner such that the effects of noise, dust and other adverse conditions are minimized.

All solid waste material shall be legally recycled or disposed of at licensed facilities.

The Contractor shall notify the Engineer in the event hazardous waste materials are encountered or may be present, including but not limited to contaminated soils, oil and/or other hazardous or potential hazardous waste materials (OHM). The removal of OHM materials shall be conducted in accordance with applicable state and federal regulations, and shall not be handled under this item of work.

201.04 METHOD OF MEASUREMENT.

201.04.13 Load and Haul Solid Waste and Disposal of Solid Waste. “Load and Haul Solid Waste” and “Disposal of Solid Waste” will be measured by the number of tons of waste material actually disposed of. The tonnage will be determined from weight slips generated at the waste disposal facilities.

201.05 BASIS OF PAYMENT.

201.05.13 Load and Haul Solid Waste and Disposal of Solid Waste. “Load and Haul Solid Waste” and “Disposal of Solid Waste” will be paid for by their respective contract unit bid prices per ton as listed in the Proposal. The prices so-stated constitute full and complete compensation for all disposal fees, recycling of waste materials, labor, materials, equipment and all incidentals required to finish the work, complete and accepted by the Engineer.

Revise **Section 202, Excavation and Embankment**, pages 2-11 to 2-22 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 202

EXCAVATION AND EMBANKMENT

- **Replace Subsection 202.02; Materials in its entirety with the following.**

202.02 MATERIALS

202.02.1 Common Borrow. Common Borrow shall consist of approved material required for the construction of embankments or for other portions of the work. Common Borrow shall meet the requirements of **Subsection M.01.01** of these Specifications prior to its final placement on the Project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

202.02.2 Gravel Borrow. Gravel Borrow shall meet the requirements of **Subsection M.01.09; Gradation of Aggregates, Table I, Column I** prior to its final placement on the Project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

- **Replace Subsection 202.03.2(b); Roadway Embankment-Earth in its entirety with the following.**

b. Roadway Embankment-Earth. Roadway embankments may consist of earth excavation, borrow material, or a combination thereof. Unless the Department mandates the sequencing of materials in the embankment, borrow material shall not be placed until all suitable and accessible materials from all structure, trench, and roadway excavations have been placed. If the Contractor places more borrow than is required and thereby causes a waste of excavation, the amount of such waste will be deducted from the borrow volume as measured.

When borrow material is required to construct embankment, the Contractor shall make his own arrangements to procure the borrow material or open a borrow source. The Contractor shall also determine the suitability of the borrow material for use in embankment by appropriate laboratory testing.

All roadway earth embankment sections shall be constructed in horizontal lifts not exceeding 15 inches (before compaction) and shall be compacted as specified in **Subsection 202.03.3 Compaction-General** before the next lift is placed.

Each lift shall be placed to the full width of the embankment section unless otherwise directed. If the full width of the embankment section cannot be placed at one time, the lifts shall be stepped back at least the length of the lift thickness to allow for benching of the remaining fill.

The entire area of each lift shall be uniformly compacted to at least the required minimum density by use of compaction equipment consisting of rollers, compactors or a combination thereof. Earth-moving

and other equipment not specifically manufactured for compaction purposes shall not be considered as compaction equipment.

The moisture content of all roadway embankment materials at the time of compaction shall be that suitable for the soil to meet the required density as specified in **Subsection 202.03.3 Compaction – General** but in no case shall it exceed 2.5% above the Optimum Moisture Content as determined by AASHTO T180. The following applies even if the moisture content is below the allowable upper limit: As observed by the Engineer, should the compacted lift exhibit instability as evident by pumping or rutting under equipment, insufficient moisture as evident by dusting, or excessive moisture or saturation, the Contractor shall make corrections to the lift at no additional cost to the State.

As the compaction of each lift progresses, continuous leveling and manipulating will be required to attain uniform density. Water shall be added or removed, if necessary, in order to obtain stability and the required density. Construction equipment shall be routed uniformly over the entire surface of each lift.

If the natural-in-place moisture of the excavated material makes it impractical to compact the soil, the Contractor shall dry the soil by disking, harrowing, blading or other approved means. If these methods do not produce the specified compaction, the Contractor shall strip and replace the soil.

The embankment shall be crowned to shed runoff and constructed such that side slopes are protected from erosion.

[Remainder of Subsection is unchanged]

• **Replace Subsection 202.03.3; Compaction-General in its entirety with the following.**

202.03.3 Compaction-General. Each lift shall be uniformly compacted to the specified density before the next lift is placed. The specified density shall be obtained by utilizing any approved compaction equipment such as: pneumatic tired compaction equipment, or three-wheeled power rollers, or vibratory, sheepfoot, or tamping rollers, or other approved types of compaction equipment.

Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until the compaction requirements of this Subsection have been met. Hauling and leveling equipment shall be routed and distributed over each lift of the fill so as to make best use of that compaction effort.

a. Densities.

1. Maximum dry density and optimum moisture content will be determined by AASHTO T180.
2. Field density of soil in place shall be determined by either AASHTO T191 or a nuclear moisture density gauge conforming to AASHTO T310.
3. The method of correcting for oversize particles in soil compaction test results shall conform to AASHTO T224.
4. The Method Specification for Compaction of Soils as described in Para. d. shall apply if an approved soil does not meet the parameters set by AASHTO T180.

b. Compaction of Earth Embankment.

1. Subgrade. Where the resulting subgrade surface is the bottom of an excavation (i.e. undisturbed existing ground), the subgrade surface shall be compacted as required, to not less than 95 percent of maximum dry density. When a nuclear density gauge is used, the in place dry density will be measured by the direct transmission method per AASHTO T 310 to a depth of 12 inches below the exposed surface.

As observed by and at the discretion of the Engineer, determinations may be made of instability and excessive or insufficient moisture of the subgrade material and in such cases, the Contractor shall correct the lift at no additional cost to the State.

2. Embankment Sections. Where embankment sections are greater than 3 feet in height above existing ground, the earth in embankment sections below a plane of three feet below subgrade shall be compacted to not less than 90 percent of maximum dry density. The remainder of the roadway section up to subgrade shall be compacted to 95 percent of maximum dry density. When a nuclear density gauge is used, the in place dry density will be measured by the direct transmission method per AASHTO T 310 to a depth of 12 inches below the exposed surface or equal to the height of the lift thickness, whichever is smaller.

As observed by and at the discretion of the Engineer, determinations may be made of instability and excessive or insufficient moisture of the embankment material and in such cases, the Contractor shall correct the lift at no additional cost to the State.

c. Compaction of Rock Embankment. Rock fill layers shall be sized, placed, and choked as described in **Subsection 202.03.2; Para. c.**

d. Method Specification for Compaction of Soils. This specification is to be used when an approved soil does not meet the parameters set by AASHTO T180.

1. A test strip shall be prepared of adequate size (approximately 100 SY) and at the appropriate lift thickness for the section.

(a) The test strip shall be uniformly compacted with two (2) passes of adequately sized piece of compaction equipment such as a vibratory steel drum roller or a plate compactor with a minimum centrifugal force rating of 5,000 lbs.

The number of roller passes is the number of times the area was rolled with the compaction equipment. e.g. forward and backward is two (2) passes.

(b) The in place field density of the test strip will be determined by the Engineer using either AASHTO T191 or a nuclear moisture density gauge conforming to AASHTO T310 in accordance with **Subsection 202.03.3, Para a.** If high gravel content impedes the use of direct transmission, then the backscatter mode will be used. In the backscatter mode, two tests performed in opposite directions over the same test spot will be averaged and recorded as a single test.

Water shall be added to the area before proceeding if the moisture content is below 3%. Care shall be taken to avoid saturating the area.

(c) Compaction shall continue on the test strip with 1 or 2 additional passes of the compaction equipment. The test area will be re-tested in the same manner as in paragraph b. for moisture and density relations and the results will be compared to the first test.

This procedure will continue until the results of three (3) consecutive density tests are within 1% of each other.

(d) The total number of roller passes required to satisfy the previous step will be established as the minimum number of roller passes required for the roller pattern. Thereafter for production, additional density testing will not be required, unless the material and/or equipment have changed as described in e. below.

(e) A new test strip is required for:

(i.) each source of material

(ii) each specific compaction equipment used

(iii) whenever the material appears to have changed

(iv) whenever the moisture content appears to have changed

2. Upon establishing the approved equipment and roller pattern for production, a visual inspection of each compacted lift will be performed by the Engineer and subsequent lifts shall be placed only upon approval by the Engineer.

Revise **Subsection 203.02, Materials**, page 2-23 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 203

STRUCTURE EXCAVATION AND BACKFILL

- **Replace the first paragraph of Subsection 203.02; Materials, with the following.**

203.02 MATERIALS. Backfill materials as specified in the Contract Documents shall conform to the applicable requirements of **SECTION M.01; BORROW AND AGGREGATES**, of these Specifications. All backfill materials shall conform to all applicable specification requirements prior to its final placement on the project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

[Remainder of this Subsection is unchanged]

Remove **Section 206, Perimeter Erosion Controls**, pages 2-37 through 2-39 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace with the following.

SECTION 206

PERIMETER EROSION CONTROLS

206.01 DESCRIPTION. This work consists of the provision of perimeter erosion controls in reasonably close conformity with the dimensions and details indicated on the plans or as directed by the Engineer, all in accordance with these Specifications. Perimeter erosion controls consist of the following four types.

206.01.1 Baled Hay Erosion Checks. Baled hay erosion checks shall consist of baled hay or straw, each bale of which is embedded and attached to the ground with wood stakes, and are constructed as indicated on the Plans.

206.01.2 Silt Fence. Silt fencing shall consist of oak fence posts to which are attached industrial support netting and sediment control filter fabric, and are constructed as indicated on the Plans.

206.01.3 Baled Hay Erosion Check and Silt Fence Combined. Baled Hay Erosion Checks and silt fence combined shall consist of baled hay erosion check installed abutting the filter fabric side of a silt fence, with a minimum of six (6) inches along the bottom edge of the silt fence toed in under the baled hay erosion check as indicated on the Plans.

206.01.4 Compost Filter Sock. Compost filter sock shall consist of a flexible mesh tube filled with composted material and staked to the ground with wooden stakes, and constructed as indicated on the plans.

206.02 MATERIALS.

206.02.1 Baled Hay Erosion Checks. Baled hay or straw shall be baled within twelve months of use. Bindings shall be sufficiently strong to act as handles when placing bales in position by hand. The minimum dimension of any bale shall be 18 inches. Wood stakes shall be oak, 1-inch by 1-inch in section, and at least 3 feet in length.

206.02.2 Silt Fence. The filter fabric shall be a material suitable for erosion control applications and shall be one of those included on the Department's Approved Materials List. Wood posts shall be oak, 2-inch by 2-inch in section, and at least 4.5 feet in length. Support netting shall be heavy-duty plastic mesh. For prefabricated silt fence, 1-inch by 1-inch wood posts will be permitted.

206.02.3 Baled Hay Erosion Check and Silt Fence Combined. Baled Hay or straw shall conform to the requirements of **Subsection 206.02.1** above. Silt fencing shall conform to the requirements of **Subsection 206.02.2** above.

206.02.4 Compost Filter Sock. Compost filter sock material shall be in accordance with AASHTO Designation: MP 9-06 (2007 or latest revision). Compost filter material shall be in accordance with AASHTO Designation: MP 9-06 (2007 or latest revision). Compost material shall also meet all applicable Federal and State Regulations. For compost filter socks 18 inches or less in diameter, wooden stakes shall be 1 inch by 1 inch, at 10 foot intervals on center, and of a length that shall project into the soil 1 foot leaving 3 inches to 4 inches protruding above the filter sock. For compost filter socks greater than 18 inches in diameter wooden stakes shall be 2 inch by 2 inch, at 10 foot intervals on center, and of a length that shall project into the soil 1 foot leaving 3 inches to 4 inches protruding above the filter sock.

206.03 CONSTRUCTION METHODS. Those erosion and pollution controls indicated on the Plans shall be installed and approved by the Engineer before the commencement of any drainage, roadway, or bridge construction.

206.03.1 Baled Hay Erosion Checks.

a. Installation. Baled hay erosion checks shall be constructed at the locations, and in accordance with the details indicated on the Plans, or as directed by the Engineer. The following stipulations also apply:

1. Bales shall be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another.

2. The erosion check shall be entrenched and backfilled. The trench shall be excavated the width of the bale and the length of the check to a minimum depth of 3 inches. After the bales are staked and chinked, the excavated soil shall be backfilled against the check. Backfill shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side.

3. The bales are to be installed so that the bindings are oriented around the sides of the bales rather than along their tops and bottoms.

4. Each bale shall be securely anchored by at least two stakes driven through the bale. The first stake in each bale should be driven toward the previously laid bale to force the bales together.

5. The gaps between bales shall be chinked (filled by wedging) with straw to prevent water from escaping between bales. Loose straw shall be scattered over the area immediately uphill from the bale erosion check to increase efficiency.

6. At approximate intervals of 100 feet, one bale is to be placed against those bales positioned along the limit of clearing. This bale is to be placed at a right angle to the line of the toe of slope, all as indicated on the Plans.

b. Removal. All stakes must be removed from the haybales at a time designated by the Engineer. In general the bales will be allowed to rot in place. If the Contract requires the haybales to be removed, they may be removed only when the adjacent exposed area has been stabilized, i.e., the area has an established grass or stone cover or has been paved, and is free from future uncontrolled discharges. Prior to such removal, however, all silt, mud, and debris entrapped by the haybales shall be removed and

the area cleaned up in accordance with the applicable provisions of **SECTION 212** of these Specifications. Immediately upon removal of the bales the remaining exposed areas (under the bales) will be backfilled, raked, and graded as necessary to match the surrounding grade and then seeded.

206.03.2 Silt Fence.

a. Installation. Silt fence shall be constructed at the locations, and in accordance with the details indicated on the Plans, or as directed by the Engineer. The following stipulations also apply:

1. A 6-inch deep by 1-foot wide minimum trench shall be dug where the fence is to be installed.
2. The fence shall be positioned in the trench with the fence posts set at 8 feet on center (maximum) in wetland areas and 4 feet on center (maximum) in wetland ravine, gully or drop-off areas, as indicated on the plans.
3. The sedimentation control fabric and the industrial netting shall be stapled to each post. When joints are necessary, filter fabric shall be spliced together only at support posts. Splices shall consist of a 6-inch overlap, and shall be securely sealed.
4. Each wood post with industrial support netting and filter fabric attached shall be driven into the undisturbed soil in the trench as indicated on the Plans.
5. The trench shall be backfilled and the soil compacted over the filter fabric.
6. The installed height of the fence shall be 2½ feet (minimum). However, height shall not exceed 36 inches since higher barriers impound volumes of water sufficient to cause failure of the fence structure.

b. Removal. This work will include the removal of the silt fence erosion checks and posts. Silt fence will not be left to rot in place. The silt fence may be removed only when the adjacent exposed area is stabilized, i.e., the area has an established grass or stone cover or has been paved, and is free from future uncontrolled discharges. Prior to such removal, however, all silt, mud, and debris entrapped by the silt fence shall be removed and the area cleaned up in accordance with the applicable provisions of **SECTION 212** of these Specifications. Immediately upon removal of the silt fence the remaining exposed areas will be finished as specified above in **Para. b** of **Subsection 206.03.1**.

206.03.3 Baled Hay Erosion Check and Silt Fence Combined.

a. Installation. Baled Hay Erosion Check and Silt Fence Combined shall be installed in accordance with the requirements of **Para. a** of **Subsections 206.03.1** and **206.03.2**, with the following additional provisions:

1. Silt fencing shall be installed prior to the installation of the baled hay or straw.
2. The trench shall be a minimum of 6-inches deep and a width wide enough to accommodate the baled hay or straw as it abuts the filter fabric side of the silt fence.

3. Prior to backfilling the trench, the baled hay or straw shall be installed tight against the filter fabric side of the silt fence, with a minimum of six (6) inches of the bottom edge of the silt fence toed in under the baled hay within the trench.

b. Removal. This work will include the removal of the combined baled hay erosion check and silt fence in accordance with **Para. b** of **Subsections 206.03.1** and **206.03.2**, with the exception that the baled hay erosion checks will not be allowed to remain and rot in place.

206.03.4 Compost Filter Sock.

a. Installation. Compost Filter socks shall be constructed at the locations, and in accordance with the details indicated on the plans, or as directed by the Engineer. The following stipulations also apply:

1. Compost filter socks may be either fabricated on site or delivered to the site.
2. Trenching is not required. Compost filter socks shall be placed over the top of ground, wooden stakes shall be driven through the center of the filter socks to anchor them to the ground. To ensure optimum performance, heavy vegetation shall be cut down or removed, and extremely uneven surfaces shall be graded to ensure that the compost filter sock uniformly contacts the ground surface.
3. Filter socks shall be placed in a continuous line. Where ends intersect they shall be sleeved to create an interlock with a two (2) foot overlap. After one section is filled and the ends tied off, the next section shall be pulled over the tied off end of the previous section, to create a 2 foot overlap. The overlap shall be staked. The intersecting overlaps shall be constructed to ensure that stormwater does not break through at these intersection points.

b. Removal. This work, if required, shall include the removal of the compost filter sock and stakes. Unless biodegradable, the mesh filter sock material shall be cut open and the mesh removed. In general, the compost filter material may be left in place, however the material will be raked out leveled to surrounding grades, then seeded. Prior to such removal, however, all silt, mud and debris entrapped outside of the compost filter sock shall be removed and the area cleaned up in accordance with the applicable provisions of **Section 212** of these Specifications. Immediately upon removal of the compost filter socks the remaining exposed areas will be finished as specified in **Para. b of Subsection 206.03.1**.

206.04 METHOD OF MEASUREMENT.

206.04.1 Baled Hay Erosion Checks. "Baled Hay Erosion Checks" will be measured by the number of linear feet actually installed in accordance with the Plans and/or as directed by the Engineer.

a. Removal. If required by the Contract, "Removal of Baled Hay Erosion Checks" will be measured by the number of linear feet actually removed in accordance with the Plans and/or as directed by the Engineer.

206.04.2 Silt Fence. "Silt Fence" erosion checks will be measured by the number of linear feet actually installed in accordance with the Plans and/or as directed by the Engineer.

206.04.3 Baled Hay Erosion Check and Silt Fence Combined. “Baled Hay Erosion Check and Silt Fence Combined” will be measured by the number of linear feet of combined baled hay erosion check and silt fence actually installed in accordance with the Plans and/or as directed by the Engineer.

206.04.4 Compost Filter Sock. “Compost Filter Sock ”of the various sizes as indicated on the plans will be measured by the number of linear feet of continuous runs of such compost filter sock actually installed in accordance with the Plans and/or as directed by the Engineer.

206.05 BASIS OF PAYMENT.

206.05.1 Baled Hay Erosion Checks. The accepted quantity of "Baled Hay Erosion Checks" will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment including excavation, haybales, stakes, removal of stakes, and all other incidentals required to finish the work, complete and accepted by the Engineer.

a. Removal. If required by the Contract, the accepted quantity of "Removal of Baled Hay Erosion Checks" will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment including, removal of hay, grading, raking, and seeding necessary to match the surrounding area, and all other incidentals required to finish the work complete and accepted by the Engineer.

206.05.2 Silt Fence. The accepted quantity of "Silt Fence" erosion checks will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment including excavation, filter fabric, industrial netting, posts, removal of fence, grading, raking and seeding necessary to match the surrounding area, and all other incidentals required to finish the work complete and accepted by the Engineer.

206.05.3 Baled Hay Erosion Check and Silt Fence Combined. The accepted quantity of “Baled Hay Erosion Check and Silt Fence Combined” will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including excavation; filter fabric, baled hay or straw, stakes, industrial netting, posts, removal of baled hay or straw, removal of fence, removal and disposal of entrapped material, backfill material, grading, raking and seeding as necessary to match the surrounding area, and all other incidentals required to finish the work complete and accepted by the Engineer.

206.05.4 Compost Filter Sock. The accepted quantity of “compost filter sock” will be paid for at the contract unit prices per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including mesh filter socks, removal of mesh filter socks, compost filter material, stakes, removal of stakes, removal and disposal of entrapped material, grading, raking and seeding as necessary to match the surrounding area, and all other incidentals required to finish the work complete and accepted by the Engineer.

206.05.5 Cleaning and Maintenance. The cleaning and maintenance of Baled Hay Erosion Checks, Silt Fence Erosion Checks, Baled Hay Erosion Check and Silt Fence Combined and Compost Filter Socks will be paid for under the provisions of **SECTION 212; MAINTENANCE AND CLEANING OF EROSION AND POLLUTION CONTROLS.**

Revise **Section 207, Check Dams**, pages 2-40 through 2-43 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 207

CHECK DAMS

- **Add the following Subsection 207.01.5.**

207.01.5 Compost Filter Sock Ditch and Swale Erosion Checks. Compost filter sock ditch and swale erosion checks shall consist of a flexible mesh tube filled with composted material and staked to the ground with wooden stakes, and constructed as indicated on the plans.

- **Add the following Subsection 207.02.5.**

207.02.05 Compost Filter Sock Ditch and Swale Erosion Checks. Compost filter sock material shall be in accordance with AASHTO Designation: MP 9-06 (2007 or latest revision). Compost filter material shall be in accordance with AASHTO Designation: MP 9-06 (2007 or latest revision). Compost material shall also meet all applicable Federal and State Regulations. For compost filter socks 18 inches or less in diameter, wooden stakes shall be 1 inch by 1 inch, and of a length that shall project into the soil 1 foot leaving 3 inches to 4 inches protruding above the filter sock. For compost filter socks greater than 18 inches in diameter wooden stakes shall be 2 inch by 2 inch and of a length that shall project into the soil 1 foot leaving 3 inches to 4 inches protruding above the filter sock. Stakes shall be placed at the ends and at 5 foot intervals, on center.

- **Add the following Subsection 207.03.5.**

207.03.5 Compost Filter Sock Ditch and Swale Erosion Checks.

a. Installation. Compost Filter sock ditch and swale erosion checks shall be constructed at the locations, and in accordance with the details indicated on the plans, or as directed by the Engineer. The following stipulations also apply:

1. Compost filter sock ditch and swale erosion checks may be either fabricated on site or delivered to the site.

2. Trenching is not required. Compost filter sock ditch and swale erosion checks shall be placed over the top of ground, wooden stakes shall be driven through the center of the filter socks to anchor them to the ground. To ensure optimum performance, heavy vegetation shall be cut down or removed, and extremely uneven surfaces should be graded to ensure that the compost filter sock uniformly contacts the ground surface. These may be placed over the top of rolled erosion controls mats or turf re-enforcement mats. These may also be stacked if additional height is needed.

3. Compost filter sock ditch and swale erosion checks shall be installed perpendicular to flow. This erosion check shall extend to such a length that the bottoms of each end are higher in elevation than the lowest middle part or the top of the banks (maximum flow line) are reached.

b. Removal. This work, if required, shall include the removal of the compost filter sock and stakes. Unless biodegradable, the mesh filter sock material shall be cut open and the mesh removed. In general, the compost filter material may be left in place, however the material shall be raked out leveled to surrounding grades, then seeded. Prior to such removal, however, all silt, mud and debris entrapped by the compost filter sock shall be removed and the area cleaned up in accordance with the applicable provisions of **SECTION 212** of these Specifications. Immediately upon removal of the compost filter socks the remaining exposed areas will be finished as specified in **Para. b of Subsection 206.03.1**.

- **Add the following Subsection 207.04.5.**

207.04.5 Compost Filter Sock Ditch and Swale Erosion Checks. “Compost Filter Sock Ditch and Swale Erosion Checks” of the various sizes as indicated on the plans will be measured by the number of linear feet of continuous runs of such compost filter sock actually installed in accordance with the Plans and/or as directed by the Engineer.

- **Add the following Subsection 207.05.5.**

207.05.5 Compost Filter Sock Ditch and Swale Erosion Checks. The accepted quantity of “Compost Filter Sock Ditch and Swale Erosion Checks” will be paid for at the contract unit prices per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including mesh filter socks, removal of mesh filter socks, compost filter material, stakes, removal of stakes, removal and disposal of entrapped material, backfill material, grading, raking and seeding as necessary to match the surrounding area, and all other incidentals required to finish the work complete and accepted by the Engineer.

- **Add the following Subsection 207.05.6.**

207.05.6 Cleaning and Maintenance. The cleaning and maintenance of Baled Hay Ditch and Swale Erosion Checks, Log and Hay Check Dams, Sand Bag Erosion Checks, Stone Check Dams and Compost Filter Sock Ditch and Erosion checks will be paid for under the provisions of **SECTION 212; MAINTENANCE AND CLEANING OF EROSION AND POLLUTION CONTROLS.**

Revise **Section 212, Maintenance and Cleaning of Erosion and Pollution Controls**, pages 2-51 to 2-55 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 212

MAINTENANCE AND CLEANING OF EROSION AND POLLUTION CONTROLS

- **Add the following to Subsection 212.01.1, Applicable Controls, subpart a .**

- a. **Perimeter Controls.**

- 3. Compost filter sock Subsection 206.01.4

- **Add the following to Subsection 212.01.1, Applicable Controls, subpart b.**

- b. **Check Dams.**

- 5. Compost Filter Sock Ditch and Swale Subsection 207.01.5
Erosion Checks

- **Replace paragraph (b) of Subsection 212.01.2 with the following.**

- b. **Maintenance.** Maintenance consists of the restoration and repair of damage sustained by erosion and pollution controls from “normal” rainfall events (Abnormal weather events are defined in **Subsection 212.03.4; Failure of Erosion and Pollution Controls**).

- **Replace the third paragraph of Subsection 212.03 with the following.**

- Erosion and pollution controls shall be routinely inspected by the Engineer. The Engineer shall immediately notify and direct the Contractor to take corrective action and make all necessary repairs whenever maintenance of the erosion and pollution controls is required. The Contractor shall commence with the requisite cleaning and maintenance measures no later than the next consecutive calendar day after receiving such a directive from the Engineer, and shall aggressively and expeditiously perform such cleaning and maintenance work until the original problem is remedied to the complete satisfaction of the Engineer. In the event of a holiday or weekend storm event, the Contractor must have resources available to restore and, if necessary, to replace any damaged erosion controls.

[Remainder of Subsection is unchanged]

- **Add the following to Subsection 212.03.1, Threshold for Cleaning Erosion Controls, subpart a.**

a. Perimeter Controls	Height
3. Compost filter sock	½ the compost filter sock height

- **Add the following to Subsection 212.03.1, Threshold for Cleaning Erosion Controls, subpart b.**

b. Check Dams	Height
5. Compost filter sock	½ the compost filter sock height

- **Replace Subsections 212.04 and 212.05 with the following.**

212.04 METHOD OF MEASUREMENT. “Maintenance and Cleaning of Erosion and Pollution Controls” as specified in this Section will not be measured by a single unit of measurement usually associated with a specific Proposal item. Rather, this work will be documented and paid for on a Force Account basis as set forth in **Subsection 212.05**.

212.05 BASIS OF PAYMENT. The “Maintenance and Cleaning of Erosion and Pollution Controls” will be paid for on a Force Account basis as set forth in **Subsection 109.04; Differing Site Conditions, Changes, Extra Work and Force Account Work; Para. a(4)** of these Specifications.

The estimated total amount established by the Department and indicated for this item in the Schedule of Prices in the Proposal is the amount from which said Force Account payments will be drawn.

Revise **Part 300, Aggregate and Gravel Base and Subbase Courses**, pages 3-1 through 3-5 of the RI Standard Specifications for Road and Bridge Construction as follows.

PART 300

AGGREGATE AND GRAVEL BASE AND SUBBASE COURSES

- **Replace Subsection 301.02; Materials in its entirety with the following.**

301.02 MATERIALS. The following materials shall conform to the applicable requirements of the indicated Subsections of **SECTION M; MATERIALS:**

- a. Gravel Borrow; Subsection M.01.09, Table I, Column I.**
- b. Crushed Stone or Gravel; Subsection M.01.09, Table I, Column II.**
- c. Fillers; Subsection M.01.08, Fine Aggregate.**

All materials shall conform to all applicable specification requirements prior to final placement on the project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

- **Add the following paragraph to Subsection 301.03.2; Shaping and Compaction.**

Field moisture content for Gravel Borrow shall be adjusted, if necessary, to be no greater than two percent (+2%) above the optimum moisture content.

[Remainder of Subsection is unchanged]

- **Replace Subsection 302.02; Materials in its entirety with the following.**

302.02 MATERIALS. Gravel Borrow shall meet the requirements of **Subsection M.01.09; Gradation of Aggregates, Table I, Column I** prior to its final placement on the Project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

- **Replace the fourth paragraph of Subsection 303.02; Materials with the following.**

303.02 MATERIALS.

The composite coarse and fine aggregate mix shall conform to the following gradation requirements as well as all other applicable specifications prior to its final placement on the Project:

Square Mesh Sieve Size:	Percentage by Weight Passing Indicated Square Mesh Sieve:
1½"	100
1"	85 - 100
½"	50 - 85
No. 4	40 - 75
No. 40	8 - 35
No. 200	2 - 10

[Remainder of this Subsection is unchanged]

- **Replace the fourth paragraph of Subsection 304.02; Materials with the following.**

304.02 MATERIALS.

The composite coarse and fine aggregate mix shall conform to the following gradation requirements as well as all other applicable specifications prior to its final placement on the Project:

Square Mesh Sieve Size:	Percentage by Weight Passing Indicated Sieve Size:
1½"	100
1"	70 - 100
¾"	50 - 85
⅜"	40 - 75
No. 4	30 - 55
No. 40	0 - 25
No. 200	0 - 8

[Remainder of this Subsection is unchanged]

Remove **Section 401; Dense Graded Bituminous Concrete Pavements**, pages 4-1 through 4-19 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 401

DENSE GRADED HOT MIX ASPHALT (HMA) PAVEMENTS

401.01 DESCRIPTION. This work consists of constructing HMA pavements on prepared foundations in conformity with the dimensions and details indicated on the Plans, and in accordance with these Specifications. These Specifications are applicable to all types of Dense Graded HMA pavements irrespective of aggregate gradation, grade of performance graded asphalt binder (PGAB), or pavement use.

The HMA shall be composed of a mixture of aggregate, PGAB, and filler if required. The aggregate shall be sized, graded and combined in such proportions that the resulting mixture meets the gradation requirements of the job mix formula (JMF).

401.02 MATERIALS.

401.02.1 Aggregates. Aggregates shall meet the applicable requirements of **Subsection M.03.02.2** of these Specifications and AASHTO M 323.

401.02.2 Performance Graded Asphalt Binder (PGAB). All grades shall conform to AASHTO M 320 and R 29. The PGAB shall meet the requirements of PG 64S-28 with the exception of both Class 19.0 and mixes designated as "Base Course" which shall incorporate PG 64S-22 for mixes with less than 15% RAP. Both Class 19.0 and "Base Course" mixes with 15 to 25 percent RAP shall incorporate PG 58S-28.

Should a class of HMA be designated as "Modified", the binder shall meet the requirements of PG 64E-28 and shall incorporate at least 2.0% SBS polymer. The nonrecoverable creep compliance versus percent recovery of the binder shall be plotted and must fall above the curve in Figure X1.1 in Appendix X1 of AASHTO M 332.

Should a class of HMA be designated as "with WMA" the Contractor shall use a WMA (Warm Mix Additive). WMA shall conform to Section 414 of these specifications.

Re-refined engine oil bottoms (REOB) shall not be used in any PGAB.

401.02.3 Mix Design. HMA mixes shall conform to AASHTO M 323, "Standard Specification for Superpave Volumetric Mix Design". The design procedure shall follow AASHTO R 35 "Standard Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA)". The optimum binder content (OBC) shall be determined as follows:

a) The OBC for Class 4.75, Class 9.5, and Class 12.5 when not designated as "Base Course" shall be determined using PG 64S-28.

b) The OBC for Class 4.75, Class 9.5, and Class 12.5 when designated as “Base Course” with less than 15 percent RAP shall be determined using PG 64S-22.

c) The OBC for Class 4.75, Class 9.5, and Class 12.5 when designated as “Base Course” with 15 to 25 percent RAP shall be determined using PG 58S-28.

d) The OBC for Class 19.0 with less than 15 percent RAP shall be determined using PG 64S-22.

e) The OBC for Class 19.0 with 15 to 25 percent RAP shall be determined using PG 58S-28.

The effective voids in the mineral aggregate ($VMA_{\text{effective}}$) and a volumetric phase diagram shall be submitted for each asphalt content during the mix design process. Mix designs shall be developed and signed by an individual certified in “Superpave HMA Mix Design” by the Asphalt Institute. Mix Designs shall be submitted no later than two weeks prior to the date when production of the mixture is scheduled to begin and shall be accompanied by a copy of that individual’s certification. No mixture may be produced for State projects until the mix design is approved by the Engineer. Mix designs shall be submitted on forms provided by the Engineer.

The following specific requirements and exceptions to AASHTO M 323 shall apply.

a. The specific gravity, absorption and consensus properties of the aggregates shall be obtained from RIDOT’s most recent sampling and testing or from a laboratory accredited to perform AASHTO T 84 and T 85.

b. The implementation of the recommendations of Section 4.2 of AASHTO R 35 is required.

c. The mix shall be coarse graded as defined in Section 6.1.3 of AASHTO M 323.

d. The dust to binder ratio ($P_{0.075}/P_{be}$) shall be 0.5 – 1.0. The effective binder content shall be used to calculate this ratio.

e. In addition to the sieves listed in Table 3 of AASHTO M 323, the 0.600 mm, 0.300 mm and 0.150 mm sieves are required. The 50.0 mm and 37.5 mm sieves are not required.

f. Class 19.0 and mixes designated as “Base Course” shall be designed with a 0%, 10%, 15%, 20% or 25% RAP content. RAP shall not be used in any other mix.

g. N_{initial} shall be 6, N_{design} shall be 50 and N_{max} shall be 75 gyrations.

h. A moisture susceptibility test is not required.

i. The design VMA, VFA, air voids and minimum optimum binder content (OBC) shall meet the following criteria:

Table 1 – HMA Properties

Class of Mix	VMA (minimum)	VFA	Air Voids	Minimum OBC
4.75	17.5%	70% - 80%	4%	7.0
9.5	16.5%	70% - 80%	4%	6.0
12.5	15.5%	70% - 80%	4%	5.5
19.0	14.5%	70% - 80%	4%	5.0

The following procedures shall be adhered to for each mix design:

- Three aggregate trial blends shall be submitted for acceptance before beginning the mix design procedure.

The procedures for mix design submittals shall include:

- All trial mixture data and calculations determined per Section 9 of AASHTO R 35 shall be submitted on forms provided by the Engineer. The Engineer will determine which trial mixture shall be used for the mix design procedure.
- After the mix design is completed it shall be submitted to the Engineer for review and approval.
- The correction factors for each mix for each ignition furnace in the plant lab shall be provided.

The two gyratory cores (AASHTO T 308) and the theoretical maximum specific gravity sample (AASHTO T 209) at the optimum binder content shall be submitted to the Engineer.

Before beginning production of a new HMA mix, a successful plant trial batch shall be performed for that mix and the results forwarded on forms provided by the Engineer.

Should a change in sources of materials be made, a new mix design shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, the Contractor shall establish a new mix design and submit it to the Engineer for approval.

401.02.4 Quality Assurance.

- a. **Process Control.** The Contractor shall exercise process control over all production operations. This shall require the constant monitoring of equipment, materials, and production activity such as testing and analysis to ensure that the HMA meets all applicable requirements and is produced within the allowable tolerances.
- b. **Acceptance Testing.** Acceptance testing will be conducted by the Engineer.
 1. Gradation, Binder Content and Air Void Content

The gradation requirements in Table 2 apply to mixes with and without pay adjustments:

Table 2 – Gradation Requirements

	Class 19.0	Class 12.5	Class 9.5	Class 4.75
25.0mm (1")	100%	100%	100%	100%
19.0mm (3/4")	90% - 100%	100%	100%	100%
12.5mm (1/2")	90% max	90% - 100%	100%	100%
9.5mm (3/8")	-	90% max	90% - 100%	95% - 100%
4.75mm (#4)	-	-	90% max	85% - 100%
2.36mm (#8)	± 5% from design	± 5% from design	± 5% from design	-
1.18mm (#16)	-	-	-	±5% from design
0.075mm (#200)	≥2%	≥2%	≥2%	≥2%
Control Sieve	2.36mm (#8)	2.36mm (#8)	2.36mm (#8)	1.18mm (#16)

During production of a specific mix, if two consecutive tests do not meet the gradation requirements of Table 2 or one test exceeds double the tolerance on the control sieve, the plant shall cease production of that HMA mix. Production will be allowed to resume after the Contractor completes a successful trial batch for that class of mix, as approved by the Engineer.

The plant shutdown criteria in Table 3 shall apply for binder content and air voids that exceed the following tolerances:

Table 3 – Plant Shutdown Criteria

Pay Adjustments	Shutdown Criteria	One Test	Two Consecutive Tests
With Pay Adjustments	Optimum Binder Content	±0.6%	-
	Design Air Voids	±2.0%	-
Without Pay Adjustments	Optimum Binder Content	±0.6%	±0.4%
	Design Air Voids	±2.0%	±1.0%

Production will be allowed to resume after the Contractor completes a successful trial batch for that class of mix, as approved by the Engineer.

2. Mix Production – Lots and Sublots.

A standard subplot is 600 tons for HMA sampled at the plant for each production run. A standard lot for each mix is ten sublots. A sample will be randomly selected and tested for each subplot. At least five sublots will be used when calculating pay adjustments.

If the quantity of HMA needed to finish a production run is projected by the Contractor to be less than the standard subplot size of 600 tons, the projected tonnage may be used to select a random sample. If the projected tonnage is not produced or a random sample is unable to be taken, the Engineer may select a sample at the end of the run or at the paver. If no sample is taken, the tonnage will be added to the previous subplot.

Additional samples may be taken at the discretion of the Engineer.

Gyratory cores and theoretical maximum density samples will be retained by the Engineer for two weeks after the results are reported to the Contractor.

3. Adjustments to Lots.

If less than five sublots are tested after the end of the final standard lot, they will be added to that lot. Five or more sublots tested after the end of the final standard lot will constitute a separate lot.

4. Plant Pay Adjustments.

(a) If a class of HMA is designated with “Pay Adjustments”, the pay adjustments for deviation from the optimum binder content (established by the mix design) in Table 4 and the design air void content in Table 5 will apply:

Table 4 – OBC Pay Adjustments

Deviation from Optimum Binder Content	Pay Adjustment
Less than or equal to 0.1 %	+2%
0.2%	+1%
0.3%	0%
0.4%	-5%
0.5%	-15%
0.6%	-30%
0.7%	-40%
Greater than 0.7 %	-50% or Remove and Replace*

Table 5 – Air Void Pay Adjustments

Deviation from Design Air Void Content	Pay Adjustment
Less than or equal to 0.5%	+1%
0.6% to 1.0%	0%
1.1% to 1.5%	-5%
1.6% to 2.0%	-10%
2.1% to 2.5%	-30%
2.6% to 3.0%	-40%
Greater than 3.0%	-50% or Remove and Replace*

* The decision to make 50% payment or Remove and Replace will be made by the Engineer

Note: All deviation values will be rounded to the nearest 0.1% before applying pay adjustments.

(b) Calculation of Pay Adjustments for Production Binder and Air Void Content.

For each test, absolute deviations will be used when determining binder and air void content pay adjustments. Absolute deviations are the values of deviation regardless of sign (\pm).

The average of the absolute deviations from the optimum binder content of all of the sublots in each lot will be used to determine the appropriate pay adjustments for the lots. The same will apply for air void content. No payment will be made for any pavement that is removed.

All other tolerances shall conform to the RI Standard Specifications.

c. Independent Assurance Testing. This testing will be performed by the Department in accordance with the Rhode Island Department of Transportation publication entitled "Schedule for Sampling, Testing and Certification of Materials."

401.03 CONSTRUCTION METHODS.

401.03.1 HMA Mixing Plant. Mixing plants shall be of sufficient capacity and coordinated to adequately handle the proposed production of HMA. The storage yard shall be maintained neat and orderly and the separate stockpiles shall be readily accessible for sampling.

a. Requirements for All Plants.

1. Equipment for Preparation of PGAB. Tanks provided for the storage of PGAB shall be equipped to heat and hold the material at the required temperatures. The heating shall be accomplished by steam coils, electricity, or other approved means such that no flame shall be in contact with the tank. The circulating system for the PGAB shall be designed to assure proper and continuous circulation during the operating period. Provision shall be made for measuring storage tanks. An adequate sampling valve shall be provided to ensure the safe and proper sampling of the PGAB.

2. Cold Feed Bins. The plant shall include no fewer than three (3) storage bins of sufficient capacity to supply the mixer when it is operating at full capacity. Bins shall be arranged to assure separate and adequate storage of appropriate fractions of the mineral aggregates without contaminations. They shall also be so constructed that samples can be readily obtained. Separate dry storage shall be provided for filler or hydrated lime when used and the plant shall be equipped to feed such material into the mixer.

3. Cold Aggregate Feeder. The plant shall be provided with accurate mechanical means for uniformly feeding the aggregate into the drier so that uniform production and temperature will be obtained.

4. Drier. The plant shall include a drier or driers which continuously agitate the aggregate during the heating and drying process.

5. PGAB Control Unit. Satisfactory means, either by weighing or metering, shall be provided to obtain the proper amount of PGAB in the mix within the tolerance specified. Means shall be provided for checking the quantity or rate of flow of PGAB into the mixer.

6. Thermometric Equipment. An armored thermometer of adequate range in temperature reading shall be fixed in the PGAB feed line at a suitable location near the charging valve at the mixer unit.

The plant shall also be equipped with either an approved dial-scale, mercury-actuated thermometer, an electric pyrometer, or other approved thermometric instrument so placed at the discharge chute of the drier as to register automatically the temperature of the exiting material.

The Engineer may require replacement of any malfunctioning or inconsistent thermometer by an approved temperature sensing and recording apparatus for better regulation of the temperature of the material.

7. Dust Collector. The plant shall be equipped with a dust collector constructed to waste or return uniformly all or any part of the material collected as directed.

8. Truck Scales. When required, the HMA shall be weighed on approved scales furnished by the Contractor or on public scales at the Contractor's expense. Such scales shall be tested at least every 60 days or whenever the Engineer deems necessary to assure their accuracy.

9. Scales. Scales shall be so located as to be easily readable from the operator's normal work station; otherwise a remote readout shall be supplied.

All plant scales, including truck scales, shall be certified at the expense of the Contractor by a competent and experienced scales technician as follows:

- (a) Annually prior to use in State work.
- (b) At intervals of not more than 60 calendar days.
- (c) At any time ordered by the Engineer.

10. Safety Requirements. Adequate and safe access to sampling points shall be provided. Guarded ladders to other plant units shall be placed at all points where accessibility to plant operations is required. Accessibility to the top of truck bodies shall be provided by a platform or other suitable device, placed in an acceptable location near the testing laboratory, to enable the Engineer to obtain samples and mixture temperature data. All gears, pulleys, chains, sprockets, and other dangerous moving parts shall be thoroughly guarded and protected. A clear, clean and unobstructed passage shall be maintained at all times in and around the truck loading area.

11. HMA Holding Bin. HMA may be stored in surge and storage systems designed for that purpose. Each surge and storage system must meet the requirements of AASHTO M156, unless otherwise permitted by the Engineer, and may be inspected by the Department to determine acceptance at specific holding times.

Acceptance shall be based upon the ability of the holding bin to hold and discharge mixtures within the quality criteria specified by the mix design and these Specifications.

b. Requirements for Batching Plants.

1. Automatic Proportioning. The plant shall be equipped with automatic proportioning devices. Such devices shall include equipment for accurately proportioning the various components of the mixture by weight in the proper sequence. PGAB and aggregates shall be proportioned by weight. Additives, if required, may be proportioned by volume or weight. The plant shall be equipped to automatically control the sequence and timing of mixing operations. There shall be auxiliary interlock cutoff circuits to interrupt and stop the automatic cycling of the batching operations at any time an error in weighing occurs, when an aggregate bin becomes empty, or when there is a malfunction of any portion of the control system.

2. Recording Equipment. The plant shall be equipped with a digital recorder which will automatically print the following data on delivery tickets:

- (a) Batch weights of each size aggregate. Weights printed may be individual or cumulative.
- (b) Total weight of aggregates in batch. The weight printed for the last aggregate batched shall be the total weight of aggregates in the batch when cumulative weights are used.
- (c) Weight of PGAB in batch.
- (d) Weight of total batch.
- (e) Total weight of batches in truck.
- (f) Total weight of PGAB in all batches in truck.
- (g) Date mixed.
- (h) The time each batch or load began or the time each was completed.

When silos are utilized, the requirements for delivery tickets shall conform to **Para. c; Requirements for Drum Dryer Mixing Plants**, of this Subsection. In addition, automated batch plant printout tickets generated in accordance with **Para. b** of this Subsection shall be given to the plant inspector and maintained on file.

There shall be sufficient copies of delivery tickets to provide a copy for the plant inspector and a copy for the Resident Engineer for permanent project record. The following information shall also be included on delivery slips:

- (i) Name of customer.
- (j) Name of project and contract number.
- (k) Name of driver and truck number.
- (l) Class of HMA.

(m) Additives.

3. Equipment Failure. If at any time the automatic proportioning or recording devices become inoperable, the plant may be allowed to batch and mix HMA for a period of not more than 48 hours from the time of the breakdown, if approved by the Engineer. Written permission of the Engineer will be required for periods of operation without automatic proportioning facilities longer than 48 hours.

4. Screens. Plant screens, capable of screening all aggregates to the specified sizes and proportions and having normal capacities in excess of the full capacity of the mixer, shall be provided.

5. Hot Aggregate Bins. Hot bin storage of sufficient capacity to ensure uniform and continuous operation shall be provided. The bins shall be arranged to ensure separate and adequate storage of appropriate fractions of the aggregate. Each bin shall be provided with overflow pipes, of such size and at such locations as to prevent backing up of material into other compartments or bins. Each bin shall be provided with its individual outlet gate, constructed so that when closed there shall be no leakage. The gates shall cut off quickly and completely. Bins shall be equipped with adequate tell-tale devices to indicate the position of the aggregates in the bins at the lower quarter points. Adequate and convenient facilities shall be provided for obtaining aggregate samples from each hot bin.

6. Aggregate Scales. Scales for any weigh box or hopper shall be of the springless dial type, having a full complement of index pointers and shall be of a standard make and design. They shall be accurate to 0.50 percent, have minimum graduations not greater than 0.50 percent and shall be readable and sensitive to 0.25 percent or less. The preceding percentages are based on total batch weight.

7. Batching Controls. Batching controls shall be electrically interlocked with the scales to prevent cycling or recycling of batching until scales tare zero.

The batching controls shall meet the following tolerances with respect to the various components weighed in each batch:

Combined Aggregate Components:	±1.5 percent of total batch weight
PGAB:	±0.1 percent of total batch weight

The total weight of the batch shall not vary more than plus or minus 2 percent from the theoretical design weight.

8. Time Locking Device. The mixer shall have an accurate time locking device to control the operation of a complete mixing cycle by locking the weigh box gate, after charging the mixer, until the closing of the mixer discharge gate at the completion of the cycle. It shall lock the PGAB feed throughout the dry mixing period and shall lock the mixer discharge gate throughout the dry and wet mixing periods. The dry mixing period is defined as the interval of time between the opening of the weigh box gate and the commencement of application of the PGAB. The wet mixing period is the interval of time between the commencement of application of the PGAB and the opening of the mixer discharge gate.

The control of the timing shall be flexible and capable of being set at intervals of not more than five seconds throughout the cycles up to three minutes. Changes in mixing time shall be made only when ordered by the Engineer.

9. Weigh Box or Hopper. The equipment shall include a means for accurately weighing each size of aggregate in a weigh box or hopper suspended on scales and of ample size to hold a full batch without hand raking or running over. The gate shall close tightly so that no material is allowed to leak into the mixer while a batch is being weighed.

10. PGAB Control. The equipment used to measure the PGAB shall be accurate to plus or minus 0.5 percent. The PGAB bucket shall be a non-tilting type with a loose sheet metal cover. The length of the discharge opening trough, bucket or spray bar shall be not less than three-fourths the length of the mixer and it shall discharge directly into the mixer. The PGAB bucket, its discharge valve or valves and spray bar shall be adequately heated. Steam jackets, if used, shall be efficiently drained and all connections shall be so constructed that they will not interfere with the efficient operation of the PGAB scales. The capacity of the PGAB bucket shall be at least 15 percent in excess of the weight of PGAB required in any batch. The plant shall have an adequately heated quick-acting, non-drip, charging valve located directly over the PGAB bucket.

The indicator dial shall have a capacity of at least 15 percent in excess of the quantity of PGAB used in a batch. The controls shall be constructed so that they may be locked at any dial setting and will automatically reset to that reading after the addition of PGAB to each batch. The dial shall be in full view of the mixer operator. The flow of PGAB shall be automatically controlled so that it will begin when the dry mixing period is over. All of the PGAB required for one batch shall be discharged in not more than 15 seconds after the flow has started. The size and spacing of the spray bar openings, trough or PGAB bucket shall provide a uniform application of PGAB the full length of the mixer. The section of the PGAB line between the charging valve and the spray bar shall be provided with a valve and outlet for checking the meter when a metering device is substituted for a PGAB bucket.

11. Mixer. The batch mixer shall be capable of producing a uniform mixture within the job mix tolerances. If not enclosed, the mixer box shall be equipped with a dust hood to prevent loss of dust.

The clearance of blades from all fixed and moving parts shall not exceed one inch unless the maximum diameter of the aggregate in the mix exceeds 1¼-inches, in which case the clearance shall not exceed 1½-inches.

12. Access to the mixer platform shall be by adequate and safe stairways. A hoist or pulley system shall be provided to raise scale calibration equipment, sampling equipment, and other similar equipment from the ground to the mixer platform and return. There shall be adequate and unobstructed space on the mixer platform.

c. Requirements for Drum Dryer Mixing Plants.

1. Proportioning. Aggregates and PGAB shall be proportioned by dry weight of the aggregate. Additives, if required, may be proportioned by volume or weight. The cold aggregate feeder shall be synchronized with the PGAB delivery system. Satisfactory means shall be provided to ensure positive

interlocking control between each cold bin, the cold aggregate feeder, and the PGAB delivery system. This interlocking control shall be such that production is interrupted if one or more cold bins becomes empty, or the flow of either aggregate or PGAB is obstructed.

2. Recording Equipment. The plant shall be equipped with a digital recording device approved by the Engineer by which the proportion of aggregate supplied by each cold bin, the flow rates by weight of dry aggregate and of PGAB, and the cumulative weights of dry aggregate and of PGAB incorporated in the mix are automatically printed. These printed records, showing the date and time of printing, shall be provided to the Engineer at the start and at the end of each production period and at any other times or intervals of time as requested.

The plant shall also have a computerized scale system consisting of a weight batcher and/or a truck scale. Delivery tickets shall be printed on an automatic digital recorder which will print the following information on delivery tickets:

(a) Date loaded.

(b) Net weight of mixture in truck. When a truck scale is used the net weight of the mixture shall be automatically calculated by weighing the truck both empty and full.

(c) Time of each load.

There shall be sufficient copies of delivery tickets to provide a copy for the plant inspector and a copy for the Resident Engineer for permanent project record. The following information shall also be included on delivery slips:

(a) Name of customer.

(b) Name of project and contract number.

(c) Truck identification and name of driver.

(d) Class of HMA.

(e) Additives.

3. Equipment Failure. If at any time the automatic recording device or the computerized scale system become inoperable, the plant may be allowed to produce HMA for a period of not more than 48 hours from the time of the breakdown, if approved by the Engineer. Approval will not be granted unless a satisfactory arrangement is made by the Contractor to weigh the mix. Written permission of the Engineer will be required for periods of operation longer than 48 hours during which any required automatic system is not functioning properly.

4. Aggregate Storage. Sufficient storage space shall be provided for each stockpile of various sized aggregates which shall be kept separated until they have been introduced into the cold bins that feed the drier. A minimum of four cold feed bins shall be required.

5. Cold Feed System. The plant shall have a device at each cold bin to feed the aggregate accurately and uniformly. No gravity type feeders will be permitted. Each adjustment opening shall be provided with indicators graduated to allow proportioning. Each cold bin gate shall be interlocked in such a manner that production is interrupted if one or more cold bins becomes empty or the flow is obstructed.

A mineral filler bin, when required, shall be added to the standard plant cold feed bins, and shall feed the mineral filler at adjustable rates accurately and uniformly. The feeder shall be interlocked so that production is interrupted if the bin becomes empty or the flow is obstructed.

The weighing equipment for all aggregates including mineral filler shall consist of a continuous weighing device either as it is proportioned by the individual feeders or after all materials have been deposited on a common belt. Belt scales shall meet the requirements of N.B.S. Handbook 44 and shall be installed according to the scale manufacturer's recommendations.

The plant shall have an adjustable feed rate control for each aggregate cold bin feeder and mineral filler feeder. The plant shall proportion the total aggregate quantity to the drum mixer with such accuracy and uniformity that the variation of material per interval of time shall not exceed an amount equal to 1.5 percent of the total weight of HMA per interval of time.

An automatic aggregate sampling device shall be provided which will divert a representative combined aggregate sample, including mineral filler, into a hopper or container for the purpose of gradation testing. The container shall cut the full width and depth of the aggregate flow. The sampling point shall be after the aggregate is proportioned and prior to its mixing with PGAB.

6. PGAB Control Unit. The PGAB shall be proportioned by a meter accurate to 0.1 percent. A flow switch designed to interrupt production if the PGAB flow is discontinued shall be installed in the delivery line between the meter and the mixer.

The PGAB delivery system shall be coupled with the aggregate delivery system to automatically maintain the required proportions as the aggregate flow varies. The delivery tolerance for PGAB shall be ± 0.2 percent of the total mixture weight.

7. Plant Calibration. The cold feed and PGAB delivery systems shall be calibrated to insure that the plant is operating within the allowable tolerances. A procedure acceptable to the Engineer and in accordance with the manufacturer's recommendations shall be followed. These calibrations shall be performed prior to the start of each paving season, and at any other time as directed by the Engineer.

8. Mixer Unit. The plant shall include a continuous mixer unit having an automatic burner control and capable of producing a uniform mixture within the job mix tolerances. The mixture shall be discharged into a HMA holding bin meeting the requirements of **Para. a.11** of this Subsection.

The moisture content of the mixture upon discharge from the mixer shall not exceed 1.5 percent by weight.

401.03.2 Hauling Equipment. Trucks or other equipment used for hauling HMA shall have tight, clean, smooth metal beds which have been thinly coated with an approved release agent. No diesel fuel or other material is to be applied to any portion of the vehicle that comes into contact with the HMA. Any hauling equipment not complying with these Specifications will be immediately rejected along with its load of HMA. Each truck shall have a cover of canvas or other suitable material of such size as to protect the mixture from the weather. Truck beds shall be securely covered and, if necessary, insulated to ensure delivery of the mixture at the specified temperature. Cleaning of equipment, vehicles, and truck beds in areas to be paved is prohibited. Any HMA placed in areas where cleaning takes place is subject to rejection by the Engineer.

a. Material Transfer Vehicle (MTV). A material transfer vehicle (MTV) is required for the construction of all HMA friction, surface, intermediate and base courses on all limited access highways. When friction course is used, both the friction course and the underlying layer must be placed using an MTV.

The MTV shall independently deliver HMA from the hauling equipment to the paving equipment. A paving hopper insert with a minimum capacity of 14 tons shall be installed in the hopper of conventional paving equipment when a MTV is used.

As a minimum, the MTV shall have a high capacity truck unloading system which will receive HMA from the hauling equipment; a storage system in the MTV with a minimum capacity of 15 tons of HMA, and a discharge conveyor with the ability to swivel to either side to deliver the mixture to the paver while allowing the MTV to operate from an adjacent lane. In addition, the paving operation must contain a remixing system to blend the mixture prior to placement. The speed of the paver and MTV shall be adjusted to coordinate with the availability of HMA. Failure to keep the MTV supplied with HMA may be cause to cease paving operations for that operation. However, more than 2 stoppages shall result in paving being ceased for that operation.

When an MTV is to be used on a project, the Contractor shall further investigate the possible movement of the fully or partially loaded MTV on the project. If there are any structures on the project that the fully or partially loaded MTV will traverse, the Contractor shall request an Overweight Permit Check from the Department. Such a request shall be made in writing, and shall include the axle configuration, weights, and the project limits. Operations shall not begin until this permission is received from the Department and one copy forwarded to the Engineer.

The following is a statewide list of limited access highways (included are travel lanes, auxiliary lanes, climbing lanes, acceleration and deceleration lanes, ramps, collector/distributor roads, service roads, and shoulders greater than 8 feet):

I-95	Connecticut State Line to Massachusetts State Line
I-195	I-95 to Massachusetts State Line
I-295	I-95 to Massachusetts State Line
US Route 1	Prosser Trail to Wakefield Cut-Off
RI Route 4	Route 1 to I-95

US Route 6	Route 102 to Route 101; Route 10 to I-295
RI Route 10	Park Avenue to Route 6
US Route 6/RI Route 10	Magnolia Street Bridge to I-95
RI Route 24	Route 114 to Massachusetts State Line
RI Route 37	Natick Avenue to Post Road
RI Route 78	Route 1 to Connecticut State Line
RI Route 99	Route 146 to Mendon Road
East Shore Expressway	I-195 to Wampanoag Trail
RI Route 114	East Shore Expressway to Forbes Street
RI Route 138	Route 1 to Admiral Kalbfus Road
RI Route 146	I-95 to Reservoir Road
RI Route 146	Route 146A to Massachusetts State Line
RI Route 403	Route 4 to Quonset Point
Airport Connector	I-95 to Post Road
Henderson Bridge Access Roadway	Waterman Street/So. Angell Street to Broadway

401.03.3 Pavers. Unless otherwise shown on the Plans, mixtures shall be spread by means of a mechanical self-powered paver capable of spreading the mixture true to line, grade and crown as approved by the Engineer.

HMA pavers shall be self-contained, power-propelled units, provided with activated vibratory screed and solid vibratory screed extenders and capable of spreading and finishing courses of plant mixed HMA in lane widths applicable to the specified typical section and thickness shown on the Plans. Pavers used for shoulders and similar construction shall be capable of spreading and finishing courses of HMA in the widths, depths and cross slopes indicated on the Plans.

When laying mixtures, the paver shall be capable of being operated at forward speeds consistent with satisfactory laying of the mixture.

The paver shall be equipped with a receiving hopper having sufficient capacity for a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed.

a. Screeding. The screed and screed extenders shall continually vibrate while placing the mixture and shall effectively produce a finished surface of the required evenness and texture without tearing, shoving or gouging the mixture. The screed shall be heated to maintain the HMA at the required placement temperature. Unless otherwise permitted by the Engineer, the screed extenders shall not extend more than two feet from the edge of the augers or auger extensions.

The paver shall be equipped with automatic screed controls with sensors for either or both sides of the paver, capable of sensing grade from an outside reference line, sensing the transverse slope of the screed and providing the automatic signals which operate the screed to maintain the desired grade and transverse slope. The sensor shall be capable of operating from a ski-type device or reference beam of not less than 25 feet in length. The sensor shall also have the capability of operating from a reference line unless the ski-type device or reference beam can ride on an adjacent, newly placed lift of HMA. A reference line shall also be used for the first course placed over in-place, recycled material.

Reference lines for the control of horizontal alignment shall be provided by the Contractor subject to the approval of the Engineer.

When a reference line is used for automatic grade control, the Contractor shall furnish and install all pins, brackets, tensioning devices, wire and accessories necessary for satisfactory operation of the automatic control equipment using a taut stringline set to grade for reference.

The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. The paver shall be equipped with automatic feeder controls, properly adjusted to maintain a uniform depth of materials ahead of the screed.

b. Manual Operation. Manual operation will be permitted in the construction of irregularly shaped and minor areas, on plant mixed seal courses, or where otherwise directed.

401.03.4 Conditioning of Existing Surfaces. Surfaces of curbs, gutters, vertical faces of existing pavements, and all structures to be in contact with the HMA shall be given a thin, even coating of tack coat. Care shall be taken to avoid the splattering of surfaces which will not be in contact with the HMA.

When a tack coat is required, the type and grade and the application methods shall conform to the applicable provisions of both **SECTION M.03; MATERIALS** and **SECTION 403; ASPHALT EMULSION TACK COAT**, of these Specifications.

401.03.5 Spreading and Finishing. The mixture shall be laid upon an approved cleaned surface, spread and struck off to the grade and elevation established. HMA pavers shall be used to distribute the mixture either over the entire width or over such partial width as may be practicable.

The practices and guidelines for placing HMA as outlined in Asphalt Institute Publication MS-22, "Construction of Hot Mix Asphalt Pavements" shall be adhered to unless otherwise permitted by the Engineer.

Unnecessary walking on the uncompacted HMA mat shall not be allowed.

Before beginning a new lane, the screed shall be heated to the proper operating temperature and any clumps of cold material in the paver hopper shall be removed.

No trucks or other equipment shall be allowed on freshly placed HMA unless specifically permitted by the Engineer.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impracticable, the mixture shall be placed as close to its final position as possible. It shall then be spread, raked, and luted by hand tools in a manner which will minimize segregation and result in the required compacted thickness.

Unless otherwise directed by the Engineer, any layer of HMA called for on side streets or driveways must be placed to a distance of at least three feet beyond the gutter line at the same time that layer is being placed on the adjacent project roadway.

a. HMA Designated for “Bridge Decks”. When HMA is being placed on a surface which is covered with a waterproofing membrane, the following precautions shall be observed:

1. No traffic other than paving equipment shall be allowed on the membrane.
2. The paver must be moved carefully on and off the membrane. Initial proper adjustment of the paver to the correct depth is very important to prevent tearing the membrane. The Contractor shall be responsible for making any repairs to the membrane or to the HMA overlay necessary to correct damage caused by the paving operation, all at its expense.
3. Any and all tears of the membrane by the paver or trucks shall be repaired immediately to the satisfaction of the Engineer. Vehicle tires shall be clean of any rocks or materials that would puncture the membrane.
4. Truck drivers shall not make quick stops and starts, nor turn the wheels while parked, nor cross the deck at an angle.

401.03.6 Compaction. Immediately after the HMA has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling.

The surface shall be rolled when the mixture is in the proper condition and when rolling does not cause undue displacement, cracking, and shoving.

Two rollers are required for all paving operations that exceed a daily total of 500 tons, except in the case of driveway, sidewalk and bridge deck paving operations. The number, weight and type of roller(s) shall be sufficient to compact the mixture to the required density before it reaches the minimum compaction temperature. Vibratory rollers used for compaction shall be operated in the vibratory mode. All rollers used for compaction shall have a minimum operating weight of ten tons or greater. The use of equipment which results in excessive crushing of the aggregate will not be permitted.

The speed of a roller shall not exceed five miles per hour.

Rollers shall not be parked on HMA. When reversing direction, the action shall be smooth, not abrupt. The drive wheel shall approach the new mix, not the tiller wheel.

When a vibratory roller is used for finish rolling, it shall be used in the static mode. Finish rolling shall continue until all roller marks are eliminated.

The motion of the rollers shall be slow enough at all times to avoid displacement of the hot mixture, and any displacement resulting from reversing the direction of the rollers, or from any other cause, shall be satisfactorily corrected. The wheels of steel-wheel rollers shall be kept moist and clean to prevent adhesion of the fresh material, but an excess of water will not be permitted.

If satisfactory density cannot be obtained in any lift, and if the Engineer determines it to be structurally inadequate and/or incapable of maintaining material integrity, the Contractor shall remove and replace any such area at its own expense.

Any mixture that becomes loose and broken, mixed with dirt, or is in any way defective shall be removed and replaced with fresh hot mixture, which shall then be compacted to conform to the surrounding area. Any area showing an excess or deficiency of PGAB shall be removed and replaced. Said removal and replacement shall be at the Contractor's expense.

For HMA not designated as with "Pay Adjustments" in-place density shall be a minimum of 92% of the theoretical maximum density obtained at the plant and will be determined using a nuclear density gauge or in-place cores.

If a class of HMA is designated as for "Bridge Decks", an oscillatory roller with a minimum operational weight of 8 tons shall be used. For HMA designated as for "Bridge Decks" and with "Pay Adjustments" the pay adjustments will only apply to binder content and air voids.

If a class of HMA is designated as for "Leveling" it shall be placed with a paver. A pneumatic roller with a minimum operational weight of 8 tons shall be used. For HMA designated as for "Leveling" and with "Pay Adjustments" the pay adjustments will only apply to binder content and air voids.

If a class of HMA is designated as for "Patching", "Miscellaneous Work" or "Paved Waterways" it shall be placed by hand. A vibratory plate compactor or roller shall be used. A hand tamper may be used only if requested, and such request is approved by the Engineer.

a) In-Place Density for classes of HMA designated as with "Pay Adjustments"

Compaction density will be measured using cores of in-place pavement. Cores not taken under the direction of and witnessed by the Engineer will not be used for acceptance. The location of all cores will be determined by the Engineer. Each lot and subplot for in-place density cores will be matched as near as practical to each production lot and subplot used at the plant.

All cores shall be extracted after completion of rolling operations and before the paved section is open to traffic. The Engineer will take immediate possession of the cores upon extraction. If the Contractor does not obtain cores before a subplot is open to traffic, no bonus (pay adjustment resulting in

more than 0%) will be paid for the subplot but disincentives will still apply. The cores will be retained by the Engineer for 4 weeks after the results are reported to the Contractor.

The Contractor may extract its own cores for QC purposes to monitor in-place density and production quality; such cores will not be used for acceptance.

1. Mat Density

Under the direction and witness by the Engineer, two stratified, randomly selected cores (4" +0"/-0.25" diameter) shall be extracted from the mat by the Contractor for each subplot greater than or equal to 450 tons. One core shall be taken for sublots less than 450 tons. The center of each core used to determine mat density will be at least one foot away from the edge of pavement and any transverse or longitudinal joints or drainage structures.

2. Joint Density

One joint density core shall be extracted for every 3000' or less when a joint is formed. Joint cores shall be extracted so that the center is within two inches of the middle of the sloped portion of a notched-wedge joint or within one inch of the middle of a butt joint.

3. In-Place Density Pay Adjustments

In-place density will be measured and reported as a percent of theoretical maximum density. The pay adjustments from Table 6 will be made for in-place mat density:

Table 6 – Mat Density Pay Adjustments

In-Place Mat Density	Pay Adjustment
95.0% and greater	+2%
94.0% to 94.9%	+1%
93.0% to 93.9%	0%
92.0% to 92.9%	-5%
91.0% to 91.9%	-15%
90.0% to 90.9%	-25%
89.0% to 89.9%	-35%
Below 89.0%	Remove and Replace

The pay adjustments from Table 7 will be made for in-place joint density:

Table 7– Joint Density Pay Adjustments

In-Place Joint Density	Pay Adjustment
93.0% and greater	+2%
92.0% to 92.9%	+1%
91.0% to 91.9%	0%
90.0% to 90.9%	-5%
89.0% to 89.9%	-15%
88.0% to 88.9%	-25%
87.0% to 87.9%	-35%
Below 87.0%	-100%

Note: All density values will be rounded to the nearest 0.1% before applying pay adjustments.

In the event material is required to be removed and replaced, the Engineer will determine the limits of the removal. The required in-place density will be 1% less for the first lift placed on gravel subbase.

4. Calculation of Pay Adjustments for In-Place Density

(i.) For Mat Density:

For each subplot, the bulk specific gravity (G_{mb}) of the mat density core(s) will be averaged and then compared to the corresponding plant theoretical maximum specific gravity (G_{mm}) to calculate the in-place density for each subplot. The average of the subplot densities in a lot will be used to determine the appropriate pay adjustment for that lot. Lot pay adjustments will be applied to the respective quantity of HMA in each lot.

(ii.) For Joint Density:

For joint density pay adjustment purposes, a joint lot will be defined as 10 joint density results. However, if less than five joint density results are remaining after the final full joint lot is formed, they will be added to the previous joint lot. Five or more joint density results remaining after the final full joint lot will constitute a separate joint lot.

Calculation of in-place joint density will be determined using the G_{mb} of joint density cores and the project average plant G_{mm} of the respective mix. The average of the individual joint density results in a joint lot will be used to determine the appropriate pay adjustment for that joint lot. The calculation of material quantity used to construct the joints will be based on the joint core density, the specified thickness, a width of one foot and the length of the joint that each core represents. This quantity will be deducted from the total tonnage.

401.03.7 Joints. Placement of the HMA shall be as continuous as possible. Rollers shall not pass over the unprotected end of a freshly laid mixture unless authorized by the Engineer.

Both longitudinal and transverse joints in successive courses shall be staggered so as not to be one above the other. Longitudinal joints shall be staggered a minimum of 6 inches and shall be arranged so that the longitudinal joint in the top course being constructed shall be at the location of the line dividing the traffic lanes. Any HMA that falls on the cold side of the mat during paving operations shall be raked onto the hot joint. Care shall be taken to ensure that the material pushed onto the hot side of the joint remains in the joint area and is not broadcast over the pavement.

Unless otherwise permitted by the Engineer, a notched wedge joint shall be used. Longitudinal drop-offs will not be allowed on both sides of a lane. Joints shall be constructed so that the height of the notch is the same as the nominal maximum aggregate size. The width of the sloped portion of the joint shall be at least 6" for each inch of lift thickness if the joint will be exposed to traffic, but in all cases it shall be 12" minimum. Tack coat shall be applied to and shall completely cover the longitudinal notched wedge joint, using either a brush or the tack coat distribution truck. Transverse joints and joints at intersections shall be manually brushed with tack coat, leaving a completely covered face.

401.03.8 Pavement Samples. As directed, the Contractor shall cut samples from the compacted pavement for testing by the Engineer. Samples of the mixture shall be taken for the full depth of the course at the locations directed by the Engineer.

Where samples have been taken, new material shall be placed and compacted to conform to the surrounding area.

401.03.9 Surface Tolerances. At the Engineer's discretion the surface may be tested at selected locations, using an approved 10-foot straightedge furnished by the Contractor. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall at no point exceed 1/4-inch. All humps or depressions exceeding the specified tolerance shall be corrected by removing defective work and replacing it with new material as directed.

401.03.10 Thickness Requirements. The thickness of a pavement shall be that as shown on the Plans and shall not vary from the specified thickness by more than that specified in **Subsection 401.04**, below, except as otherwise provided for in resurfacing existing pavements.

401.03.11 Weather Limitations. HMA shall not be placed on any wet surface, or when weather conditions otherwise prevent the proper handling or finishing of the HMA.

For lifts with a target compacted lift thickness less than or equal to 1.5" both the air and surface temperature in the shade shall be 45° F or greater. For lifts with a target compacted lift thickness greater than 1.5" both the air and surface temperature in the shade shall be 40° F or greater. If an approved WMA (warm mix additive) is used both the air and surface temperature in the shade shall be 35° F or greater regardless of lift thickness. No HMA shall be placed on frozen ground.

For projects that do not specify pay adjustments all rolling shall be completed before the temperature of the mat falls below 165° F. The HMA mat (not including WMA modified pavement) shall be at least 265° F when placed.

401.03.12 Cold Weather Paving. If the existing pavement is removed before the winter shutdown, the Contractor shall not close the project for the season until a new HMA layer has been placed and striped with temporary epoxy pavement markings.

401.03.13 Drop-Offs.

a. Longitudinal Drop-Offs. A longitudinal drop-off occurs along the outside edges of pavement and is the difference in elevation between the top of recently placed HMA pavement and the top of existing ground (or pavement).

1. For Posted Speeds of 35 mph or Less. Drop-offs greater than 3 inches but less than 5 inches shall be tapered to a maximum 1-to-1 slope to existing ground or pavement. Drop-offs 5 inches, or greater, shall be tapered to a maximum 4-to-1 horizontal to vertical slope to existing ground or pavement.

2. For Posted Speeds Greater than 35 mph. Longitudinal drop-offs will not be permitted within 2 feet of a travel lane. The first 2 feet adjacent to a travel lane must be at grade with the travel lane. However, should either the sequence of operation required by the Contract or the Contractor's

approved sequence of operation result in overnight drop-offs greater than 3 inches occurring between 2 and 6 feet from the edge of a travel lane, then such drop-offs shall be tapered to a 4-to-1 horizontal to vertical slope to existing ground or pavement.

All tapers shall be constructed with HMA conforming to the requirements of this **SECTION 401** of these Specifications.

Longitudinal drop-offs within the roadway cross section will not be allowed except as otherwise detailed on the Plans or as described in a Special Provision.

Longitudinal drop-offs will not be paid for separately, but will be included in the contract unit price for HMA pavements as listed in the Proposal.

b. Transverse Drop-Offs. Transverse drop-offs occur as follows:

Pavement removal. A transverse drop-off occurs when pavement removal operations cease at the end of a working day. The drop-off is the difference in elevation between the bottom of the excavated pavement and the top of the existing pavement.

Pavement overlay. A transverse drop-off occurs when pavement overlay operations cease at the end of a working day. The drop-off is the difference in elevation between the top of the overlay pavement and the top of the existing pavement.

If traffic is allowed across either of these drop-offs during the period prior to the resumption of pavement removal or pavement overlay operations, tapers must be provided as follows:

1. For Posted Speeds of 35 mph or Less. Transverse drop-offs in place at the end of a working day shall be graded at a slope of 2 feet horizontal to 1 inch vertical.

2. For Posted Speeds Greater than 35 mph. Transverse drop-offs in place at the end of a working day shall be graded at a slope of 5 feet horizontal to 1 inch vertical.

All slopes shall be constructed with HMA conforming to the requirements of **SECTION 401** of these Specifications.

The Contractor shall place “BUMP” signs in accordance with the MUTCD (Manual on Uniform Traffic Control Devices) at each drop-off for each direction of traffic.

Prior to the resumption of pavement overlay operations the transition slope shall be removed as follows: The pavement overlay shall be saw cut back approximately 6 inches to expose a fresh, full thickness vertical face. This face shall be brush-painted or pressure sprayed with tack coat, after which the HMA paving may resume.

Transverse drop-offs will not be paid for separately, but will be included in the contract unit prices for HMA pavements as listed in the Proposal.

401.04 METHOD OF MEASUREMENT.

401.04.1 Measurement of HMA Pavement. HMA Pavements will be measured by the number of tons actually placed in accordance with the Plans and/or as directed by the Engineer.

a. Determination of Thickness. The design thickness of each course as well as of the total HMA pavement structure shall be that indicated on the Plans, or as ordered by the Engineer.

Prior to the determination of placed thickness, the roadway shall exhibit acceptable workmanship and all defects shall have been corrected. The placed thickness of HMA pavement will be determined by cutting or coring holes to full depth. For courses with In-Place Density Cores specified, the average thickness of the Density Cores will be used to determine placed thickness.

For courses where In-Place Density Cores are not specified the following requirements apply: For projects with less than 1 paved lane mile, two cores will be taken. For projects with 1 to 2 paved lane miles, four cores will be taken. For projects with greater than 2 paved lane miles, two cores will be taken from each lane mile, except that there will be a minimum of ten cores for the project, all at the discretion of the Engineer.

Cores will be measured in accordance with ASTM D3549; Standard Test Method for Thickness or Height of Compacted HMA Paving Mixture Specimens. The depth measurement will be considered as applying for the full width of the lane. Measurements will be made at random locations determined by the Engineer and all information relative thereto will be recorded in the project records.

For the determination of thickness, a shoulder width of eight feet or greater will be considered to be a separate lane of the roadway. A shoulder width of less than eight feet will be considered part of the adjacent lane. The Contractor shall fill all holes cut or cored in the pavement with a compacted, dense HMA which is acceptable to the Engineer. If required by the Engineer, the Contractor shall maintain and control traffic while the pavement samples are being taken and while the holes are being filled and compacted. Payment will be made for the applicable traffic control item(s).

b. Adjustment of Tonnage Quantity.

The pavement thickness will be considered acceptable if both of the following requirements are met:

(a) The total HMA tonnage delivered and placed does not exceed the tonnage calculated from the approved area measured from the final surface course width by the project length and the pavement thickness specified in the Contract Documents by more than 5 percent.

and,

(b) When Specification Conformity Analysis (Federal Highway Administration Technical Advisory T5080.12; dated June 23, 1989) is applied to the entire roadway or sections thereof as determined by the Engineer, at least 80 percent of the total HMA pavement will have a thickness that

meets the minimum pavement thickness. The minimum pavement thickness is that contained in the contract documents minus ½-inch, (e.g., a total pavement thickness of 7 inches will have a minimum pavement thickness requirement of 6.5 inches).

If the first requirement is not met, no payment will be made for all tonnage exceeding 5 percent, unless unusual field conditions are present and documented (e.g., pavement rutting).

If the second requirement indicates that the pavement thickness is deficient, the Contractor with permission of the Engineer shall place a correction course not less than one inch in depth after compaction, provided an acceptable grade and cross section can be achieved. Where an acceptable grade and cross section cannot be achieved through the above means, the Contractor shall reconstruct by cutting back and into the pavement a sufficient distance to permit the placement of an acceptable depth and place new material to achieve the proper depth, cross section and profile. These areas where a corrective course is placed or reconstruction of the pavement is performed, will be measured again as though originally constructed; no compensation will be made to the Contractor for the material removed or removal of materials and disposal thereof or for restoration of affected supporting base or adjacent construction, or for traffic control, adjusting all utility appurtenances in the roadway or for correcting pavement striping. Compensation will be made for the additional pavement correction course accepted in place.

Determination of the quantity to be used for adjusted payment or exclusion for payment will be based on tons per square yard per inch thickness as determined using in-place density cores or 96% of the plant core (AASHTO T245) densities if in-place densities are not available.

Sweeping and cleaning, as included in the items covered by this section, refers to the normal removal of dust, debris, etc. only. Any sweeping and cleaning necessary due to construction being held over for the winter season, in accordance with the approved construction schedule, will be paid for separately.

Work described in **Subsection 401.03.4; Conditioning of Existing Surface**, will be paid for at the contract unit prices for the material used.

Tolerance Limitation. Pavement will be considered acceptable when meeting the specifications. Pavement that is not accepted will be excluded from the tolerance allowance. When delivery tickets are directly collected by the Engineer from each truck prior to placing in the hopper, the delivery tickets may be used in the determination of total tonnage delivered and placed. Delivery tickets not collected directly by the Engineer prior to placing in the hopper will not be used to determine tonnage.

When delivery tickets are not used to determine tonnage, the accepted total tonnage delivered and placed will be calculated according to the following formula: [final surface course width] x [project length] x [specified pavement thickness] x [the average unit weight of all acceptance density cores] = contract tonnage. If density cores are not required then 96% of the average unit weight of the plant produced acceptance gyratory cores shall be used.

Payment will be made at full contract unit bid prices with pay adjustments for all accepted HMA up to 105% of the contract quantity tonnage. Accepted HMA quantities above 105% and up to 110% of the contract quantity tonnage will be paid at 50% of the contract unit bid price with the resultant adjusted price further modified by additional pay adjustments as applicable according to the following formula:

Pay adjustments will apply to 50% of the contract unit bid price for quantities above 105% and up to 110%.

401.05 BASIS OF PAYMENT. The accepted quantity of the HMA will be paid for at its respective contract unit price per ton as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, and for all incidentals required to finish the work, complete and accepted by the Engineer.

Pay adjustments for binder content, air voids and in-place density will be added together to determine a final pay adjustment for both the mat and the joint. If more than one pay adjustment is negative then only the most negative adjustment will be added to the remaining non-negative adjustments to determine the final pay adjustment. Pay adjustments will be applied to the unit bid price for the applicable item code.

Remove **Subsection 402.03.2; Friction Courses – Production and Placement**, page 4-22 the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following:

SECTION 402

FRICION COURSES

402.03.2 Production and Placement. When placed on a newly reconstructed surface, the thickness shall be as shown on the Plans with a tolerance of $\pm\frac{1}{4}$ inch. When used to overlay an existing roadway, the thickness shall be minimum of 1 inch and a maximum of $1\frac{3}{4}$ inches to accommodate for rut depths of up to $\frac{3}{4}$ inch on the existing pavement.

The surface on which the friction course is to be placed shall be treated with a tack coat. Tack coat must be applied uniformly over the surface of the underlying pavement. The surface shall be broom cleaned before the application of tack coat.

Spreading of the mixture shall be performed carefully and the operation shall be as continuous as possible. Particular attention shall be given to the joints and any irregularities shall be removed before compacting.

After placement, the mixture shall be thoroughly and uniformly compacted with power rollers as directed by the Engineer. Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until all roller marks are eliminated, the surface is of uniform texture and true to grade and cross section.

The first pass with the specified roller shall be completed when the temperature of the layer is $240^{\circ}\text{F} \pm 20^{\circ}\text{F}$. At least three passes must be made at all locations on the mat. Each roller shall exert a minimum average force of 150 pounds per inch along the width of each drum. At least two of the rollers must have a minimum dry weight of eight tons each.

Excess concentrations of asphalt can be easily detected during paving operations. All "fat" areas shall be removed immediately. The wasted quantity, as determined by the Engineer, will be subtracted from the quantity shipped that day.

Remove **Section 403, Asphalt Emulsion Tack Coat**, pages 4-23 and 4-24 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 403

ASPHALT EMULSION TACK COAT

403.01 DESCRIPTION. This work consists of furnishing, delivering, and placing a liquid asphalt tack coat on bituminous concrete or Portland cement concrete, prior to the placement of a bituminous concrete overlay, all in accordance with these Specifications.

403.02 MATERIALS. The asphalt emulsion shall be RS-1.

403.03 CONSTRUCTION METHODS.

403.03.1 Equipment. Application of the asphalt emulsion tack coat shall be by means of a pressure distributor capable of producing a uniform continuous fine spray, through multiple nozzles, resulting in a uniform continuous coat of asphalt emulsion over the entire section to be treated. Any puddles of tack coat shall be squeegeed or broomed out or corrected by whatever means chosen by the Contractor which will achieve the required surface treatment. Any areas not receiving the specified coverage of tack coat shall be corrected and brought into compliance.

403.03.2 Application of Bituminous Material.

a. Application Rates. The asphalt emulsion shall be uniformly applied at the following rates over the entire existing surface to be overlaid:

1. Old Pavement. The application rate shall be 0.08 gallons per square yard, plus-or-minus 0.02 gallons per square yard.

2. New Pavement.

(a) For new pavements at least thirty days old or has been opened to traffic: The application rate shall be 0.06 gallons per square yard, plus-or-minus 0.02 gallons per square yard.

(b) For new pavements less than thirty days old which have not been opened to traffic tack coat is not required.

b. Nozzle Settings. Tack coat shall be applied using the proper nozzle settings and the “double coverage” or “triple coverage” techniques as outlined in Chapter 5 of Asphalt Institute Publication MS-22, “Construction of Hot Mix Asphalt Pavements.”

c. Additional Requirements. The newly placed tack coat shall be allowed to break and set prior to paving. This process is defined as the separation of the asphalt from the water from within the

emulsion which is signified by a change in color of the material from brown to black, the evaporation or removal of the resultant surface water and the adherence of the tack material to the underlying pavement.

NOTE: The Contractor will be required to wait for this process to complete for up to one hour. At the end of this specified period, if the tack coat has not fully transformed as defined herein (break and set), the Contractor may by his choice proceed to pave over the tacked area. Nevertheless, in any case the Contractor shall ensure that should any material be picked up by his equipment, that it be removed by whatever means, prior to its falling onto or affecting the newly placed pavement layer in any way. Special care shall be taken to eliminate or minimize equipment passage over tacked surfaces so as not to hinder or negate the tack's effectiveness in the pavement bonding process. Furthermore, attention shall be given to gore areas to ensure that asphalt emulsion is not sprayed or tracked onto precast gore markers. This shall be accomplished by placing a covering, to be anchored in place, to prevent any movement, over the gore markers. Additionally, the Contractor shall not proceed to pave over any tacked surface until approval from the Engineer is given. Sections not approved by the Engineer shall be corrected and subsequently receive the Engineer's approval prior to paving. Should there be multiple rejections of tack coat, the Engineer reserves the right to suspend paving and require the Contractor to submit a detailed action plan outlining those steps to be taken to ensure proper application of tack coat prior to the commencement of further paving operations.

403.04 METHOD OF MEASUREMENT. "Asphalt Emulsion Tack Coat" will be measured by the number of square yards actually spread in the designated area(s) and at the specified rate, all in accordance with the Plans and/or as directed by the Engineer.

403.05 BASIS OF PAYMENT. The accepted quantity of "Asphalt Emulsion Tack Coat" will be paid for at the contract unit price per square yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment, and all other incidentals required to finish the work, complete and accepted by the Engineer.

403.06 FAILURE TO COMPLY. Should the Contractor fail to comply with any portion of this provision, a penalty will be imposed for each tacked subsection not in compliance with these requirements. The penalty for a subsection will be five percent (5%) of the combined contract cost for asphalt and asphalt emulsion tack coat for the particular subsection in noncompliance. The total penalty for a day/night's paving will be the combined fines from all noncompliant subsections or \$2500.00, whichever is greater. A tacked subsection will be defined as that area covered with tack coat, the width of a single paving machine's actual asphalt placement, extending to the end of that particular pass of tack coat but not to exceed 0.2 (two-tenths) miles in length. This means that if the Contractor tacks in excess of 0.2 mile on a pass then there would exist multiple tacked subsections each subject to the terms and conditions of this provision.

CODE 408.0100
CLEANING AND SEALING CRACKS IN BITUMINOUS CONCRETE PAVEMENT:
CRACKS LESS THAN ONE INCH IN WIDTH

CODE 408.0200
CLEANING AND SEALING CRACKS IN BITUMINOUS CONCRETE PAVEMENT:
CRACKS ONE INCH AND OVER IN WIDTH

408.01 DESCRIPTION. This work shall consist of performing all operations and furnishing all materials, labor, and equipment necessary in connection with the cleaning and sealing of cracks and open joints in bituminous concrete pavements at the locations indicated and as directed by the Engineer, all in accordance with these Specifications. In this specification, the terms “crack” and “open joint” are used synonymously.

All cracks shall be designated as follows:

- Cracks 1/16-Inch to Less than One Inch in Width;
- Cracks One Inch and Over in Width;
- Alligator Cracks, which are cracks in any area where the density and/or severity of cracking forms a chicken wire or alligator pattern.

408.02 MATERIALS.

408.02.1 Sealant. The sealant shall be either one of the following and shall be subject to approval by the Engineer prior to the start of work.

- a. Joint and crack sealant, hot applied, conforming to ASTM D6690 Type II.
- b. Fiber reinforced modified asphalt compound consisting of:

1. Modified Asphalt Binder - This shall consist of a blend of neat asphalt cement and crumb rubber, which are chemically bonded to produce a modified asphalt binder that complies with all the requirements of AASHTO MP1a for PG 70-34, with a separation less than 5% (AASHTO PP 5-93, Section 8.3). The modified asphalt binder shall not contain any particles of rubber or elastomeric material when tested in accordance with AASHTO T 44. The viscosity shall not exceed 3 Pa·s at 300°F. The dynamic shear of the pressure aging vessel residue shall not exceed 5000 kPa at 7°C. The elastic recovery at 4°C (AASHTO T301) shall be not less than 70%. The modification at a minimum shall consist of 5% crumb rubber from tires. The supplier of the modified asphalt binder shall certify the composition and PG grade of the modified asphalt binder.

2. Asphalt Cement - The high temperature grade (AASHTO MP1a) of the neat asphalt cement shall not exceed PG 58-XX.

3. Crumb Rubber – The modified asphalt binder shall have a crumb rubber content of not less than 5% by weight of neat asphalt cement. The maximum size of the crumb rubber shall be 80 mesh.

4. Chemical Bonding Agent – The chemical bonding agent shall be heat stable and compatible with asphalt and rubber.

5. **Fibers** - Polyester, fully drawn.
- | | |
|----------|--------------|
| Length | 10 mm (max) |
| Denier | 15 dpf (max) |
| Tenacity | 4 gpd (min) |
| Crimp | none |
| Color | natural |

Fiber Reinforced Modified Asphalt Compound Properties:

Fiber concentration	8% by weight of modified asphalt binder; uniform dispersion of fibers
Elongation	8% at 0°F (max)
Tensile Strength	450 psi at 0°F (min)

Blending of the fibers with the modified asphalt binder shall be in accordance with the recommendations of the manufacturer of the fibers.

408.02.2 Filler. Filler shall consist of Bituminous Concrete Class I-2 or High Performance Bituminous Cold Patch. The crack filler shall be compatible with the crack sealer and be pre-approved by the Engineer.

408.02.3 Blotter Material. Blotter Material shall be black beauty.

408.03 CONSTRUCTION METHODS.

408.03.1 Equipment. Equipment shall be subject to the approval of the Engineer and maintained in a satisfactory working condition at all times.

a. Air Compressor. Air compressors shall be portable and capable of furnishing not less than 100 cubic feet of air per minute at not less than 120 pounds per square inch pressure at the nozzle. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water.

b. Hot Air Lance. A hot air lance for cleaning, drying, rejuvenating and heating sidewalls of cracks shall provide clean, oil-free compressed air at a volume of 100 cubic feet per minute, a pressure of 120 pounds per square inch and a temperature of 2000°F. The lance shall be designed such that the flame does not come in contact with the pavement.

c. Hand Tools. Hand tools such as brooms, shovels, metal bars with chisel shaped ends, tamping equipment and other miscellaneous tools which may be used to accomplish this work.

d. Melting Kettle. The unit used to melt the sealant shall be a double boiler, indirect fired type with a heating capacity of 550°F. The space between the inner and outer shells shall be filled with suitable heat transfer oil or substitute having a flash point of not less than 530°F. The kettle shall be equipped with a satisfactory means of agitating the crack sealer at all times. This may be accomplished by continuous stirring with mechanically operated paddles and/or by a continuous circulating gear pump attached to the heating unit. The kettle must be equipped with thermostatic control calibrated between 200°F and 550°F with a $\pm 5^\circ\text{F}$ accuracy and a temperature measuring device located such that the Engineer may safely check the temperature of the sealant material.

e. Wand Applicator. The wand applicator shall be capable of applying the sealant to the specified width. It shall be connected to the holding tank through a heated applicator hose that ensures operator safety and allows operator control of material flow. A device shall be mounted to bypass material into a holding tank should the applicator nozzle shut off.

f. Squeegee. Industrial type to shape the surficial sealant material into a feather-edge band 2-1/2 inches wide.

408.03.2 Preparation of Surface. The crack sealing operation shall be performed only on pavement surfaces that have been thoroughly cleaned and swept by the Contractor.

a. General. No crack sealing material shall be applied when the ambient temperature is below 40°F or above 90°F; nor shall it be applied in wet weather, when the pavement is wet, or when frost, snow, or ice is present. If such conditions are present, drying of the cracked areas to be sealed with a hot compressed air lance may be performed with the approval of the Engineer. Care shall be taken so as not to damage traffic loops.

b. Cleaning. All cracks to be sealed shall be thoroughly cleaned with a hot compressed air lance. Cleaning shall remove all moisture, dirt, foreign material and loose edges.

c. Debris Removal. All loose material and debris evacuated from the cracks shall be immediately removed from the pavement surface by means of mechanical sweepers or hand brooms.

408.03.3 Sealing of Cracks

a. Cracks Under 1/16-Inch in Width shall not be sealed.

b. Cracks 1/16-Inch to Less than One Inch in Width.

1. Preparation of Sealer. Crack sealing material shall be heated and applied at the temperature specified by the manufacturer. The sealant shall have the consistency of a free flowing liquid.

2. Heating of Cracks. The sealant shall be applied within three minutes of the cracks being heated with the hot air lance.

3. Installation of Sealer. All cracks shall be sealed according to the manufacturer's recommendations at the time of sealant approval, the sealant shall be well bonded to the pavement, and as specified herein. The cracks shall be completely filled and banded with a 2-1/2 inch width of sealant centered directly over the crack. The thickness (i.e., projection above the pavement profile) of the middle portion of the sealant band shall be between 1/16 and 3/16 inches. The band shall be feathered so its edges are flush with the pavement. More than one application of sealant may be necessary where the sealant has sunk into the crack, leaving a crevice. A squeegee may be required to obtain the sealant profile. There shall be no defects, including any formation of voids or entrapped air. Blotter material shall be spread over the hot sealant to prevent lifting and tracking. Corrections of these deficiencies or other unsatisfactory work unacceptable to the Engineer shall be at no additional cost to the state.

c. Cracks One Inch and Over in Width.

1. Preparation of Sealer. Preparation shall follow the procedures **Subsection**

408.03.3, Para. b.1 above.

2. Heating of Cracks. Cracks shall be filled and sealed within three minutes after being heated with the hot air lance.

3. Filling of the Cracks. All cracks of sufficient depth shall first be coated with sealant material on all contact surfaces, filled with Class I-2 bituminous mixture or high performance cold patch, compacted by rolling and tamping, and sealed in accordance with the provisions of **Subsection 408.03.3, Para. b.3** above with two or more adjacent passes of the wand.

d. Alligator Cracks.

1. Preparation of Sealer. Preparation shall follow the procedures of **Subsection 408.03.3, Para. b.1** above.

2. Heating of Cracks. Cracks on the perimeter or boundary of the alligator cracked area shall be treated in accordance with the provisions of **Subsection 408.03.3, Para. b.2** above.

3. Installation of Sealer. The cracks on the perimeter or boundary of the alligator cracked area shall be completely filled and banded with a 2-1/2 inch width of sealant in accordance with the provisions of **Subsection 408.03.3, Para. b.3** above. **There shall be no treatment of the alligator cracks within the boundary.**

408.04 METHOD OF MEASUREMENT.

408.04.1 Cracks Less than One Inch in Width. "Cleaning and Sealing Cracks in Bituminous Pavement: Cracks Less than One Inch in Width" will be measured by the number of linear feet of cracks actually sealed in accordance with this contract and/or as directed by the Engineer.

408.04.2 Cracks One Inch and Over in Width. "Cleaning and Sealing Cracks in Bituminous Pavement: Cracks One Inch and Over in Width" will be measured by the number of linear feet of cracks actually sealed in accordance with this contract and/or as directed by the Engineer.

408.04.3 Alligator Cracks. There will be no separate measurement for this item, however "Cleaning and Sealing Cracks in Bituminous Pavement: Alligator Cracks" will be measured by the number of linear feet of cracks actually sealed in accordance with this contract and/or as directed by the Engineer and included in the measurement under **Section 408.04.1** above.

408.05 BASIS OF PAYMENT.

408.05.1 Cracks Less than One Inch in Width. The accepted quantity of "Cleaning and Sealing Cracks in Bituminous Concrete Pavement: Cracks 1/16-Inch to less than One Inch in Width" will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for furnishing and applying all materials; labor, equipment, tools; cleaning of cracks and debris removal; maintenance and protection of traffic, including but not limited to trucks (with Truck Mounted Attenuators, Flashing Arrow Boards and Variable Message Signs), temporary

construction signs, and any incidentals necessary to complete the work in accordance with the contract and to the satisfaction of the Engineer. Initial sweeping of the pavement will be paid for separately.

408.05.2 Cracks One Inch and Over in Width. The accepted quantity of "Cleaning and Sealing Cracks in Bituminous Concrete Pavement: Cracks One Inch and Over in Width" will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for furnishing and applying all materials; labor, equipment, tools; cleaning of cracks and debris removal; maintenance and protection of traffic, including but not limited to trucks (with Truck Mounted Attenuators, Flashing Arrow Boards and Variable Message Signs), temporary construction signs, and any incidentals necessary to complete the work in accordance with the contract and to the satisfaction of the Engineer. Initial sweeping of the pavement will be paid for separately.

408.05.3 Alligator Cracks. There will be no separate payment for this item. The accepted quantity of "Cleaning and Sealing Cracks in Bituminous Pavement: Alligator Cracks" will be paid for at the contract unit price per linear foot as listed in the Proposal under the provisions of **Subsection 408.05.1** above. The price so-stated constitutes full and complete compensation for furnishing and applying all materials; labor, equipment, tools; cleaning of cracks and debris removal; maintenance and protection of traffic, including but not limited to trucks (with Truck Mounted Attenuators, Flashing Arrow Boards and Variable Message Signs), temporary construction signs, and any incidentals necessary to complete the work in accordance with the contract and to the satisfaction of the Engineer.

Remove **Section 410, Temporary Patching Material Potholes and Trenches**, pages 4-39 and 4-40 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 410

TEMPORARY PATCHING OF POTHOLES AND TRENCHES

410.01 DESCRIPTION. This work consists of repairing roadway potholes and patching utility and drainage trenches during the construction of the roadway at locations indicated on the Plans and/or as directed by the Engineer and/or as necessary to maintain a safe and passable transportation facility, all in accordance with applicable specifications.

410.02 MATERIALS. The temporary patching material shall conform to the requirements for Class 4.75 or Class 9.5 hot mix asphalt as required, or High Performance Cold Patching Material, as set forth in **Subsection M.03.04** of these Specifications.

410.03 CONSTRUCTION METHODS.

410.03.1 Potholes. The Contractor shall repair all potholes within the project limits, regardless of the cause for, or tenure of the pothole, commencing ten calendar days following the official notice to proceed and thereafter maintain the roadway within the project limits in a safe and passable condition.

Repair shall consist of placing asphalt patching material by hand in up to 2-inch lifts leaving the repair flush with the existing roadway pavement when complete. The pothole shall be free of loose asphalt, debris and excess moisture. The compaction shall be done using a vibratory plate compactor or other appropriate equipment.

410.03.2 Trenches. The Contractor shall repair all trenches within the project limits.

Repair shall consist of placing asphalt patching material in a workmanlike manner. The existing pavement shall be neatly cut on both sides. The gravel backfill shall be compacted to the required density and the subgrade left free of loose asphalt, debris and excess moisture. The bituminous patch material shall be placed in a properly compacted 2-inch lift unless otherwise detailed on the Plans. When completed, the patch shall be left flush with the existing roadway pavement.

410.03.3 Damage Claims. Failure to maintain the roadway as required by this Section will result in the Contractor being held liable for any and all damage claims in accordance with **Subsection 107.13; Responsibility for Damage Claims.**

410.04 METHOD OF MEASUREMENT. Temporary patching of potholes as specified in this Section will not be measured by a single unit of measurement but instead will be documented on a Force Account basis as set forth below in **Subsection 410.05.1**.

410.04.1 Trenches. Temporary patching of trenches will be measured by the number of tons of such material actually placed in accordance with the Plans and/or as directed by the Engineer

410.05 BASIS OF PAYMENT.

410.05.1 Potholes. Temporary patching of potholes will be paid for on a Force Account basis as set forth in **Para. a.4 of Subsection 109.04; Differing Site Conditions, Changes, Extra Work and Force Account Work**, of these Specifications.

410.05.2 Trenches. Temporary patching of trenches will be paid for at the contract unit price per ton as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment and all incidentals required to finish the work, complete and accepted by the Engineer.

CODE 411.0100

PAVER PLACED ELASTOMERIC SURFACE TREATMENT

411.01 DESCRIPTION. This work shall consist of providing a paver placed elastomeric surface treatment (PPEST) at the locations designated on the plans and as directed by the Engineer. All work shall be performed in accordance with the provisions of Part 400 of the Standard Specifications for Road and Bridge Construction, with the following additions and amendments.

411.02 MATERIALS.

411.02.1 Modified Asphalt Binder. This shall consist of a blend of neat asphalt cement and crumb rubber, which are chemically bonded to produce a modified asphalt binder that complies with all the requirements of AASHTO MP1a for PG 76-34, with a separation less than 5% (AASHTO PP 5-93, Section 8.3). The modified asphalt binder shall not contain any particles of rubber or elastomeric material when tested in accordance with AASHTO T 44. It shall incorporate an aromatic VOC inhibitor to mitigate odors at a dosage rate that conforms to the manufacturer's recommendation. The modified asphalt binder shall contain no polyphosphoric acid. In addition, the dynamic shear of the pressure aging vessel residue shall not exceed 5000 kPa at 7°C. The elastic recovery at 4°C (AASHTO T301) shall be not less than 70%. The supplier of the modified asphalt binder shall certify the composition and PG grade of the modified asphalt binder.

Asphalt Cement. The high temperature grade (AASHTO MP1a) of the neat asphalt cement shall not exceed PG 58-XX.

Anti-Stripping Agent. An anti-stripping agent that heat stable and approved by the Engineer may be added to the neat asphalt cement prior to blending with the crumb rubber. The dosage (not exceeding 1.0% by weight of asphalt cement) shall be within the manufacturer's specified range and shall be determined during the course of the mix design. (Note: Notwithstanding the addition of an anti-stripping agent, the asphalt binder grade shall be PG 76-34.)

Crumb Rubber. The asphalt binder shall have a crumb rubber content of not less than 7% by weight of asphalt cement. The maximum size of the crumb rubber shall be 80 mesh.

Chemical Bonding Agent. The chemical bonding agent shall be heat stable and compatible with asphalt and rubber.

411.02.2 Aggregate. The coarse aggregate shall be virgin crushed quarry rock from a RIDOT approved source. Processed gravel shall not be permitted. There shall be no more than 10% flat or elongated particles (ASTM D4791). The aggregate wear, from resistance to abrasion, shall be a maximum of 30% as determined by the Los Angeles Abrasion Test (AASHTO T 96).

The fine aggregate shall be crushed stone screenings, natural sand, or a blend thereof. No more than 10 percent of the total aggregate blend may be natural sand.

411.02.3 Mix Design. The mix design shall be in accordance with **Subsection 401.02.5** of the RI Standard Specifications, with the following exceptions:

a. The job-mix formula shall be within the following master range:

<u>Sieve Size</u>	<u>Percent Passing</u>
1/2"	100
3/8"	91 - 95
#4	40 - 45
#8	22 - 26
#30	9 - 12
#50	6 - 8
#200	4.0

b. The modified asphalt binder shall be the same grade and shall consist of the same components in the same proportions as the asphalt binder that will be used in production. The mixing and compaction temperatures shall be the same as those that will be used in production. The optimum modified asphalt binder content shall be not less than 6.0%.

c. The Marshall specimens shall be compacted with 50 blows on each side. The Moisture Sensitivity shall be determined in accordance with AASHTO T-283. At the optimum modified asphalt binder content, the mix shall satisfy the following requirements:

<u>Property</u>	<u>Requirement</u>
Stability (lb)	1000 min.
Flow (1/100 in.)	8 - 16
Voids (%)	4 - 6
VMA (%)	18 min.
Moisture Sensitivity (%)	80 min.

411.03 CONSTRUCTION METHODS.

411.03.1 Surface Preparation. All surface preparations shall be completed prior to applying the PPEST. All manhole covers, water boxes, catch basins and other such structures shall be adjusted prior to paving. These shall be covered and the location of each referenced for cleaning after paving. All localized depressions, ruts, trench cuts, utility settlements and joint settlements shall be brought to grade with a Type I-2 hot mix or high performance cold patch shim course. A tack coat shall be applied to these surfaces before the shim course is placed. High spots, localized bumps and joints shall be brought to grade by milling or other treatments approved by the Engineer. The entire perimeter of the pavement on which the PPEST is to be placed shall be milled. The milled wedge shall be 3 feet wide, triangular in shape and 1-1/4 inches at the extreme edge and feathered at the inside edge. At the limits of the work and at all cross streets, driveways, and any other locations where the PPEST will adjoin an existing pavement, the milling shall facilitate a smooth transition of the profile between the PPEST and the existing pavement. The transition shall be prior to the termini of any traffic detector loops. The surface shall be swept and thoroughly cleaned of vegetation, debris, loose aggregate, soil and dust, particularly soil that is bound to the surface. All matter shall be legally disposed off site. Prior to application of the surface treatment, the Contractor shall obtain from the Engineer approval and acceptance of the surface preparation.

411.03.2 Production Tolerances. The aggregate gradation and asphalt binder content of the production mix shall comply with the job-mix formula and optimum asphalt binder content, within the following tolerances:

<u>Sieve Size</u>	<u>Tolerance</u>
1/2"	-
3/8"	±5%
#4	±7%
#8	±4%
#30	±4%
#50	±3%
#200	±1.5%
Asphalt Binder	±0.3%

411.03.3 Mixing and Compaction Temperatures. The mixing and compaction temperatures shall be as recommended by the supplier of the modified asphalt binder.

411.03.4 Weather Limitations. The PPEST shall be placed only when the surface is dry and the surface temperature is at least 50°F and rising.

411.03.5 Time Limitation. The PPEST shall not be placed before June 1 or after September 30.

411.03.6 Tack Coat. An SS-1 or RS-1 asphalt emulsion tack coat shall be applied uniformly over the surface on which the PPEST is to be placed. The application rate shall be 0.10 ± 0.01 gallons per square yard. The tack coat shall be applied using the proper nozzle settings and the “double coverage” or “triple coverage” techniques outlined in Chapter 5 of the Asphalt Institute publication MS-22 “Construction of Hot Mix Asphalt Pavements.”

411.03.7 Placement. The mix placement temperature shall be as recommended by the supplier of the modified asphalt binder.

Special attention shall be paid to the formation of longitudinal joints. The cold edge shall be as vertical and square as possible. Sloughed or disturbed material at the edge shall be luted back to form a vertical face in alignment with the joint.

411.03.8 Compaction. The compacted thickness of the PPEST shall be $1 \pm 1/4$ inch. Under no circumstances shall the minimum thickness be less than $3/4$ inch.

Compaction shall commence immediately after placement. All rollers shall weigh at least 10 tons and shall operate in the static mode. Compaction to the specified density shall be attained before the PPEST cools to a temperature 20°F less than the specified compaction temperature.

411.04 METHOD OF MEASUREMENT. “Paver Placed Elastomeric Surface Treatment” will be measured by the number of square yards of paver-placed surface treatment completed in place in accordance with the contract or as directed by the Engineer.

411.05 BASIS OF PAYMENT. The accepted quantities of “Paver Placed Elastomeric Surface Treatment” will be paid for at the contract unit price per square yard as listed in the Proposal. The price so-stated shall constitute full and complete compensation for all traffic control, including traffic control for adjustment of manholes, gates, catch basins and other such structures; mobile phones; surface preparation; furnishing, transporting, handling, placing and rolling the PPEST material as specified; site clean up; furnishing of all labor, tools equipment, and incidentals for the satisfactory completion of the work; and all work not specifically identified as separate pay items in the contract provisions.

The shim course, including the tack coat applied under the shim course, will be paid for under separate items in the Proposal.

Ten percent of the total amount due the contractor will be withheld until at least 60 days after all the contract work specified is completed, the surfaced highways have been opened to traffic and the surface treatment is determined to be performing satisfactorily.

CODE 412.0100

RUBBERIZED ASPHALT CHIP SEALING

412.01 DESCRIPTION. This specification covers all materials, equipment, construction, application and post-placement procedures for the rubberized asphalt chip sealing of existing paved surfaces at the locations designated on the plans and as directed by the Engineer. The work shall consist of an application of rubberized asphalt binder followed by an application of pre-coated cover aggregate in accordance with this specification and as directed by the Engineer.

412.02 MATERIALS.

412.02.1 Asphalt Cement. Neat asphalt cement for the rubberized asphalt shall meet all the requirements of AASHTO MP1a for PG 58-28. The high temperature grade shall not exceed PG 58.

412.02.2 Anti-Stripping Agent. If necessary for water resistance, an anti-stripping agent that is heat stable and approved by the Engineer shall be added to the neat asphalt cement prior to blending with the granulated rubber. The dosage (up to 1.0% by weight of neat asphalt cement) shall be determined during the course of the surface treatment design.

412.02.3 Granulated Rubber. The granulated rubber shall be vulcanized rubber from the ambient temperature processing of scrap pneumatic tires. The granulated rubber shall meet the following gradation. No substitutions will be accepted.

<u>Sieve</u>	<u>% Passing</u>
#10	100
#16	90-100
#30	25-75
#80	0-20

The use of rubber of multiple types from multiple sources is acceptable provided that the overall blend of rubber meets the gradation requirements. The length of the individual rubber shall not exceed 1/8". Certification shall be provided by the rubber supplier.

412.02.4 Cover Aggregate. The cover aggregate shall be virgin crushed quarry rock from a RIDOT approved source. Processed gravel will not be permitted. For the material retained on the #4 sieve, no more than 10% of the particles shall have a flatness or elongation ratio greater than 3:1 (ASTM D4791). The aggregate wear, from resistance to abrasion, shall be a maximum of 30% as determined by the Los Angeles Abrasion test (AASHTO T96). The aggregate shall be pre-heated to a temperature between 280° F and 320° F and be uniformly and completely pre-coated with a PG 64-28 or PG 58-28 prior to application. The asphalt content for the pre-coating shall be determined by laboratory and field testing and be approved by the Engineer. The gradation shall meet the following limits:

<u>Sieve Size</u>	<u>% Passing</u>
1/2"	100
3/8"	85-100
1/4"	0-25
#4	0-5
#8	0-3
#200	0-2

412.02.5 Engineering. The contractor shall determine the asphalt content and mixing time of the pre-coated aggregate to obtain a uniform and complete pre-coating. Samples of the same shall be forwarded to the Engineer for approval.

Design of the rubberized asphalt chip seal surface treatment shall be the responsibility of the contractor. The application rate of the rubberized asphalt shall be at least 0.60 gallons per square yard. The application rate of the pre-coated cover aggregate shall be between 30 and 40 pounds per square yard. No later than two weeks before work commences, the contractor shall submit for the approval of the Engineer the surface treatment design, with supporting test data, specifying the additives for the rubberized asphalt, application rate of the rubberized asphalt, and the source, composition, and application rate of the cover aggregate.

Samples of each material shall be included with the submittal. Once the materials and design are approved, no substitution will be permitted unless approved by the Engineer.

412.02.6 Rubberized Asphalt. Granulated rubber shall be added to the PG58-28 asphalt cement at a rate of $20 \pm 3\%$ by total weight (i.e., asphalt cement plus granulated rubber).

The supplier of the rubberized asphalt shall certify the percent of granulated rubber in the blend.

The temperature of the asphalt cement shall be between 350°F and 425°F at the time the granulated rubber is added. The asphalt cement and granulated rubber shall be combined and mixed together in a blender unit and reacted for a minimum of one hour. The temperature of the rubberized asphalt shall be above 325° F during the reaction period.

412.02.7 Delays. When a job delay occurs after full reaction, the rubberized asphalt may be allowed to cool. The rubberized asphalt shall be reheated slowly just prior to application, but not to a temperature exceeding 375°F. An additional quantity of granulated rubber or additive not exceeding 3% by volume of the rubberized asphalt may be added after reheating.

412.02.8 Field Viscosity Tests. Viscosity tests shall be run by the contractor on each load of rubberized asphalt using a Haake-type field viscometer. One viscosity test shall be run prior to, and another after, the addition of diluent (if used). The viscosity of the final product shall be in the range of 1000 to 3000 centipoise.

412.03 CONSTRUCTION METHODS.

412.03.1 Equipment

a. Mechanical Blender. A mechanical blender for proper proportioning and thorough mixing of the asphalt-cement and granulated rubber is required. This unit shall be equipped with: an asphalt totaling meter (gallons); a flow rate meter (gallons per minute); a positive displacement auger to feed the rubber properly to mixing chamber at the specified rate; and a static motionless mixer. The blender will have a separate asphalt cement feed pump and finished product pump to maximize production, and shall be capable of providing 100% proportional mix at any given time during the blending cycle; supporting documentation from the manufacturer shall be submitted to the Engineer.

b. Distributor Truck. On projects exceeding 35 tons of rubberized asphalt, at least two pressure-type bituminous distributor trucks in good condition will be required. The distributor shall be equipped with an internal heating device capable of heating the material evenly up to 425°F, an internal agitation unit capable of maintaining a proper mix of asphalt cement and granulated rubber, have adequate pump capacity to maintain a high rate of circulation in the tank and to spray the rubberized asphalt at a viscosity of 1000 to 3500 centipoise, and have adequate pressure devices and suitable manifolds to provide constant positive cut-off to prevent dripping from the nozzles.

The distributor shall be equipped with an electronically controlled computerized compensation unit for controlling application rates at various width and speed changes. The application unit shall have electronic controls and a digital read-out installed and operated from the inside of the cab of the distributor. The distributor bar shall be fully circulating. Any distributor that produces a streaked or irregular distribution of the material shall be promptly repaired or removed from the project.

The distributor equipment shall include a tachometer, pressure gauges, volume measuring devices, and a thermometer for reading temperature of tank contents. Controls for the width and rate of spray from the spray bar shall be located in the cab of the truck, and shall enable uniform applications to be made at the specified rate per square yard within a tolerance of 0.05 gallons per square yard.

A “bootman” shall accompany the distributor and ride in a position so that all spray bar nozzles are in full view and readily accessible for unplugging.

c. Hauling Equipment. Trucks for hauling cover aggregate shall be rear discharge conveyor-fed or “live bottom” trucks and shall be equipped with a device to lock onto the hitch at the rear of the aggregate spreader to prevent spillage.

Sufficient hauling vehicles will be available to ensure continuous operation of the distributor and aggregate spreader.

d. Aggregate Spreader. The aggregate spreader shall be hydrostatically driven and self-propelled. It must be equipped with a hydraulically controlled variable adjustable head that is capable of spreading cover aggregate in widths from 4.5 to 18 feet. The spreader shall be mounted on pneumatic tires, and shall apply the cover aggregate on the road surface in a manner that ensures that the tires do not contact the road surface until after the cover aggregate has been applied. The unit shall be equipped with an electronic radar type sensor used to measure ground speed and that will automatically adjust the cover aggregate application rate depending on width of application and the speed of the spreader. It shall have the ability to apply cover aggregate at a uniform coverage on any grade from 0 - 6%. The spreader shall be equipped with an integral hopper with a minimum capacity of 5 tons of cover aggregate which shall be filled by trucks in a manner which ensures that the truck tires never come in contact with rubberized asphalt treated road surfaces until the cover aggregate has been properly applied. To maintain constant

cover aggregate application, a self-locking truck hitch will permit towing of aggregate trucks without stopping the spreader. It will be capable of maintaining positive engagement over irregular terrain.

e. Pneumatic Tire Rollers. A minimum of two self-propelled, multiple wheel pneumatic tire rollers shall be used. Each shall weigh a minimum of 10 tons, have a total compacting width of at least 56 inches, and a minimum tire pressure of 100 psi.

412.03.2 Weather Limitations. The rubberized asphalt shall not be applied when weather conditions are unfavorable to obtaining a uniform spread. Construction shall proceed only when the surface temperature is at least 50°F and rising. No water or moisture shall be present on the road surface.

412.03.3 Surface Preparation. The area to be sealed shall be swept and thoroughly cleaned of vegetation, debris, loose aggregate and soil, particularly soil that is bound to the surface. All cracks shall be thoroughly cleaned. All localized depressions, trench cuts, utility settlements, and joint settlements shall be brought to grade with hot mix Type I-2 shim course. A tack coat shall be applied to the surfaces before the shim course is placed. High spots, localized bumps and joints shall be brought to grade by milling or other treatments as approved by the Engineer. At the limits of the work, there shall be a smooth milled transition of the profile between the existing pavement and the rubberized asphalt chip seal. All thermoplastic pavement markings shall be removed and disposed off site. Manholes, valve boxes and other service entrances will be protected from the applied material. Bridge joints, appurtenances, drainage openings, etc., shall be covered and sealed so as not to clog or permit the entry of loose aggregate. Prior to application of the rubberized asphalt chip seal, the Contractor shall obtain from the Engineer approval and acceptance of the surface preparation.

412.03.4 Construction Procedures.

a. Treatment of Distressed Areas. Prior to rubberized asphalt chip sealing of the entire roadway within the specified limits, a rubberized asphalt chip seal shall be applied to any distressed areas within these limits, as directed by the Engineer. The Construction Procedure shall be as specified under Rubberized Asphalt Application, Aggregate Application, and Rolling. This quantity of work shall be measured and paid under **Sections 412.04** and **412.05** of this specification.

b. Rubberized Asphalt Application. The rubberized asphalt shall be applied uniformly at double coverage at a temperature of 325°F to 425°F at the approved design application rate within a tolerance of ± 0.05 gallons per square yard. The application rate shall be not less than 0.60 gallons per square yard.

Longitudinal joints shall be reasonably true to line and parallel to centerline. Where any construction joint occurs, the edges shall be broomed back and blended so there are no gaps and the elevations are the same, and free from ridges and depressions. Longitudinal joints shall be overlapped from 4 to 6 inches.

During application, adequate provision shall be made to prevent marring and discoloration of adjacent pavements, curbing, structures, vehicles, foliage or personal property.

c. Cover Aggregate Application. The application of cover aggregate shall follow as close as possible behind the application of the rubberized asphalt which shall be applied no further in advance of the aggregate spreader than can be immediately covered. Construction equipment or other vehicles shall

not drive on the uncovered rubberized asphalt. The cover aggregate shall be spread uniformly and completely across the hot rubberized asphalt by a self-propelled spreader at the approved design application rate within a tolerance of ± 5 pounds per square yard. In no case shall the application rate shall be less than 30 pounds per square yard. Any deficient areas shall be covered with additional cover material to provide complete coverage.

d. Rolling. Rolling with pneumatic tire rollers shall commence immediately following spread of pre-coated aggregate. There shall be at least three passes of a roller to embed the cover aggregate particles firmly into the rubberized asphalt. No steel wheel rollers will be allowed.

e. Initial Sweeping. After the aggregate has been rolled and embedded into the rubberized asphalt and the pavement has cooled, all loose material shall be swept and removed offsite. This shall be done at a time and in a manner so as to not displace any embedded aggregate or damage the rubberized asphalt surface. The accumulations of the sweepings shall be collected and disposed properly off site.

f. Site Clean Up. The contractor shall uncover and unseal all drainage openings and clean any covers or grates that the cover aggregate and rubberized asphalt may have adhered to, and shall remove any excess material in areas such as driveways, gutters, and intersections as specified by the Engineer. The contractor shall, on a daily basis, remove any debris associated with the performance of the work.

g. Traffic. Traffic will not be permitted on the surface until the rubberized asphalt binder has cured sufficiently to minimize any dislodging of cover aggregate. The pilot car shall be used to guide and control speed of traffic. The contractor shall be responsible for any damage done to vehicles as a result of the operation. Any damage to the rubberized asphalt chip seal shall be repaired by the contractor, to the satisfaction of the Engineer and at no additional cost to the State.

h. Post Placement Sweepings. There shall be post placement sweepings at the following times:

1. Seven to ten days after the rubberized asphalt chip sealing operation;
2. Three to five weeks after the rubberized asphalt chip sealing operation;
3. At the end of the first winter after the rubberized asphalt chip sealing operation.

For each sweeping, all loose cover aggregate shall be removed from the pavement surface, including the shoulders. The accumulations of sweepings shall be collected and properly disposed off-site.

412.04 METHOD OF MEASUREMENT. “Rubberized Asphalt Chip Sealing” will be measured by the number of square yards of rubberized asphalt chip seal completed in place in accordance with the contract or as directed by the Engineer.

412.05 BASIS OF PAYMENT. The accepted quantities of “Rubberized Asphalt Chip Sealing” will be paid for at the contract unit price per square yard of the type and application rate specified. The price so-stated shall constitute full and complete compensation for traffic control and pilot car; mobile phones; surface preparation; furnishing, transporting, handling, placing and rolling the material specified; initial sweeping and removal of excess aggregate; site clean up; furnishing of all labor, tools, equipment and incidentals for the satisfactory completion of this item; and all other work not specifically identified in the Contract Provisions as separate items of work.

Compilation of Approved Specifications
Date: 04/22/2016

The shim course, including tack coat, and each post placement sweeping will be paid for under separate items in the contract.

Ten percent of the total amount due the contractor will be withheld until the final sweeping and at least 60 days after all the rubberized asphalt chip seal locations have been open to traffic and it has been determined that the rubberized asphalt chip seal is performing satisfactorily.

Add the following new **Section 414; Warm Mix Additive** to the RI Standard Specifications for Road and Bridge Construction.

SECTION 414

WARM MIX ADDITIVE

414.01 DESCRIPTION. This work consists of incorporating a WMA (Warm Mix Additive) in HMA (Hot Mix Asphalt).

414.02 MATERIALS. One unit of WMA shall be added to each ton of HMA. All WMA shall be selected from the RIDOT Approved Materials List and shall be added at a dosage rate recommended by the manufacturer.

414.03 CONSTRUCTION METHODS. If HMA is designated as “with WMA”, the Contractor shall use a WMA. If HMA is not designated as “with WMA”, the Contractor may request to use a WMA at his own discretion and expense. Additionally, the Engineer may direct the Contractor to use a WMA. If a WMA is used it shall be for an entire day’s production for that class of HMA.

414.04 METHOD OF MEASUREMENT. WMA will be measured by the number of units actually used in accordance with the specifications and/or as directed by the Engineer.

414.05 BASIS OF PAYMENT The accepted quantity of the WMA will be paid for at its respective contract unit price per each as listed in the Proposal.

Remove **Section 601, Portland Cement Concrete**; pages 6-1 through 6-25 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 601

PORTLAND CEMENT CONCRETE

601.01 DESCRIPTION. This work consists of furnishing, placing, curing, and finishing Portland cement concrete for bridges, pavements, structures, and incidental construction in accordance with these Specifications, the Special Provisions and Contract Documents. Any modifications of these general requirements will be given in the specific requirement for each item unless otherwise indicated in the Contract Documents.

Concrete shall consist of a homogeneous mixture of Portland cement, coarse aggregate, fine aggregate, air entrainment, water, admixtures and pozzolan (when used), mixed in proportions herein specified.

601.01.1 Classification. Portland cement concrete shall be proportioned with the required cement content for each class and shall be thoroughly mixed to the consistency herein after specified.

Each class of concrete shall be used in that part of the work in which it is called for on the Plans, Proposals, Special Provisions, or where otherwise directed.

The classes of concrete required for the particular work, unless otherwise indicated or superseded by Special Provisions, are shown in Table 1. All concrete mixes are subject to the approval of the Engineer. The minimum compressive strength of each class of concrete shall be as listed in Table 2 or as specified on the Plans.

Various sizes of approved coarse aggregate for the classes of concrete may be combined during the batching operation in the amount of each fraction of aggregate size required to obtain the specified gradation. When testing aggregates to determine compliance with a specified gradation, fractions will be tested separately and combined mathematically or combined mechanically in predetermined proportions, and tested.

Table 1

Class of Concrete ¹		General Classification of Work
X	Structural & Precast Elements	Highway Bounds, Modular Wall Units, Flared Ends, Drilled Shafts, Concrete-Filled Shell Piles.
HP	Structural & Prestressed/Precast Elements:	I-Beams, Cellular Slabs, Box Beams, Cast-in-place Bridge Structures, Box Culverts, Retaining Walls, Backwalls, Beam Seats, Pier Caps, Pier Columns, Diaphragms, Abutment Stems, Pier Stems, Wall Stems, Bridge Decks, Railings, Parapets, End Posts, Bridge Sidewalks, Cast-in-place Piles, Reinforced Overhead Sign Foundations, Miscellaneous Prestressed/Precast Elements.
XX	Precast Elements:	Collars, Catch Basins, Manholes, Drop Inlets, Sumps, Electrical Handholes, Median Barriers, Copings, Pipe.
	Structural Elements:	Reinforced Footings, Approach Slabs.
	Miscellaneous:	Road Pavements, Commercial Driveways, Headwalls, Endwalls, High Capacity Inlets, Road Base, Residential Driveways, Mast Arm Foundations.
A	Miscellaneous & General Use:	Tremie Seals, Sidewalks, Fence Post Footings, Guardrail Anchorage, Unreinforced Footings, Paved Waterways, Concrete-Filled Pipe Piles, Non-specified use.
Z	Precast Elements:	Curbing, Pipe.
B	General Use:	Void Filler, Thrust Blocks, Class A Bedding.

Notes: 1. All concrete shall be air entrained.

601.02 MATERIALS.

601.02.1 Portland Cement. Portland cement shall conform to the requirements of **SECTION M.02; PORTLAND CEMENT CONCRETE**, and be listed on the Department's Approved Materials List.

For bridge projects, one brand of Portland cement shall be furnished and used for all visible portions of a structure, but is not required for interior deck slabs, beams or corresponding elements that are semi-exposed.

The Contractor shall provide suitable means for storing and protecting the cement against dampness. Cement that becomes partially set or contains lumps of caked cement will be rejected.

All Portland cement used shall be supplied from mill silos that have cement which has been tested. A copy of a certified mill test report shall be furnished to the Engineer for the cement being used. Deliveries may be directed to the site or through a regional distribution base. No cement may be used for the project without a Certificate of Compliance issued by the manufacturer.

In addition, the following will be required:

a. The manufacturer's Certificate of Compliance as referenced above and signed by the company representative having legal binding authority shall accompany each shipment of cement. The Certificate of Compliance shall conform to the Department's requirements. Copies of a standard form are available from the Department upon request.

b. Each shipment or truckload thus received will be sampled and tested by the Engineer. If rejected, the degree to which a structure has been affected by the use of this non-conforming product will be assessed and either the removal of the structure or an adjustment in price will be warranted.

c. Under all steps and conditions, delivery shall be made in weatherproofed and sealed transporting equipment. All cement shall be well protected from moisture and contaminants. Any cement which fails to meet any of the requirements mentioned above shall be rejected and removed from the work. Any hydraulic cement stored by the Contractor for a period longer than 60 days shall be retested in accordance with AASHTO M85 by an independent laboratory at the Contractor's expense and approved by the Engineer before being used on the work.

601.02.2 Chemical Admixtures. Previously approved admixtures shall be used when specified or ordered by the Engineer, or may be used at the Contractor's option if approved by the Engineer as described herein.

Admixtures used in Portland cement concrete shall conform to the requirements of **SECTION M.02**. No admixture shall be used in the work unless it is approved by the Engineer.

Physical and chemical properties of admixtures shall be uniform throughout their use in the work. Should it be found that an admixture as furnished is not uniform in properties, its use shall be discontinued.

If more than one admixture type or brand is used, said admixtures shall be compatible with each other so that the desirable effects of all admixtures used will be realized.

When the Contractor proposes to use an admixture of a brand and type on the Department's Approved Materials List, he shall furnish a Certificate of Compliance from the manufacturer, certifying that the admixture furnished conforms to the chemical and physical requirements as specified by the Department. The Engineer may take samples for testing at any time.

The cost of the admixtures, when approved for use, shall be distributed over the appropriate pay items at no extra compensation. The quantity of admixture used shall be in accordance with the manufacturer's recommended minimum and maximum dosage range.

Air-entraining admixture shall be used in amounts to produce a concrete having the specified air-content.

Chemical admixtures, including air-entraining admixtures, shall be dispensed in liquid form. If more than one chemical admixture is used in the concrete mix, a separate dispensing measuring unit shall be provided for each admixture. Dispensing shall be accomplished in accordance with manufacturer's approved recommendations. Dispensers for chemical admixtures shall have sufficient capacity to measure at one time the prescribed quantity required for each batch of concrete. Each dispenser shall include a graduated measuring unit into which liquid admixtures are measured to within plus or minus 2 percent of the prescribed quantity (volume or weight, as applicable) for each batch of concrete. Dispensers shall be located and maintained so that the graduations can be accurately read from the point at which proportioning operations are controlled to permit a visual check of batching accuracy prior to discharge. Each dispensing unit shall be clearly marked for the type and quantity of admixture.

Each liquid admixture dispensing system shall be equipped with a sampling device consisting of a valve located in a safe and readily accessible position such that a sample of the admixture may be withdrawn by the Engineer.

For all types of admixtures the water content as determined by manufacturer's recommendations and/or Departmental testing must be taken into account when calculating the total unit free water of the concrete mix.

601.02.3 Pozzolans. Mineral admixtures such as fly ash, blast furnace slag, and silica fume may be permitted as a partial replacement of Portland cement in any concrete as approved by the Engineer. Mineral admixtures shall conform to the requirements of both **Subsection M.02.06** and **SECTION 602** of these Specifications, and furthermore, shall be listed on the Department's Approved Materials List. The Engineer will evaluate requests of alternate cement/pozzolans combinations in the concrete mix design. The Engineer's evaluation may include laboratory testing, field trial runs and other related work required to determine equivalency with specified materials, mix designs, and performance.

The Contractor shall provide suitable means for storing and protecting the pozzolans against moisture. Pozzolans that become partially hydrated or contain lumps will be rejected.

Handling and storage of all pozzolans shall conform to the requirements listed under **Subsection 601.02.1; Portland Cement.**

The manufacturer's Certificate of Compliance signed by a company representative having legal binding authority shall accompany each shipment of pozzolans.

Any pozzolan stored by the Contractor for a period longer than 60 days shall be retested for compliance with the required specifications by an independent laboratory at the Contractor's expense and approved by the Engineer before being used on the work.

601.02.4 Aggregates. Coarse and Fine Aggregates shall conform to the requirements of **Subsections M.01.05** and **M.02.02**, respectively, of these Specifications.

a. Sources of Aggregates. Aggregates shall be obtained from sources which have been previously tested and approved by the State. Results and information of such tests may be obtained from the Engineer upon request. If the Contractor proposes to obtain aggregates from sources that have not been tested and approved, the Contractor shall:

1. Notify the State three months in advance of use, together with relevant test results in accordance with **SECTIONS M.01** and **M.02**. These tests shall be performed by an AASHTO or CCRL accredited laboratory and signed by a Rhode Island Registered Professional Engineer.

2. Submit report of test results ASTM C295 "Petrographic Examination of Aggregates for Concrete" for the proposed aggregates. This test shall be performed by an independent laboratory and signed by a Rhode Island Registered Professional Engineer.

3. Provide a sufficient quantity of aggregate samples to the Engineer for verification testing three months in advance of use.

4. Assume all costs for sampling and testing, except for the cost of verification testing which shall be borne by the State.

The Contractor's attention is directed to the fact that the above requirements may have a direct impact on project schedules.

All proposed aggregates from sources not previously approved will be tested by the State and must produce concrete which has freeze-thaw durability of 80 percent as determined by the relative dynamic modulus (ASTM C215, Transverse Method) at 300 cycles as tested in accordance with ASTM C666 - Procedure A, as modified by the Department. Copies of modification may be obtained from the Engineer upon request.

Aggregates shall be handled or conveyed from stockpiles or other sources to the batching plant in such manner as to secure a uniform grading of the material.

The batch plant site, layout, equipment and provisions for transporting material shall be such as to assure a continuous supply of material to the work. Stockpiles shall be built up in layers of not more than 3 feet in thickness. Each layer shall be completely in place before beginning the next, which shall not be allowed to "cone" down over the next lower layer.

The Contractor, at his expense, shall provide safe and suitable facilities for obtaining and storing samples of aggregates.

Aggregates from different sources and of different gradings shall not be stockpiled together. Aggregates that have become segregated, mixed with foreign materials, or contaminated by aggregates of different gradings shall not be used. All aggregates produced or handled by hydraulic methods shall be stockpiled or binned for draining at least 12 hours before being batched. Rail shipments requiring more

than 12 hours will be accepted as adequate binning only if the car bodies permit free drainage. In case the aggregates contain high or nonuniform moisture content, storage or stockpile periods in excess of 12 hours may be required by the Engineer. In no event shall the moisture content of the fine aggregate at the time of batching exceed 8 percent of its dry weight.

601.02.5 Water. Water used in mixing and curing of concrete shall be subject to approval and shall conform to **Subsection M.02.07** of these Specifications.

601.03 CONSTRUCTION METHODS.

601.03.1 Proportioning.

a. General. The proportioning of ingredients for each batch shall be that approved by the Engineer as herein specified. All concrete used on State of Rhode Island projects will be air-entrained and have the following air contents:

Coarse Aggregate Designated Size	Percent By Volume (Mix Design Basis)	Air Content Range
3/8"	7.0	6.0 - 9.0
1/2"	7.0	6.0 - 9.0
3/4"	6.0	5.0 - 8.0
1"	6.0	5.0 - 8.0
1 1/2"	5.5	4.5 - 7.5

The following classes and proportions of materials per cubic yard of concrete shall govern unless otherwise specified or approved:

Table 2

Class¹	B	A	XX	HP	MC²	Z
Minimum Cementitious Content, lb/yd ³	400	400	500	500	500	500
Maximum Cementitious Content, lb/yd ³	700	700	700	700 ⁵	600	700
Maximum w/cm	0.55	0.45	0.42	0.40	0.40	0.42
Acceptance Criteria						
Consistency Range ³ , AASHTO T119 Slump, in.	2-4	2-4	2-4	2-4	2-4	<1
AASHTO T23 Minimum Compressive Strength, psi						
28 days	3000	3000	4000	5000	3500	5000
56 days	----	----	----	----	5000	----
Air Content Range, AASHTO T152, %	5-9	5-9	5-9	5-9	5-9	6-9
Prequalification Criteria						
Chloride permeability, AASHTO T277, coulomb						
28-day standard cure				≤2000	≤3000	
28-day accelerated cure				≤1000	≤1500	
Maximum 28-day drying shrinkage, ASTM C157, %				-0.040	-0.045	
Maximum Adiabatic temperature rise, degree F ⁴					75	

Table 2 Footnotes:

1. A single concrete mixture may be used for multiple classifications if performance and prequalification criteria are satisfied.
2. Class MC concrete may have a total supplementary cementitious content of 75 percent by weight of total cementitious material when using either ground-granulated blast-furnace slag meeting the requirements of AASHTO M 302, or combinations of slag and other supplementary cementitious materials. Maximum cement replacement by fly ash or other pozzolan meeting requirements of AASHTO M 295 is 30 percent by weight. Maximum cement replacement by silica fume meeting the requirements of AASHTO M 307 is 7 percent by weight.

3. Slump range measured at the point of discharge. The Contractor shall submit for approval by the Engineer, the target slump range for each element. Slump shall not exceed 4 inches for surfaces sloped greater than 4 percent. If additional workability is desired the Engineer may allow an increase of the maximum specified slump to 6 inches if an AASHTO M 194 Type A - Water Reducing Admixture is used, or an increase of up to 9 inches if an AASHTO M 194 Type F or G - High Range Water Reducing admixture is used.

AASHTO M 194 Type F or G - High Range Water Reducing Admixture is required when concrete is to be placed by pumping equipment. Admixtures must be used in accordance with manufacturers' recommended dosages.

4. Maximum concrete temperature rise measured in Section 607 mockup trial with cube insulated with curing blankets, or prequalification calorimetry tests.
5. The maximum cementitious content for Class HP may be exceeded for the fabrication of precast/prestressed concrete structures as approved by the Engineer. Class HP concrete shall replace all references to Class X in RIDOT's standard specifications.

b. Design and Approval of Concrete Mixtures. The Contractor shall design the concrete mixtures for each class of concrete specified. The concrete mix components shall be proportioned using the absolute volumes method in accordance with the requirements for each class as specified herein and methods outlined in the American Concrete Institute's "Manual of Concrete Practice," 2000 edition; Standard 211.1, "Recommended Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete"; and Standard 301, "Specifications for Structural Concrete in Buildings - Section 4.2.3.3."

Step 1. Laboratory Testing. At least 60 days prior to production, the Contractor shall submit in writing its concrete mix design on Department forms, and trial batch reports supported by laboratory test data to the Engineer for review.

The trial batch test reports shall include the following information:

- (a) Contractor/Testing Laboratory name.
- (b) The coarse and fine aggregate gradations and sources.
- (c) The fine aggregate fineness modulus (FM).
- (d) Any other pertinent information (i.e., aggregate specific gravities, unit weights, absorptions, or any other material properties).
- (e) Date of mixing.
- (f) Mixing equipment and procedures used.
- (g) The size of batch in cubic yards.
- (h) Weight/volume, type, source/manufacturer of all ingredients used in the mix.
- (i) Slump.

- (j) The air content of the mix.
- (k) Concrete temperature.
- (l) Unit weight of fresh concrete.
- (m) Curing method, age at time of testing and compressive strength of concrete.

Note: All testing shall conform to the applicable AASHTO and/or ASTM requirements listed in these Specifications.

Original copies of concrete mix designs and trial batch reports submitted for approval to the Department shall have an original Rhode Island Professional Engineer's stamp and signature.

Step 2. Trial Runs. Once the concrete mix design provided by the Contractor has been reviewed and no exception taken by the Engineer, the Contractor will conduct trial runs prior to production using the submitted mix design's component materials and proportions including the amount of admixtures which will be necessary to meet the specifications and produce concrete of the required plasticity, workability, air content, compressive strength, flexural strength, or any other specified concrete property. The Contractor shall conduct the trial runs by employing the concrete batch plant, mixer and handling equipment which the Contractor proposes to use in production. All equipment employed in the batching, mixing, transporting, and testing shall be properly calibrated and meet the requirements listed herein prior to commencement of the trial runs. The Contractor shall attempt to produce concrete using the maximum amount of water and air content specified in the submitted mix design during the trial runs. The Engineer shall be notified by the Contractor at least 48 hours in advance of performing the trial runs so that he can witness the test procedures.

The Contractor's attention is directed to the time required to test trial runs. The Contractor shall be responsible for production of trial runs at a sufficiently early date so that the commencement of the work is not delayed.

Once the concrete temperature, slump and air content are tested and found to be in compliance with the Specifications listed herein, the Engineer shall fabricate compressive strength specimens to be tested at 28 days or earlier as determined by the Engineer.

When all specified concrete parameters have been met, the Engineer shall approve the proposed mix design for production.

The approved mix design proportions will govern during the progress of the work.

No changes in the sources or character of the materials shall be made without approval of the Engineer. New materials shall not be used until a revised mixture design and new proportions based on laboratory tests and a minimum 3 cubic yard trial batch is approved by the Engineer. Trial batch testing shall be conducted by an AASHTO Accredited laboratory at the Contractor's expense. Testing requirements are as follows:

1. No testing is required for changes in admixture dose provided the proposed dose does not exceed manufacturer recommendations and the admixture does not retard or accelerate setting characteristics.
2. Trial batches for the proposed mixture(s) and a control batch of the existing approved concrete mixture shall be conducted on the same day for comparison. All required tests shall be conducted for both the approved and proposed mixtures.
3. Slump, air content, concrete temperature and unit weight is required for all modifications.
4. 28 day compressive strength is required for all modifications.
5. AASHTO T277 testing is required for any change to aggregate source, cementitious material source, cementitious material content, or water content for concrete classes HP and MC. T277 testing is not required for admixture modifications.
6. AASHTO T160 Shrinkage testing is required for concrete classes HP and MC as determined by the Engineer. Testing is required for changes to coarse aggregate source, size, or content greater than 300 lb/yd³, cementitious material source, cementitious material proportions, or water content. Shrinkage testing is not required for admixture-only modifications.
7. Heat development, as determined by Adiabatic Temperature Rise or calorimetry, is required for any change in cementitious material content or source for Class MC concrete.
8. AASHTO T197 Time of set is required for any admixture addition that may accelerate or retard setting characteristics for pavement or bridge deck concrete mixtures.

c. Concrete Durability Requirements. All concrete mixtures shall be proportioned to meet or exceed minimum durability requirements for the application by the Contractor. At his expense, the Contractor shall conduct prequalification trial batches for durability properties using the materials proposed for the project. Trial batch testing shall be performed by an AASHTO accredited laboratory. The Contractor shall submit complete mixture proportions and durability test results of all plastic and hardened concrete properties listed in **Subsection 601.03.1(b)** and **Table 2** to the Engineer for review. The Engineer reserves the right to perform acceptance testing for any of the durability properties specified.

1. Concrete mixtures shall have an AASHTO T277 coulomb rating less than or equal to the value listed in Table 2 for the class of concrete.

A minimum of two specimens shall be reported for both the standard and accelerated curing for AASHTO T277 testing.

Accelerated curing shall be accomplished by moist curing cast concrete cylinders at 70 degree F for the first seven (7) days, followed by twenty-one (21) days of moist curing at 100 degrees F in a saturated lime water bath.

Prequalification testing for coulomb rating shall be performed by the Contractor. Neither process control nor Engineer acceptance testing is required.

2. Concrete mixtures shall have a 28-day drying shrinkage value less than the value listed in Table 2 for the class of concrete. Drying shrinkage shall be determined in accordance with the procedure described in AASHTO T160 with the following clarifications. Specimens shall be 3 x 3 x 11.25 in. prisms. All specimens shall be moist cured in a saturated lime water bath for seven (7) days prior to exposure to the drying environment. The specimen length shall be taken upon demolding after the curing period, and weekly for 28 days while placed in the drying environment. The shrinkage value shall be calculated after 28-days of drying as the percent change in length from the time the specimen is removed from curing.

Prequalification testing for drying shrinkage shall be performed by the Contractor. Neither process control nor Engineer acceptance testing is required.

601.03.2 Batching Plants and Equipment.

a. General. Equipment and tools necessary for handling materials and performing all parts of the work must meet with the approval of the Engineer as to design, capacity, and mechanical condition and the equipment must be available sufficiently ahead of the start of construction operations to be examined thoroughly for approval.

The batching plant shall include bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. Cement shall be weighed independently on a separate scale. The weighing hopper shall be properly sealed and vented.

b. Bins and Hoppers. Bins and hoppers with adequate separate compartments for fine aggregate and for each size of coarse aggregate shall be provided in the batching plant.

c. Cement Silos. Separate silos or holding bins shall be provided for each cement type and pozzolan. The bins shall protect the cement and pozzolan from rain and moisture.

A log must be maintained showing deliveries which will include the brand, supply, location, type, quantity and date. This log shall be maintained by the Contractor on a weekly basis to fully document the cement on hand. All received cement must conform to the specified quality requirements. This log will also contain data showing the quantitative distribution of all cement used on both private and State projects. Copies of the log will be submitted to the Engineer upon request and attested to by the Contractor or his representative.

d. Discharge Chutes. All discharge chutes shall be arranged so that materials will not lodge or be lost on discharge.

e. Scales. The scales for weighing aggregates and cement shall be either the beam-type or the springless-dial type of standard make and design. They shall be accurate within 0.50 percent throughout the range of use and have minimum graduations not greater than 0.50 percent and shall be readable and sensitive to 0.25 percent or less. The preceding percentages are based on total batch weight.

When beam-type scales are used, provision, such as a "telltale" dial, shall be made for indicating to the operator that the required load in the weighing is being approached. A device on weighing beams

shall indicate critical position clearly. Poises shall be designed to be locked in any position and to prevent unauthorized change. The scale, weigh beam and "telltale" device shall be in full view of the operator while charging the hopper, and he shall have convenient access to all controls.

Scales shall be sealed as often as the Engineer may deem necessary to assure their continued accuracy. The Contractor shall have on hand not less than ten, 50-pound weights for frequent testing of all scales. For each scale, a cradle or platform, approved by the Engineer shall be provided for applying the test weights.

All plant scales and water meters, including truck scales, involved in the plant operation shall be tested at the expense of the Contractor by a commercial scale company as follows:

1. Annually prior to use in State work.
2. At intervals of not more than 60 calendar days.
3. At any time ordered by the Engineer.

Note: Every 60 days, the plant owner must submit to the Engineer a certificate from the commercial scale company making the checks attesting to the accuracy of all plant scales. The certificate must be signed by the technician or a responsible representative of the scale company making the check.

f. Automation and Recordation. Plants producing Portland cement concrete for the State of Rhode Island shall conform to the following plant equipment requirements:

1. Automatic Proportioning. Portland cement concrete shall be produced in batch type mixing plants equipped with approved automatic proportioning devices. Such devices shall include equipment for accurately proportioning batches of the various components of the mixture by weight or volume in the proper sequence. Cement and aggregates shall be proportioned by weight. Water and admixtures shall be proportioned by weight or volume. The batch weights will have to be adjusted periodically to take into account the actual moisture content of the aggregates at time of use. Plants shall be automatically equipped to control the batching sequence and timing of operations. There shall be auxiliary interlock cutoff circuits to interrupt and stop the automatic cycling of the batching operations at any time an error in weighing occurs, when an aggregate bin becomes empty or when there is a malfunction of any portion of the control system.

2. Recording Equipment. The plant shall be equipped with a DIGITAL RECORDER which will automatically print the following data on delivery tickets and it shall reproduce the reading of the scale being recorded within ± 0.1 percent of scale capacity.

- (a) Approved mix design.
- (b) Batch weights and storage bins for each size aggregate.
- (c) Total weight of aggregates in batch. The weight printed for the last aggregate batched shall be the total weight of aggregate in the batch when cumulative weights are used.

- (d) Weight of cement and/or pozzolans, and storage silo designation.
- (e) Weight or volume of water.
- (f) Weight or volume of admixtures.
- (g) Date batched.
- (h) Time of each batch or load.
- (i) Tare zero balance to within ± 0.3 percent of scale capacity.
- (j) Total size of batch
- (k) Name of customer.
- (l) Name of project and RI Project Contract Number.
- (m) Name of trucker and truck number.

The following information shall be included on the delivery ticket.

- (a) Signature of Inspector (Plant).*
- (b) Amount of water and/or admixtures added at the point of delivery.
- (c) Signature of Inspector (Site).*

* Signatures do not indicate "acceptance" of the material, but only signify that the required inspection/witnessing has been accomplished.

There shall be sufficient copies of delivery tickets to provide a copy for the plant inspector and a copy for the Resident Engineer for permanent project record.

3. Equipment Failure. If at any time the recording devices become inoperative, the plant may be allowed to batch materials for a period of not more than 1 work day from the time of breakdown, if approved by the Engineer. Written permission of the Engineer will be required for periods of operations without automatic proportioning facilities longer than 1 work day. As a condition for continued use with inoperative recording devices the Contractor will be required to manually record all required information on all delivery tickets.

4. Batching Controls. Batching controls shall be electrically interlocked with the scales to prevent cycling or recycling of batching until scales tare zero.

The batching controls shall meet the following tolerances with respect to the various components weighed in each batch:

Coarse Aggregate:	±2.0 percent of required weight of the total coarse aggregate being weighed.
Fine Aggregate:	±2.0 percent of required weight of the total fine aggregate being weighed.
Portland Cement:	±1.0 percent of required weight of cement being weighed.
Pozzolans:	±1.0 percent of required weight of pozzolans being weighed.
Water:	±1.0 percent of required weight or volume of water being weighed.
Admixtures:	±3.0 percent of required weight or volume of each admixture being used.

The total weight of the batch shall not vary more than ±1.0 percent from the theoretical design weight.

601.03.3 Concrete Mixing, Delivery, and Discharge. Concrete may be mixed at the site of construction, at a central point, or in transit mixers, all in accordance with these Specifications.

a. Equipment - Mixers and Agitators. Mixers may be stationary mixers or truck mixers. Agitators may be truck mixers or truck agitators.

Stationary mixers shall be equipped with a metal plate or plates on which are plainly marked the mixing speed of the drum or paddles, and the maximum capacity in terms of the volume of mixed concrete. When used for the complete mixing of concrete, stationary mixers shall be equipped with an acceptable timing device that will not permit the batch to be discharged until the specified mixing time has elapsed.

Each truck mixer or agitator shall have attached thereto in a prominent place a metal plate or plates on which are plainly marked the gross volume of the drum, the capacity of the drum or container in terms of the volume of the mixed concrete, and the minimum and maximum mixing speeds of rotation of the drum, blades, or paddles. When the concrete is truck-mixed the volume of concrete mixed per batch shall not exceed the mixer's nominal capacity as shown on the manufacturer's standard rating plate on the mixer, except that an overload up to 10 percent above the mixer's nominal capacity may be permitted, provided concrete test data for strength, segregation, and uniform consistency are satisfactory, and provided no spillage of concrete takes place.

Truck mixers and agitators shall be equipped with means by which the number of revolutions of the drum, blades, or paddles may be readily verified. Truck mixers must also have a means of measuring

the amount of water added during retempering such as a water meter or other method approved by the Engineer.

All stationary and truck mixers shall be capable of combining the ingredients of the concrete within the specified time or number of revolutions specified herein into a thoroughly mixed and uniform mass and of discharging the concrete so that no less than 5 of the 6 requirements shown in AASHTO M157-93 Table A1 shall have been met.

The agitator shall be capable of maintaining the mixed concrete in a thoroughly mixed and uniform mass and of discharging the concrete with a satisfactory degree of uniformity as defined by AASHTO M157-93 Annex A1.

Slump tests of individual samples taken after discharge of approximately 15 percent and 85 percent of the load may be made for a quick check of the probable degree of uniformity. These two samples shall be obtained within an elapsed time of not more than 15 minutes. If these slumps differ more than that specified in AASHTO M157-93 Annex A1, the mixer or agitator shall not be used unless the condition is corrected.

Mixers and agitators shall be examined or weighted routinely as frequently as necessary to detect changes in condition due to accumulations of hardened concrete or mortar and examined to detect wear of blades. When such changes are extensive enough to affect the mixer performance, the proof-tests described in AASHTO M157-93 Annex A1 shall be performed to show whether the correction of deficiencies is required.

b. Mixing and Delivery. Ready-mixed concrete shall be mixed and delivered to the point designated by the Engineer by means of one of the following combinations of operations, central-mixed and truck-mixed concrete.

Agitators and non-agitating equipment shall only be used for delivering pre-mixed concrete.

Mixers and agitators shall be operated within the limits of capacity and speed of rotation designated by the manufacturer of the equipment.

Ready-mix concrete delivery trucks shall be National Ready Mixed Concrete Association (NRMCA) (nrmca.org) certified via a non-expired certificate affixed to the truck in a location readily visible to the inspector (see Section 5 of NRMCA Plant Inspector's Guide).

1. Central Mixed Concrete. Concrete that is mixed completely in a stationary mixer and transported to the point of delivery either in a truck agitator, or a truck mixer operating at agitating speed, or in non-agitating equipment approved by the Engineer and meeting the requirements specified herein shall conform to the following: The mixing time shall be counted from the time all the solid materials are in the drum. The batch shall be so charged into the mixer that some water will enter in advance of the cement and aggregate, and all water shall be in the drum by the end of the first one-fourth of the specified mixing time.

Where no mixer performance tests are made, the acceptable mixing time for mixers having capacities of 1 cubic yard or less shall not be less than 1 minute. For mixers of greater capacity, this

minimum shall be increased 15 seconds for each cubic yard or fraction thereof of additional capacity. For mixer performance refer to AASHTO M157 Annex A1.

2. Truck Mixed Concrete is that which is completely mixed in a truck mixer, 70 to 100 revolutions at the mixing speed designated by the manufacturer, to produce the uniformity of concrete indicated in AASHTO M157 Annex A1. Concrete uniformity tests shall be made in accordance with AASHTO M157 and if requirements for uniformity of concrete indicated in AASHTO M157 Annex A1 are not met with 100 revolutions of mixing, after all ingredients, including water, are in the drum, that mixer shall not be used until the condition is corrected.

When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of blades may be regarded as satisfactory. Additional revolutions of the mixer beyond the number found to produce the required uniformity of concrete shall be at a designated agitating speed.

3. Use of Non-agitating Equipment. Central-mixed concrete may be transported in suitable non-agitating equipment approved by the Engineer. The proportions of the concrete will be approved by the Engineer and the following limitations shall apply:

Bodies of non-agitating equipment shall be smooth, watertight, metal containers equipped with gates that will permit control of the discharge of the concrete. Covers shall be provided for protection against the weather when required by the Engineer.

The concrete shall be delivered to the site of the work in a thoroughly mixed and uniform mass and discharged with a satisfactory degree of uniformity as prescribed in AASHTO M157 Annex A1.

c. Discharge.

1. Time and Rate. The time elapsing from the time water is added to the mix until concrete is discharged into the forms at the site of work shall not exceed 90 minutes when hauled in truck-mixers or truck agitators, or 30 minutes when concrete is hauled by non-agitating equipment. Concrete not discharged into its final place within 90 minutes (30 minutes when using non-agitating equipment) after batching shall be wasted at no additional expense to the State.

The rate of discharge of mixed concrete from transit mixers or agitators shall be controlled by the speed of rotation of the drum in the discharge direction with the discharge gate fully open. These limits shall not be exceeded.

If the discharge of concrete is accomplished by tilting the transportation device, the surface of the load shall be restrained by a suitable baffle to prevent segregation.

Approved set-control admixtures may be used to extend the maximum time of discharge for ready-mixed concrete delivered in truck mixers to 120 minutes provided the Contractor submits trial mix data subject to the following conditions:

(a) The concrete mixture proportions and prequalification test results have been approved in accordance with **Section 601.03.1(b)**.

(b) Set-control admixture usage shall be in strict accordance with admixture manufacturer instructions and guidelines.

(c) Trial batches of the concrete mixture without the admixture (control) and additional batches covering the anticipated range of admixture doses are conducted by the contractor. Trial batch volume shall be a minimum of 3 cubic yards, and trial batches shall be conducted at the maximum water content for the approved mixture.

(d) For the control batch, only sample after initial mixing.

(e) For batches containing the set-control admixture, sample after initial mixing, and after 30, 60, 90, and 120 minutes. The truck mixer shall be kept in motion between sampling intervals.

(f) Data for each trial batch shall include plastic properties (slump, air content, unit weight, and temperature) after initial mixing, and after 30, 60, 90, and 120 minutes of slow mixing. The number of drum rotations at each sampling interval shall be reported.

(g) If plastic properties fall outside specification limits at any time interval, retesting after high speed mixing for up to 5 minutes will be allowed.

(h) Data for each trial batch shall include 7 and 28-day compressive strength results sampled after initial batching for the control; and after initial batching and 120 minutes of slow mixing for batches containing the set-control admixture.

(i) Trial batch test results shall indicate the concrete properties of mixtures containing the set-control admixture meet specification requirements after 120 minutes of slow mixing.

2. Retempering. Retempering shall be defined as adjusting concrete properties by addition of water or chemical admixtures after initial batching. Retempering concrete by adding water or other means may be permitted 1) only after concrete arrival and initial testing on the jobsite, 2) only when delivered in truck mixers, and 3) only if permitted by the Engineer. When authorized, additional water or chemical admixtures may be added to the batch materials with additional mixing to increase slump or air entrainment to meet the specified requirements, provided that:

(a) The maximum water-cementitious materials ratio is not exceeded.

(b) The admixture doses do not exceed manufacturer's recommendations.

(c) All retempering and retesting operations are completed at least 30 minutes prior to the maximum allowable discharge time limit.

All admixtures shall be added at the plant. The engineer may approve addition of withheld mixing water, water-reducing admixture adjustments, or air entrainment admixture adjustments at the jobsite by means of a metered pressurized wand. No admixture shall be added during retempering that is not present in the approved mixture. All other admixtures, (eg. mineral, set control, corrosion-inhibiting, defoaming, or other specialty admixtures) may only be added at the plant. The manufacturer's recommended dose shall not be exceeded.

Prior to allowing retempering with water-reducing admixtures on the project, trial batches shall be conducted to simulate the impact of delayed addition as follows:

- (a) Both the control and retempered batch shall contain the same plant-added admixture dose.
- (b) The retempered batch shall have the second dose of admixture added at least 30 minutes prior to the maximum discharge time.
- (c) The combination of plant added admixture dose and retempered admixture dose shall not exceed the maximum manufacturer recommended dose.
- (d) Plastic properties shall be sampled initially, at the time of retempering, and maximum discharge time.
- (e) Specimens for strength and time of set for both the control and retempered mixture shall be sampled at the maximum allowed discharge time.

No trial batches are required for retempering with air entrainment admixtures.

If additional water is to be incorporated into the concrete, the drum shall be revolved not less than 30 revolutions at mixing speed immediately after retempering the concrete and before discharge is commenced.

If additional admixtures are incorporated into the concrete, the drum shall be revolved between 30 to 60 revolutions at mixing speed immediately after retempering the concrete and before discharge is commenced.

Concrete that is not within the specified slump or air content limits at the time of placement shall not be used. The Contractor shall assume the responsibility for any concrete retempering at the site as permitted by the Engineer. Retempering with admixtures will be permitted only with the approval of the Engineer or when specifically provided for in the Contract.

601.03.4 Limitations for Mixing and Placement. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate artificial lighting system is operational and approved by the Engineer.

The Contractor, at all times during and immediately after placement, shall protect the concrete from adverse effects of rain.

When there is a probability of air temperature 40°F or less at the time and location of placement, or when there is a local forecast indicating that the temperature will be below 40°F during the 5 (cast in place masonry) or 14 (bridge deck) day curing period cold weather concreting, as defined herein and in **Subsection 601.03.5**, will apply. At least 24 hours prior to placement the Contractor shall submit for approval by the Engineer, a cold weather concreting and curing plan detailing the methods and equipment which will be used to assure that the concrete temperature does not fall below 50°F during the curing period after placement and shall be considered the protection period. Concrete mixing operations shall conform to **Subsection 601.03.5; Cold Weather Concrete**.

601.03.5 Cold Weather Concrete.

a. Plant Procedures: When concreting is authorized by the Engineer during cold weather, the aggregates and/or water may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be so arranged as to preclude the possible occurrence of overheated areas which might injure the materials. Unless otherwise authorized, the temperature of the mixed concrete shall be not less than 50°F and not more than 90°F at the time of placing it in the forms.

If the air temperature is 40°F or less at the time of placing concrete, the Engineer may require the water and the aggregates to be heated to not less than 70°F, nor more than 150°F, and be verifiable by a temperature measuring device. No frozen aggregates shall be used in the concrete.

Stockpiled aggregates may be heated by the use of dry heat or steam. Aggregates shall not be heated directly by gas or oil flame or on sheet metal over fire.

When aggregates are heated in bins, steam-coil or water-coil heating, or other methods which will not be detrimental to the aggregates, may be used. The use of live steam on or through binned aggregates will not be permitted without approval by the Engineer.

b. Concrete Placement Procedures. No concrete shall be placed on frozen subgrade. Sufficient heating devices of a type approved by the Engineer shall be installed under an enclosure or covering, capable of maintaining at all times and under all weather conditions during the protection period, a uniform concrete temperature of not less than 50°F. From days 8 to 14 of the concrete bridge deck curing period the minimum concrete temperature to be maintained shall not be less than 40°F. Heating devices shall be arranged to prevent overheating any areas of forms or concrete. Before any concrete is placed, the enclosure and heating apparatus shall be as nearly complete as the placing of the concrete will permit. The minimum temperature shall be continuously maintained around deposited concrete for the curing period of 5 days (cast in place masonry) or 14 days (bridge deck) immediately after concrete has been placed and then reduced gradually so the concrete will not be subjected to sudden change in temperature. When permitted by the Engineer, the heating period may be reduced when the concrete units involved will not be subjected to any appreciable bending stress from dead or live load until after seasonal conditions have permitted normal curing.

In general, a steam heating system may be used to supply heat during the protection period. Auxiliary devices such as stoves, covered salamanders with stacks or unit heaters shall be provided for use during the periods required for preheating the forms, reinforcing steel and previously placed concrete to 40°F minimum prior to placing the concrete, during placing of concrete, during the time required for the removal of forms and during the surface finishing operations.

When approved by the Engineer, heat for protection may be supplied by any method which will maintain the required concrete temperature of not less than 50°F. When methods other than live steam are used, provisions shall be made in the enclosure being heated to maintain a humid condition of sufficient vapor (minimum humidity of 100 percent) content to prevent the moisture in the concrete from being evaporated.

The Contractor shall provide adequate fire protection when heating is in progress and shall maintain watchmen or other attendants to keep heating units in continuous operation. The use of open fires will not be permitted.

When approved by the Engineer, concrete may be protected and cured by the use of insulating materials of sufficient thickness to properly maintain the concrete at the specified minimum temperature. The insulating materials and methods of application shall meet with the approval of the Engineer. In general, the insulating material used on vertical forms shall consist of blankets having a durable liner on the side exposed to the weather. The liners shall be asphalt-bonded to both sides of the insulating mat. The insulation material shall be applied tightly against the wood form with the nailing flanges extending out from the blanket so they can be stapled or battened to the sides of the horizontal or vertical studs, spaced as required. The top of all piers, abutments and like concrete shall be covered with the insulating blanket, tightly secured to prevent loss of heat. Areas around protruding reinforcing which cannot be protected with the insulation blankets shall be first covered with sufficient straw or hay to prevent loss of heat from the concrete. In addition to the above, tarpaulins shall be used as an overall cover on top of such concrete. Failure to attain satisfactory control and results with insulation materials will be cause for rejection.

The Contractor will keep a daily permanent record of the concrete surface temperatures throughout the curing period with the use of a 24-hour temperature recording device (disc or other approved type). The Engineer will retain these records.

During freezing weather, all keyways, anchor bolt holes or other depressions in exposed horizontal concrete surfaces shall be sealed against the admission of water, and any damage to the concrete due to the freezing of water in such depressions shall be repaired if practicable, or the concrete shall be replaced by the Contractor at his expense and as directed by the Engineer.

Although permission may be granted to mix and place concrete under the conditions described above, the Contractor is not relieved of any responsibility for obtaining satisfactory results. Unsatisfactory concrete placed under such conditions shall be removed and replaced at the Contractor's expense.

601.03.6 Hot Weather Concrete. For the purpose of these Specifications, Hot Weather shall be as defined in The American Concrete Institute Manual of Concrete Practice, 1993 Edition. During concreting operations in hot weather, appropriate measures shall be taken to reduce the hazards of increased rate of cement hydration, flash set, loss of water due to evaporation, high concrete ingredient temperatures, and the increased difficulty of concrete placing and finishing. The following requirements shall be met during concrete placement operations in hot weather:

a. Concrete Temperature. The temperature of the concrete at the point of discharge shall not exceed 90°F.

b. Cooling Materials. The Contractor may reduce the temperature of the concrete by cooling one or more of several ingredients. The aggregates may be cooled by fogging, or other suitable means which will not result in a high variation of moisture content within the stockpile. Chipped or crushed ice may be used in the mix as a portion of the mixing water on a pound for pound basis, provided such measure is determined at the time it is placed in the mix.

If used, all ice shall be melted before the batch is discharged from the mixing unit. Water may also be cooled by refrigeration or other means which provide a uniform mixing water temperature.

c. Concrete Placing. Immediately before the concrete is placed, the forms and reinforcement steel shall be cooled by spraying with water. In no case shall there be any standing water in the concrete forms as a result of the spraying procedures. The Contractor shall have sufficient skilled men and adequate equipment to place the concrete without delays which may cause excessive slump loss and evaporation due to over-mixing or exposure before it is placed.

d. Finishing. To prevent thermal and shrinkage cracking resulting from moisture loss, the Contractor may be required to furnish wind screens, to use water fogging, or other approved means of supplying moisture. Finishing operations shall follow as closely as practicable behind the placing operation so that curing may begin as soon as possible.

601.03.7 Testing of Concrete.

a. Process Control of Concrete. In the production and placement of all Portland cement concrete, the Contractor shall be responsible for the process control of all materials during the handling, blending, mixing and placement operations.

The Contractor shall have a competent and experienced concrete technician in charge of the mixing operations and overall quality control. Production control procedures shall be such to insure that the concrete produced complies with these Specifications.

The Contractor shall furnish a sufficient number of concrete curing boxes, as determined by the Engineer, that meet the requirements of **Subsection 929.03.6 para. c** of these Specifications in order to accommodate all concrete test cylinders for all specified curing locations for each concrete placement. The curing boxes will be used for curing of accepted concrete test specimens, and will be required for all classes of concrete.

b. Engineer's Acceptance Sampling, Testing and Inspection. The Engineer is responsible for sampling, testing, and inspection for acceptance, except for furnishing of necessary materials, which shall be the Contractor's responsibility as directed by the Engineer and at no additional cost to the State. Acceptance is based on the Engineer's inspection of the construction, monitoring of the Contractor's quality control program, and the acceptance test results.

The Contractor shall afford the Engineer all reasonable access without charge.

Samples of fresh concrete for testing will be taken after all concrete retempering is performed. When sampling from within the forms is impractical, samples will be taken at the nearest accessible point in the conveyance system prior to placement into the forms.

Acceptance sampling and testing will meet the requirements of the Contract and the "Master Schedule for the Preparation of a Project Schedule for Sampling, Testing, and Certification of Materials."

Whenever random samples do not meet specifications, subsequent continuous samples will be taken from each truck batched until field test results indicate that specifications are satisfied, after which time random sampling will resume.

Compressive strength test specimens will be standard 4"x 8" cylinders for all placements unless otherwise modified by the Engineer.

c. Engineer's Acceptance Plan.

The following is the acceptance plan necessary to obtain samples, perform tests and provide inspection of the work. The terms used in this acceptance plan are defined as follows:

1. **Placement.** For a given class of concrete, the portions of a concrete structure constructed during one continuous concrete operation.
2. **Acceptance Plan.** The method of taking measurements of samples for the purpose of determining the acceptability of a Placement of material or construction. Acceptance plans include random sampling plans.
3. **Random Sample.** A sample chosen in such a manner that each increment in the Lot has an equal probability of being selected. The Engineer reserves the right to take more samples, in addition to those samples taken in accordance with the random sampling plan.
4. **Acceptance.** As defined in Table 5 - Placement Acceptance Schedule.
5. **Rejection.** When used in this context "rejection" shall mean remove, dispose and replace at the Contractor's expense, or at the discretion of the Engineer "rejection" will mean acceptance at a lower price determined by Pay Factors, as specified herein.
6. **Lot.** An isolated quantity of material from a single source or a measured amount of construction produced by the same process. For Placements less than 750 cubic yards the Lot shall be 150 cubic yards or less. For Placements of 750 cubic yards or greater the Lot shall be 250 cubic yards or less.

Lots will be determined as follows:

- a) The total cubic yards for the Placement will be divided by 150 for Placements less than 750 cubic yards and 250 for Placements greater than or equal to 750 cubic yards.
 - b) The result will then be rounded up to the next whole number. This number is the number of Lots in the Placement.
 - c) The total cubic yards for the Placement in (a) will be divided by the number in (b) to determine Lot size.
 - d) Each Lot size will be adjusted by rounding to the nearest 10 CY (or other number representing one truck load), and this adjusted Lot size will be used to determine the number of trucks in the Lot.
 - e) For purposes of the acceptance plan the total cubic yards of concrete placed for all the Lots will be the Placement volume.
7. **Sublots.** Equal divisions or portions of a Lot as defined herein.

The Sublot size for each Lot will be calculated by dividing each Lot into thirds rounded to the nearest truck.

a) Cylinders will be cast for each Placement less than or equal to 150 cubic yards of concrete delivered for each class of concrete in accordance with the following:

1 truck = 4 cylinders from the 1 truck
(6 cylinders for Class MC)

2 trucks = 4 cylinders from 1 randomly selected truck
(6 cylinders from 1 randomly selected truck for Class MC)

3 trucks = 2 cylinders from each of 2 randomly selected trucks
(3 cylinders from each of 2 randomly selected trucks for Class MC)

4 thru 10 trucks = 2 cylinders from 1 randomly selected truck from the first half of the Placement and 2 cylinders from 1 randomly selected truck from the second half of the Placement.
(3 cylinders from 1 randomly selected truck from the first half of the Placement and 3 cylinders from 1 randomly selected truck from the second half of the Placement for Class MC).

11 thru 15 trucks = 2 cylinders from 1 randomly selected truck from the first third of the Placement, 2 cylinders from 1 randomly selected truck from the second third of the Placement and 2 cylinders from 1 randomly selected truck from the final third of the Placement.

b) Cylinders will be cast for each Placement greater than 150 cubic yards and less than 750 cubic yards of concrete delivered for each class of concrete in accordance with the following:

2 cylinders from 1 randomly selected truck from the first third of the Lot, 2 cylinders from 1 randomly selected truck from the second third of the Lot and 2 cylinders from 1 randomly selected truck from the final third of the Lot.

c) Cylinders will be cast for each Placement greater than or equal to 750 cubic yards of concrete delivered for each class of concrete in accordance with the following:

2 cylinders from 1 randomly selected truck from the first third of the Lot, 2 cylinders from 1 randomly selected truck from the second third of the Lot and 2 cylinders from 1 randomly selected truck from the final third of the Lot.

Sidewalk placements will have a minimum of one set of four cylinders taken from one randomly selected truck per project per day.

d. Placement Acceptance Compressive Strength Evaluation. Acceptance for compressive strength will be evaluated relative to compliance with the minimum 28 or 56 day compressive strength (f_c) specified herein for each class of concrete produced in accordance with TABLE 5 - Placement Acceptance Schedule. Acceptance for Class MC will be based on 56-day compressive strength test.

Three cylinders randomly selected from each set of 4 or 6 cylinders, as determined under “Sublots”, will be tested for either 28-day or 56-day compressive strengths.

Case A: Single Lot Placement.

The average 28 or 56 day compressive strength of 3 cylinders selected from a set of 4 or 6 cylinders and the Range, the difference between the largest and the smallest test result, will be used to calculate the acceptance of the Placement. The following formulas will be used to calculate the Placement Acceptance Test Result (PATR). The Engineer reserves the right to use Formula – B for any Lot size when more than one set of 3 cylinders are tested.

Formula - A

$$\text{PATR} = \bar{X} = \frac{X_1 + X_2 + X_3}{3}$$

$$\text{RANGE (R)} = X_{(\text{largest})} - X_{(\text{smallest})}$$

Symbols

X= individual test value which is the 28 or 56 day compressive strength of each cylinder tested.

\bar{X} = the mean (average) 28 or 56 day compressive strength of a set of 3 cylinders.

R= (Range), the difference between the largest and smallest 28 or 56 day compressive strength test result.

PATR= Placement acceptance test result.

Case B: Multiple Lot Placements.

For multiple Lot placements 3 cylinders from each set of 6 cylinders from each Lot will be tested for 28 or 56 day compressive strength. The mean value of the sum of the average compressive strengths and the mean value of the sum of the Ranges will be used to calculate the acceptance of the Placement. The following formula will be used to calculate the Placement Acceptance Test Result (PATR).

Formula – B

$$\text{PATR} = \bar{X} = \frac{\bar{X}_1 + \bar{X}_2 + \dots + \bar{X}_n}{n}$$

$$\bar{R} = \frac{R_1 + R_2 + \dots + R_n}{n}$$

Symbols

\bar{X} = the mean (average) 28 or 56 day compressive strength of a set of 3 cylinders for each Lot.

\bar{X} = the mean (average) of the sum of the average 28 or 56 day compressive strength test result of each Lot.

\bar{R} = the average of the sum of the Ranges (R) for each Lot.

n = number of sets.

Concrete will be evaluated for acceptance in accordance with Table 5 - Placement Acceptance Schedule, on the basis of the calculated Placement Acceptance Test Results (PATR).

Table 5
Placement Acceptance Schedule

Placement Acceptance Test Result (PATR) $(\bar{X} \text{ or } \bar{X})$	Pay Factor (PPF)
Not less than $f'c + 0.21 R$ (or \bar{R})	1.00
Not less than $f'c + 0.04 R$ (or \bar{R})	0.95
Not less than $f'c - 0.10 R$ (or \bar{R})	0.70
For less than $f'c - 0.10 R$ (or \bar{R})	0.50

1. $f'c$ is the specified 28-or 56 day compressive strength. —
2. Range R (or \bar{R}) is the difference between the results of the largest and smallest Lot acceptance test results.

Acceptance of the Placement at the 0.95 Placement Pay Factor (PPF) in lieu of remove, dispose and replacement of the Placement will be at the request of the Contractor and approval by the Engineer.

Acceptance at the 0.70 or 0.50 Placement Pay Factor (PPF) in lieu of remove, dispose and replacement will be as determined by the Engineer on the basis of the effect of the non-conforming Lot on the structural and durability integrity of the concrete structure.

The Contractor may elect to remove and dispose any non-conforming material and replace it with new material to avoid a PPF of less than 1.00. Any such new material will be sampled, tested, and evaluated for acceptance in accordance with the applicable requirements of this **SECTION 601**.

The Engineer may reject any quantity of material which appears to be non-conforming based on visual inspection or test results. Such rejected material shall not be used in the work and the results of the tests run on the rejected material will not be included in the calculation of the Placement Acceptance Test Results.

601.03.8 Curing.

a. Curing Plan. The Contractor shall submit to the Engineer for approval a plan detailing his scheme for achieving the curing of the concrete for the various structural elements as required by these Specifications. This detailed plan shall include, but is not limited to, the following:

1. Curing method.

2. Providing for enclosures, indicating method of holding down enclosure safely in place.
3. Heat devices, types and location around the structure.
4. Method of monitoring the temperature of hardened concrete.
5. Back up systems as required.

The temperature on the surface of the hardened concrete shall not fall below 50⁰F at any time during the first 5 days of curing.

Curing operations on all exposed surfaces shall commence immediately after the placing and finishing operations have been completed. The method of curing selected shall be that allowed under the various concrete items and shall be continued throughout the work unless the Engineer determines that the curing plan results in unsatisfactory concrete curing.

Any changes in the method of curing must be authorized in writing. In all cases in which curing requires the use of water, the curing shall have prior right to all water supply or suppliers. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than ½ hour between stages of curing and during the curing period. All newly placed concrete shall be cured in accordance with the methods set forth in these Specifications.

b. Water Method. The concrete shall be kept continuously wet by the application of water for a minimum period of 7 days after the concrete has been placed.

Cotton mats, rugs or carpets may be used as a curing medium to retain the moisture during the curing period. When cotton mats, rugs or carpets are to be used to retain the moisture, the entire surface of the concrete shall be kept damp by applying water with a nozzle so that the flow is atomized in the form of a mist rather than a spray, until the surface of the concrete is covered with the curing medium. The moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow or wash the surface. At the expiration of the curing period, the concrete surfaces shall be cleared of all curing mediums.

When concrete bridge decks and flat slabs are to be cured without the use of a moisture retaining medium, the entire surface shall be kept damp by the application of water with an atomizing nozzle as specified in the preceding paragraph, until the concrete has set, after which the entire surface of the concrete shall be sprinkled continuously with water for a period of not less than 7 days.

c. Curing Compound Method. Concrete that is treated with any additional coatings or overlays shall not be cured as provided in this Section.

Surfaces of the concrete which are exposed to the air shall be sprayed uniformly with a curing compound.

Curing compound shall be applied at a rate in accordance with the manufacturer's recommendation.

Runs, sags, thin areas, skips, or holidays in the applied curing compound shall be evidence that the application is not satisfactory. If a clear color curing compound is used, a fugitive dye shall be added to the curing compound to insure complete coverage.

Curing compounds shall be applied using power operated atomizing spray equipment. The power operated spraying equipment shall be equipped with an operational pressure gauge and a means of controlling the pressure.

The curing compound shall be applied to the concrete following the surface finishing operation immediately before the moisture sheen disappears from the surface, but before any drying, shrinkage, or craze cracks begin to appear. In the event of any drying or cracking of the surface, application of water with an atomizing nozzle as specified above for the "Water Method," shall be started immediately and shall be continued until application of the compound is started or resumed. However, the compound shall not be applied over any resulting freestanding waters. Should the film of compound be damaged from any cause before the expiration of 7 days after the concrete is placed in the case of structures and 72 hours in the case of pavement, the damaged portion shall be repaired immediately with additional compound.

All curing compounds shall remain sprayable at temperatures above 40°F. They shall not be diluted or altered in any manner after manufacture.

When the curing compound is shipped in tanks or tank trucks, a shipping invoice shall accompany each load. The invoice shall contain the same information as that required herein for container labels.

Curing compounds may be sampled by the Engineer at the source of supply or at the job site, or at both locations.

The curing compound shall be used within 120 days of its manufacture.

All tests will be conducted in accordance with the latest test methods of the American Society for Testing Materials.

d. Waterproof Membrane Method. The exposed finished surfaces of concrete shall be sprayed with water, using a nozzle that atomizes the flow so that a mist and not a spray is formed, until the concrete has set, after which the curing membrane shall be placed. The curing membrane shall remain in place for a period of not less than 72 hours.

Sheeting material for curing concrete shall conform to the specifications of AASHTO M171 for white reflective materials.

The sheeting material shall be fabricated into sheets of such width as to provide a complete cover for the entire concrete surface. All joints in the sheets shall be securely cemented together in such a manner as to provide a waterproof joint. The joint seams shall have a minimum lap of 6 inches.

The sheets shall be securely weighted down by means satisfactory to the Engineer. No rocks, sand or loose debris shall be used as ballast.

Should any portion of the sheets be broken or damaged before the expiration of 72 hours after being placed, the broken or damaged portions shall be immediately repaired with new sheets properly secured into place.

Sections of membrane which have lost their waterproof qualities or have been damaged to such an extent as to render them unfit for curing the concrete shall not be used.

e. Forms-In-Place Method. Formed surfaces of concrete may be cured by retaining the forms in place. The forms shall remain in place for a minimum period of 7 continuous days after the concrete has been placed, except that for members over 20 inches in least dimension the forms shall remain in place for a minimum period of 5 continuous days. The forms shall be removed no later than 3 weeks maximum.

All joints in the forms and the joints between the end of forms and concrete shall be kept moisture tight during the curing period. Cracks in the forms and cracks between the forms and the concrete shall be resealed by methods subject to the approval of the Engineer.

f. Curing Precast Concrete Members. Precast concrete members shall be cured for not less than 7 days in conformance with "Water Method," steam curing, or by radiant heat at the option of the Contractor. Steam curing for precast members shall conform to the following provisions:

1. After placement of the concrete, members shall be held for a minimum 4-hour presteaming period. If the ambient air temperature is below 50°F, steam shall be applied during the presteaming period to hold the air surrounding the member at a temperature between 50 and 90°F.

2. To prevent moisture loss on exposed surfaces during the pre-steaming period, members shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.

3. Enclosures for steam curing shall allow free circulation of steam about the member 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 to prevent the loss of steam and moisture.

4. Steam at the jets shall be low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam the temperature rise within the enclosure shall not exceed 40°F per hour. The curing temperature throughout the enclosure shall not exceed 150°F, and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. 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. Calibrated temperature recording devices that will provide an accurate continuous permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 100 feet of continuous bed length will be required for checking temperature.

6. Once minimum transfer compressive strength is achieved, members in tension shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm or the temperature under the enclosure shall be maintained above 60°F until the stress is transferred to the concrete.

7. Initial curing of precast concrete will be considered complete once specified transfer strength is verified by compressive strength test results.

8. Radiant heat may be applied by means of pipes circulating steam, hot oil or hot water, or by electric heating elements. Radiant heat curing shall be done under a suitable enclosure to contain the heat and moisture loss and shall be minimized by covering all exposed concrete surfaces with plastic sheeting.

If the Contractor proposes to cure by any other special method, the method and its details shall be subject to the approval of the Engineer.

601.03.9 Method for Placement of Portland Cement Concrete by Pumping. Placement of concrete by pumping will be permitted as approved by the Engineer. The equipment shall be so arranged that no vibrations result which might damage freshly placed concrete. Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall be suitable in kind and adequate in capacity for the work. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. To facilitate the continuity of the stream, an elbow is required at the end of the discharge trunkline. When pumping is completed, the concrete remaining in the pipeline, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients.

Concrete shall be placed so as to avoid segregation of materials and displacement of reinforcement. Prior to the actual placement of concrete, the Engineer may require the Contractor to demonstrate the capability of the equipment to convey the concrete mixture to maintain the specified quality. No further verification of the equipment's capability will be required unless evidence of nonuniform concrete is observed by the Engineer during placement.

Concrete shall not come in contact with aluminum during conveying and placing operations. The lines shall have a minimum diameter of 5 inches. The specific pumping equipment which the Contractor proposes to use shall be subject to the approval of the Engineer.

All chutes, troughs and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run; water used for flushing shall be discarded clear of the concrete already in place.

Dropping concrete a distance of more than 5 feet or depositing a large quantity at any point and running or working it along the forms shall not be permitted.

Special care shall be taken to fill each part of the form by depositing concrete directly in the form as near to its final position as possible, to work the coarser aggregates back from the face of the concrete and to force the concrete under and around the reinforcement. After the concrete has taken its initial set, care shall be exercised to avoid jarring the forms or placing any strain on the ends of projecting reinforcement.

The Contractor shall have the option to submit for approval by the Engineer a "pump" mix design formula of the concrete mixture to be used with the specific pumping equipment. The concrete mixture shall meet the specific requirements of paragraph entitled "Proportioning" for air content, cement factor and slump for the various classes of concrete specified.

601.04 METHOD OF MEASUREMENT. "Portland Cement Concrete" will be measured as provided for in the Specifications and/or Special Provisions for the particular item or items under which it is paid.

601.05 BASIS OF PAYMENT. "Portland Cement Concrete," complete in place and fully accepted, will be paid for as provided in these Specifications. These payments constitute full compensation for furnishing all labor, materials, equipment, tools, and incidentals to produce, place, and protect the concrete as herein specified, in addition to any requirements in the Specifications for the particular use, except that a reduction in payment will be made for each Placement of Concrete not fully accepted. This reduction in payment for Placement will be based on the following:

Case 1: For concrete for which a unit price is provided in the Proposal:

Unit price reduction = $(1.00 - \text{PPF}) \times$ the unit bid price in the Proposal

Case 2: For concrete which is paid for as part of a lump sum item or lump sum items as listed in the Proposal:

1. $(1.00 - \text{PPF}) \times$ the price of the various items of concrete per cubic yard as provided in the approved Contractor's Lump Sum Breakdown

PPF is the pay factor determined in **Subsection 601.03.7(d)**.

Revise **Subsections 602.03.1; Fly Ash** and **602.03.3; Ground Granulated Blast Furnace Slag**, page 6-27 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 602

MINERAL ADDITIVES FOR PORTLAND CEMENT CONCRETE

- **Replace Subsection 602.03.1 with the following.**

602.03.1 Fly Ash. Fly ash shall be substituted or added to Portland cement in the amounts specified in the Contract Documents. If no quantity has been so-specified the Contractor has the option of substituting fly ash for Portland cement up to 15 percent by weight on a 1-to-1 ratio.

The fly ash supplier shall maintain a quality control program open for inspection by the State as deemed by the Engineer.

- **Replace Subsection 602.03.3 with the following.**

602.03.3 Ground Granulated Blast Furnace Slag. Ground granulated blast furnace slag shall be substituted or added to Portland cement in the amounts specified in the Contract Documents. The use of ground granulated blast furnace slag shall be in accordance with the requirements of **Subsection M.02.06.3** of these Specifications.

Prequalification of a source may be based upon test results by the Department's laboratory or a certified report of test results by a Cement Concrete Reference Laboratory (CCRL) approved or nationally recognized independent laboratory attesting that the material is in full compliance with these Specifications.

Delete **Section 604, Class HP(AE) Portland Cement Concrete**, pages 6-32 and 6-33 of the RI Standard Specifications for Road and Bridge Construction in its entirety.

SECTION 604

CLASS HP(AE) PORTLAND CEMENT CONCRETE

[SECTION DELETED]

Revise **Section 605, Concrete with Calcium Nitrite Based Corrosion Inhibitor**, pages 6-34 and 6-35 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 605

CONCRETE WITH CALCIUM NITRITE BASED CORROSION INHIBITOR

- **Replace Subsection 605.02.2(a); Concrete Mix Design Approval Process – Rate, with the following.**

605.02.2 Concrete Mix Design Approval Process.

a. Rate. Calcium nitrite based corrosion inhibitor shall be added at a rate specified in the Contract Documents per cubic yard with a tolerance of +/- 1 percent.

- **Delete Subsection 605.03.1; Sampling of Calcium Nitrite Based Corrosion Inhibitor.**

605.03.1; Sampling of Calcium Nitrite Based Corrosion Inhibitor. [Deleted]

Add the following new **Section 606, Self-Consolidating Concrete** to the RI Standard Specifications for Road and Bridge Construction.

SECTION 606

SELF-CONSOLIDATING CONCRETE (SCC)

606.01 DESCRIPTION. This Specification covers the requirements for modifying all Classes of concrete mix designs, except Classes “B” and “Z”, for self-consolidating applications. Concrete containing this admixture shall conform to the applicable requirements of **PARTS 600 and 800** of these Specifications, together with the additional provisions set forth below.

606.02 MATERIALS. All concrete material components shall conform to the requirements of **SECTION M.02; PORTLAND CEMENT CONCRETE** of these Specifications with the following additional provisions.

606.02.1 Chemical Admixture for SCC. SCC admixture shall be a viscosity modifying admixture and shall conform to the requirements of **Subsection 601.02.2**, ASTM C494 Type A & F and be on the Approved Product Listing.

606.02.2 Concrete Mix Design Approval Process. Proportioning of ingredients and the design and approval of mixtures shall conform to the requirements of **Paras. a** and **b** of **Subsection 601.03.1** of these Specifications, together with the following additional provisions:

a. Rate. SCC generating chemical admixture shall be added at a rate that is recommended by the admixture manufacturer with a tolerance of ± 3 percent by weight.

b. Water-to-Cementitious Ratio. The maximum water to cementitious matter by weight ratio shall be 0.36.

c. J-Ring Test. During the trial batch, the mix shall be tested in accordance with ASTM C 1621. The difference between the slump flow and J-Ring shall be a maximum of 2 inches. This will ensure that the mix will not be in the ‘noticeable to extreme blocking’ range. If the difference is greater than 2 inches, the mix will be revised and retested prior to approval.

606.03 CONSTRUCTION METHODS. Construction methods shall conform to the applicable requirements of **Sections 600 and 800** of these Specifications except as modified below.

606.03.1 Sampling of SCC Admixtures. A sample of SCC admixture may be taken by a Department representative. Sampling and approval of SCC admixtures shall conform to **Subsection 601.02.2** of these Specifications.

606.03.2 Placement and Finishing of SCC. The placement of SCC shall be in accordance with **Sections 600 and 800** of these Specifications where applicable, except that a minimal amount of concrete vibrating is necessary to prevent segregation of SCC.

606.03.4 Testing of SCC. The testing of SCC shall be in accordance with **Subsections 601.03.7, 809.03.09 and 816.03.6** where applicable except the following:

Slump Flow Test. This test will be in lieu of the conventional slump test. The slump flow range shall be 23 in. \pm 3 in. measured diameter as per ASTM C1611.

606.04 METHOD OF MEASUREMENT. The SCC admixture required for “Self-Consolidating Concrete” will not be measured for payment.

606.05 BASIS OF PAYMENT. No separate payment will be made for the addition of the SCC admixture required for “Self-Consolidating Concrete.” Portland cement concrete with SCC admixture will be paid for under the appropriate item or items as listed in the Proposal.

Add new **Section 607, MASS CONCRETE** to the RI Standard Specifications for Road and Bridge Construction.

SECTION 607

MASS CONCRETE

607.01 DESCRIPTION. This specification covers the requirements for concrete used in mass concrete elements. Concrete proportioned for mass concrete applications shall conform to the applicable requirements of **PARTS 600** and **800** of these specifications, together with the additional provisions set forth below.

607.01.1 DEFINITIONS. Mass Concrete is defined as any elements so specified on the Plans and any other concrete pour where the ratio of the total volume to the surface area of the element equals or exceeds 0.6 and has a minimum dimension of 3 feet in any of the three planes. Calculation of the ratio shall be performed based on all dimensions measured in feet.

Requirements for mass concrete construction include laboratory testing, thermal modeling, temperature monitoring, and providing concrete temperature control before, during, and after placement. All testing shall be performed at a laboratory with recognized AASHTO accreditations for performing the required tests (AASHTO T22, AASHTO T23, AASHTO T121, AASHTO T152, ASTM C1064, ASTM C1074), with the provision that no exception is taken by the Engineer with the Contractor's choice of laboratory.

The peak temperature is defined as the average of the values measured at any given time by the two temperature sensors placed at the location of the highest temperature as determined by the thermal model for the structural element. The highest acceptable peak temperature is 155°F.

The differential temperature is defined as the difference in values measured at any given time between the temperature sensor(s) in any given location (or the average, if two sensors placed in the location) in the structural element and the peak temperature as defined above. The highest acceptable differential temperature until the completion of temperature control is 35°F.

The performance-based differential temperature is defined as a limit that changes as the concrete gains strength, determined as a function of the established maturity curve for the mix. The benefit of this method is a potential acceleration of the production schedule over the use of a fixed limit. This option may be considered by the Engineer, with the proper submission of an implementation plan for the process as described herein, after the contractor has demonstrated compliance with the specifications of the concrete mix during batching, placement and curing.

607.02 MATERIALS AND EQUIPMENT.

607.02.1. CONCRETE. The concrete shall meet the applicable material requirements of **SECTION 808** and **SECTION 601**. Unless specified in the contract documents, calcium nitrite based corrosion inhibitor shall not be used in Mass Concrete mixtures. Any proposed mixture adjustment that meets the

requirement in **SECTION 601** for a new approval of the mix design will also require a new approval of the mass concrete temperature control plans per this specification.

607.02.2 TEMPERATURE AND MATURITY RECORDING. Primary temperature measuring loggers shall be designed specifically for determining the maturity of concrete in accordance with ASTM C1074. They shall operate in the range of 0°F to 212°F to an accuracy of +/- 1°F and internally record the time and temperature at a minimum of 1 hour intervals for a minimum of 90 days. Each logger shall have a unique serial number and shall upon download of the information using the compatible reader or other appropriate data connection, produce a secure (unalterable) Windows PC-readable file that identifies the logger by its serial number and the start date. Software shall be provided to develop maturity curves to predict strength and display the temperature versus time data for all of the loggers in a given placement.

The data leads shall be sized to reach from the logger's installed location to an accessible site where a handheld reader can be employed. A data cable that can connect the loggers to a notebook computer or other standard mobile device will be considered equivalent to a handheld reader, providing a Windows PC-readable file can be created that can be transferred to a Windows PC. The Contractor shall provide a reader and necessary software for the exclusive use of the Engineer. The reader and software provided for the Engineer shall become the property of the State at the completion of the project.

The loggers selected by the Contractor shall have the capability to use battery operated Wireless Remote Boxes for the downloading of data. The transmission range of the system shall be sufficient to provide a reliable connection to both the Contractor's and Engineer's field offices. A Windows PC-Compatible Wireless System Radio Base Station shall be provided and capable of downloading the data file as described above. The Wireless System Radio Base Station shall be maintained by the Contractor for monitoring the mass concrete placement. An additional Wireless System Radio Base Station shall also be provided for the Engineer's field office. The additional device and associated software provided for the Engineer shall become the property of the State at the completion of the project.

The requirement for a wireless communications system may be waived by the Engineer, if the Engineer determines that access to the placement does not warrant it.

The Contractor shall provide the Engineer recording equipment that will allow intermediate downloading of measurements to a computer without restarting the logger. The recording equipment provided for the Engineer shall become the property of the State at the completion of the project. An automatic temperature monitoring system shall be provided with email, phone, or text message alarm capability to notify the Contractor when temperature control limits are about to be exceeded.

The Contractor must submit technical literature on the complete maturity logger system, including the loggers, handheld reader, wireless system, software and any other components to the Engineer for approval prior to the first mass concrete placement. This shall include manufacturer contact information for the responsible technical representative and product performance history showing at least one year of successful use of the complete system on a minimum of three projects with mass concrete placements comparable to those within the scope of this project. Contact information shall be provided for the project owners. No mass concrete placements shall proceed until approval of the maturity logger system has been given in writing by the Engineer.

607.03 SUBMITTALS.

607.03.1 Mass Concrete Temperature Control Plans. As part of the submittals, the Contractor shall submit a "Mass Concrete General Temperature Control Plan" for approval prior to the first mass concrete placement and shall be stamped by a Rhode Island Registered Professional Engineer. This shall show the general procedures proposed for temperature control. A "Mass Concrete Specific Temperature Control Plan" shall be prepared for each unique placement and shall be based on the general plan. Each specific temperature control plan shall provide guidance for the Contractor, developed based on a concrete hydration temperature model, to indicate when the peak and differential temperatures might exceed the specification limits. The guidance shall provide specific concrete placement temperature restrictions based on anticipated ambient temperatures and other environmental factors, passive and active cooling, and insulation practices that could produce peak or differential temperatures that require remedial action. Guidance shall also be provided on appropriate remedial actions to be taken when concrete temperatures approach specification limits. At a minimum, these guidelines shall take effect when the concrete peak temperature reaches 3°F below the specification limit of 155°F and when the differential temperature reaches 2°F below the specification limit of 35°F or the temperature value at the specified maturity, for the variable differential limit, (if approved). Each specific plan shall be submitted for approval prior to the placement and shall be stamped by a Rhode Island Registered Professional Engineer. Costs related to the development of Mass Concrete Temperature Control Plans shall be considered incidental to the project, and will not be paid for separately.

Approval of any Mass Concrete Temperature Control Plan by the Engineer will not relieve the Contractor of his responsibility to maintain concrete temperatures within specification limits.

a. General Mass Concrete Temperature Control Plan. The General Mass Concrete Temperature Control Plan shall include the following:

1. Concrete mixture proportions, indicating aggregate sources and physical properties, cementitious material sources, and admixture product names and doses for each concrete mixture. The Class MC concrete mixture design and prequalification test results shall be submitted for approval separately.

2. Anticipated mass concrete placement schedule, including proposed concrete mixture adjustments for the full range of conditions that may occur during placement and curing operations.

3. Concrete temperature rise for each mixture shall be tested directly in an adiabatic concrete calorimeter cast from laboratory trial batches using the same material sources and proportions as intended for use on the project.

4. Concrete compressive strength development in standard moist curing environment (73.5 ± 3.5 deg F) at 3, 7, 14, 28, and 56 days for each mixture, based on the average of three 6" x 12" cylinders for each age. Cylinders shall be cured and tested per AASHTO T22. Cast a temperature sensor in the center of two additional cylinders and cure these cylinders alongside those used for compressive strength. Record the average temperatures of the cylinders hourly. Report the compressive strength and maturity for each specimen at each test age and the average values.

5. Calculate and report the concrete strength development-maturity equation for each mixture from the standard cured strength results as described in ASTM C 1074 "Estimating Concrete Strength by

the Maturity Method".

6. Demonstration Mock-up(s) shall be performed at least 60 days prior to the first scheduled Mass Concrete Placement. The Contractor shall cast at least one mock-up to verify that the concrete thermal properties and temperature control procedures required for the Mass Concrete General Temperature Control Plan are adequate to meet the specification limits. The mock-up(s) shall use the same concrete mixture proportions and materials, form materials, curing materials, and monitoring devices defined in the General Temperature Control Plan, and shall use the same batching and placing operation to be used for the project. The mock-up shall be a cube or other element measuring 4 ft or more in the least dimension. Temperature monitoring of the mock-up shall be as specified in the General Mass Concrete Temperature Control Plan and shall continue for at least seven (7) days. As a minimum, the demonstration mock-up shall be insulated with R-20 insulation on all sides. If alternate insulation, cooling, or curing options are proposed, a separate demonstration mock-up cube shall be cast and instrumented for each alternate. The engineer responsible for the design of the temperature control plan shall be present at the placement for each mock-up.

Sensor placement:

- a. Two sensors shall be located at the center of the mock-up. The average of these two shall be used.
- b. Two sensors shall be located within one inch from the top surface located directly above the center of mass sensors. The average of these two shall be used.
- c. Two sensors shall be located within one inch from the center of a vertical face. The average of these two shall be used.
- d. Two sensors shall be located in an upper corner of the cube. The average of these two shall be used.
- e. One sensor shall be used to record the ambient temperature. This sensor shall be placed at approximately ten (10) feet from the placement, in a shaded area.

Note: A 5°F or greater variation between sensors of a paired set, or erratic variations or outright failure of a sensor shall be brought to the attention of the Engineer immediately upon discovery of the problem. At the time of the notification, the Contractor shall provide the Engineer with a course of corrective action for approval. If the approved corrective action requires that the data from one sensor in a pair no longer be used, the other functioning sensor shall be used solely for the peak and maximum differential temperature measurements.

From the concrete batched for the mock-up, the Contractor shall have tests conducted for air content (AASHTO T152), placement temperature (ASTM C1064, unit weight (AASHTO T121) and fabricate cylinders (per AASHTO T23) from the same concrete by an ACI Certified Concrete Field Technician Level I. The cylinders shall be tested for compression strength by an AASHTO Accredited independent concrete testing laboratory (AASHTO T22) at 3, 7, 14, 28, and 56 days. The Contractor shall coordinate the mock-up with the Engineer, and shall provide the State at least one week advance notice of the casting date. The Engineer shall be provided the opportunity to witness the placement and functioning of temperature recording sensors prior to casting, and may perform concrete property tests

on companion samples selected by the Engineer.

If a mix design has been approved for mass concrete placement prior to the scheduled first placement for this project and the testing conforms to these standards, the Engineer may waive the requirement of **Subsection 607.03.1(a.1)** through **607.03.1(a.6)**. However, any requirements for testing/analysis added after the aforementioned mix design was approved shall still be performed, with the exception that mix designs previously approved using data derived from semi-adiabatic testing will not require re-testing per the above requirements. If the approved mix design has already had a mock-up performed previously and the criteria matches that for the applicable temperature control plan, the Engineer may accept the results of the previous mock-up instead of running a new one.

A letter report documenting the concrete properties and temperatures developed in the mock-up compared against the thermal analysis contained in the General Mass Concrete General Temperature Control Plan models shall be submitted as part of the General Temperature Control Plan. Any revisions/corrections required to the General Mass Concrete Temperature Control Plan for differing ambient conditions shall be outlined in the letter report. Strength results may be submitted separately.

If the project involves four or less unique mass concrete placement designs, the Engineer may waive the requirement for a General Mass Concrete Temperature Control Plan. If waived, the Specific Mass Concrete Temperature Control Plans shall meet all of the requirements listed above.

b. Specific Mass Concrete Temperature Control Plans. Each Specific Concrete Temperature Control Plan shall include the following:

1. Form and form liner R-value and anticipated time of form removal.
2. Insulating material(s) R-value and anticipated periods of use.
3. Curing procedure and duration.
4. Thermal modeling analysis for typical placement scenarios shall be provided. The analysis shall incorporate, but not be limited to: A range of anticipated ambient placement temperatures, anticipated water temperatures for active cooling, effects of water temperature for placements in water, effects of convection cooling in locations where high winds may be a factor, anticipated concrete placement temperatures, assumed R-values for concrete forms and insulation, and shall calculate maximum core and surface temperatures vs. time after placement. The impact of planned construction activities, such as form removal, shall be included in the analysis. Concrete strength at form removal shall be estimated from the maturity relationship using the lowest calculated maturity value shown by the sensors placed within the concrete.
5. Drawings identifying temperature monitoring locations for each placement, and product data for all sensors and recording instrumentation shall be provided. With the exception of the ambient sensor, the sensors shall be installed in pairs for the redundancy. The minimum number of automated temperature monitoring locations shall be nine (9) per element for placements less than 500 yd³, and seventeen (17) for placements 500 yd³ or larger. Minimum sensor locations are noted below. Each of the sensors in a pair shall be placed in separate locations, no less than 6" and no more than 18" apart: The relative locations shall be as shown for the mock-ups.

- a. Two sensors shall be placed in the center of thermal mass of the placement, where the peak

temperature will occur. This location shall be based on the isocurves developed for the model, with the approval of the Engineer. The average of the two will be used to determine the peak temperature at any given time and to measure the maximum temperature differential in the placement based on the difference between the peak temperature and each sensor location at any given time. The average of the two sensors shall be used.

b. Two sensors shall be placed at the location as determined by isocurves developed for the model that shows the point where the lowest temperature is predicted during temperature control. The average of the two sensors shall be used.

c. Two sensors shall be located within one inch from the top surface located directly above the center of thermal mass sensors. This location may be adjusted, based on the isocurves developed for the model, with the approval of the Engineer. The average of the two sensors shall be used.

d. Two sensors shall be located within one inch from the center of vertical formed surfaces at mid-height. This location may be adjusted, based on the isocurves developed for the model, with the approval of the Engineer. The average of the two sensors shall be used.

e. One sensor shall be used to record the ambient temperature. This sensor shall be placed at approximately ten (10) feet from the placement, in a shaded area.

f. The Contractor shall also provide up to four (4) additional sensor pairs to be located at the discretion of the Engineer.

g. Use similar sensor distribution for placements greater than 500 yd³.

Note: A 5°F or greater variation between sensors of a paired set, or erratic variations or outright failure of a sensor shall be brought to the attention of the Engineer immediately upon discovery of the problem. At the time of the notification, the Contractor shall provide the Engineer with a course of corrective action for approval. If the approved corrective action requires that the data from one sensor in a pair no longer be used, the other functioning sensor shall be used solely for the peak and maximum differential temperature measurements.

Following a mass concrete pour, the Engineer may require the Contractor to perform thermal modeling analysis of the placement using actual concrete and ambient temperatures to evaluate the effects of construction practices such as, but not limited to, form removal or curing. If required, this shall be performed at no additional cost to the State.

Procedures for achieving temperature restrictions including contingencies for severe weather events shall be provided. Procedures may incorporate either active (cooling pipes) or passive control methods (insulation, tenting, venting, etc.) or both. The Temperature Control Plan shall show the expected duration of all temperature control measures for each model condition provided.

If cooling pipes are proposed, submit detailed description of the system describing the layout and size of pipes, anticipated coolant flow rate, temperature of the raw coolant source, pump size, flow and recirculation control equipment, instrumentation, coolant temperature control procedure, and contingency plans.

607.03.2 Performance-Based Variable Temperature Differential Limit. After the Contractor has established, to the satisfaction of the Engineer, that proper control can be maintained of the concrete mix properties, including curing temperatures, the Contractor shall have the option of submitting a plan to use a performance-based criteria for a variable differential limit, based on the concrete strength as determined by the maturity at any given time. This will supersede the 35°F limit. Failure to maintain proper temperature control under this plan will result in reversion to the 35°F limit for subsequent placements until such time that the Contractor demonstrates to the Engineer that causes for the loss of control have been identified and corrected. Temperature control will be considered to have failed if one of the following conditions occurs:

- The differential exceeds the variable value by more than 3°F at any time during the first 40 hours after placement.
- The differential exceeds the variable value by more than 5°F at any time after the first 40 hours after placement during temperature control.
- The differential exceeds the variable value by 2°F or more for any period of 8 hours or more at any time during temperature control.
- Cracking of the placement determined to be the result of thermal issues will also be considered to be failure of the temperature control and will result in reversion to the 35°F limit, as well as triggering the provisions specified in **Subsection 607.05.4**.

Plan Submission Requirements. The Contractor's written implementation plan shall include complete back-up data such as, but not limited to, listing of all assumptions used in the analysis, published reference documents, coefficient of the thermal expansion for the mix being placed, tensile strength development versus maturity equations for the mix being placed, elastic modulus versus maturity equations for the mix being placed, example implementation of the method using a predicted thermal gradient analysis and complete test data justifying the prediction equations for the proposed mixture. Each placement shall also include a specific plan with an assumed restraint factor, consideration of the placement geometry and other factors that can affect the differential limit. The other factors shall include, but not be limited to, anticipated concrete placement temperature, ambient temperatures, cooling water temperature (if active cooling is used), convection effects from wind and design elements of the temperature control plan.

For acceptable demonstration of the submission of an implementation plan, the Contractor may use a mass concrete pour defined and conducted using the 35°F differential limit. The gradients predicted in the thermal model for the performance-based temperature limit shall match the actual temperatures to the satisfaction of the Engineer. It shall have as a minimum a set of at least eleven temperature/maturity sensors. Locate sensors as follows:

1. At the location of the maximum temperature, at least one sensor shall be placed as defined in **Subsection 607.03.1(b.5.a)**;
2. Near the formed surface, at least one sensor shall be placed as defined in **Subsection 607.03.1(b.5.b)**;
3. Near the top surface, at least one sensor shall be placed as defined in **Subsection 607.03.1(b.5.c)**;

4. A minimum of two equally spaced between the location of the maximum temperature and top surface sensor in an approximate straight line configuration;
5. A minimum of two equally spaced between the location of the maximum temperature and formed surface sensor in an approximate straight line configuration;
6. At the location of the minimum temperature, at least one sensor shall be placed as defined in **Subsection 607.03.1(b.5.d)**;
7. A minimum of two equally spaced between the location of the maximum temperature and the location of the minimum temperature, in an approximate straight line configuration;
8. One sensor shall be used to record the ambient temperature remote from the placement, as defined in **Subsection 607.03.1(b.5.e)**.

For items 1, 2, 3 and 6, the sensors may be the same as those used for the actual temperature control of the placement as specified in **Subsection 607.03.1(b)**. While redundant sensors are not required, failure at any of the required locations without a backup will invalidate the results.

The performance-based temperature limit plan shall be submitted for approval prior to the first placement for which it is proposed to be used and shall be stamped by a Rhode Island Registered Professional Engineer. Should the plan be approved by the Engineer, this will become the standard sensor distribution for as long as this plan is in effect and shall be used to verify the accuracy of the performance-based temperature limit plan thermal model for each placement. The plan shall show a relationship between the maturity and the appropriate maximum acceptable temperature differential that will prevent cracking of the concrete. The relationship shall be shown in tabular form, at intervals of one (1)°F for the first forty (40) hours after placement and two (2)°F for more than forty (40) hours after placement, to a minimum of fourteen (14) days. The maturity value used to determine the appropriate differential at any given time shall be the lowest measured within the placement.

607.04 CONSTRUCTION METHODS. Applicable construction requirements for **SECTION 808; CAST-IN-PLACE STRUCTURE CONCRETE MASONRY** and **SECTION 601; PORTLAND CEMENT CONCRETE** shall apply, with the following additions:

607.05 TEMPERATURE CONTROL REQUIREMENTS.

607.05.1 Temperature Control. Mass concrete temperature control shall be monitored by maturity loggers cast into the concrete, as described in **Subsection 607.03.1**. Use of low heat concrete mixtures, pre-cooling of the concrete, insulated curing blankets, insulated forms, cooling pipes, and other measures may be necessary to satisfy the temperature control requirements.

The Contractor shall notify the Engineer immediately when temperature control limits are exceeded.

Complete concrete temperature records for each placement including the secure files generated by the automated temperature sensors shall be provided to the Engineer. The Engineer shall be provided unobstructed access to temperature sensors at any time to verify compliance with temperature control

criteria.

a. When forms are placed in water, the forms and insulation shall be waterproof or otherwise protected against water absorption. The required combined form and insulation R-Value shall be determined through thermal analysis prior to placement using forecasted temperatures to meet the requirements to maintain the maximum peak and differential temperatures within the limits defined in its specification.

b. The temperature of the concrete at placement must not exceed 65°F for cold weather placements, nor 85°F for hot weather placements, unless active temperature control precautions are employed. All active temperature control piping shall be non-metallic and shall be filled with a non-shrink grout on the RIDOT Approved Products List upon completion of cooling operations. The temperature of the concrete at placement shall be within the acceptable range of values shown in the temperature control plan for the structural element.

c. Temperature sensors shall be maturity loggers as described in **Subsection 607.02.2**. The logger shall be programmed with the appropriate datum temperature.

d. Wiring for loggers that must be cast into the concrete shall be secured to reinforcing or otherwise protected to prevent damage during concrete placement. The method of protection of the wires cast into the concrete shall be approved by the Engineer and shall use methods satisfactory to the Engineer. Wiring for loggers shall be clearly labeled to identify the location within the form at both ends before being placed into the form. Ambient temperature sensors shall be located no closer than 10 feet from the Mass Concrete Placement and shall be placed as to provide an accurate measurement of the environmental condition. Wire runs outside of concrete shall be encased in conduit where necessary to prevent damage during subsequent construction operations.

e. The Contractor shall not perform installation and verification checks for operation of any loggers unless the Engineer is present. The Contractor shall provide as-built versions of the temperature control plans showing the location of the loggers as identified by the unique serial numbers. Upon completion of monitoring all visible wires shall be removed from the concrete and any conduit penetrations filled with a non-shrink grout on the RIDOT Approved Product List.

f. Each logger shall be programmed with notes identifying the placement and relative location within the placement. Loggers shall be secured into position and function shall be verified at least one day prior to concrete placement. Temperature recording for each placement shall start no less than 2 hours prior to the initial concrete placement. The Contractor shall provide the Engineer safe access to the locations where readings will be taken, to observe the initialization of the loggers and record relevant information. This information shall include each logger serial number, location in the placement and start time. Access shall also be provided as needed for subsequent readings, as required by the Engineer.

g. Each logger for each placement shall be connected to the Wireless Remote Boxes purchased by the Contractor. The Contractor shall provide as many Wireless Remote Boxes as necessary to monitor all loggers simultaneously. The Contractor shall be aware that a sufficient quantity of Wireless Remote Boxes must be on hand to monitor all of the loggers for all of the placements being actively monitored at any given time during the project. The Contractor shall also maintain two (2) spare Remote Boxes or 10% of the total on hand, whichever is larger, in operating condition at all times.

h. The Contractor shall maintain the wireless system in operating condition, including maintaining any batteries at sufficient charge and protecting the units from damage due to the environment and other factors. This shall be done to ensure that the Remote Boxes are capable of retrieving and transmitting data on a daily basis for the duration of the specified monitoring period for the concrete placement.

i. The Contractor shall have at the Contractor's field office a Wireless System Radio Base Station compatible with the Wireless Remote Boxes and the same model shall be provided to the Engineer, as described in **Subsection 607.02.2**. Both Wireless System Radio Base Stations shall be configured to access all of the active Wireless Remote Boxes at any given time without reconfiguration of any component. Upon setup of each Wireless Remote Box and prior to placement of the concrete, the Contractor shall test the remote operation of the system to verify that it works properly and that all loggers that are to be connected to the Wireless Remote Box can be accessed. The Contractor may, at his discretion, have a handheld reader for the loggers. However, this shall not be used, except to configure the loggers initially or to collect data in the event of a problem with a Wireless Remote Box. Any such problem shall be corrected within 24 hours. Upon connection/reconnection of a Wireless Remote Box, the operation shall be tested as described above.

j. Automated temperature measurements shall be downloaded within one hour of the start of each calendar day during which any element of temperature control is in place. Secure data files from each logger shall be provided to the Engineer on a daily basis.

k. The peak concrete temperature at any location within the mass shall not exceed 155°F at any point in time. Failure to maintain a maximum peak concrete temperature less than or equal to 155°F will be cause for rejection of the concrete placement by the Engineer.

l. The temperature differential shall not exceed 35°F or the value of the variable limit (if approved) at any point in time. Failure to control the maximum concrete temperature differential less than or equal to the specified limit may be cause for rejection of the concrete placement by the Engineer. Malfunctioning sensors, as determined by the Engineer, shall be excluded from the differential calculation.

m. The placement shall be completely protected from exposure to precipitation to prevent cooling of the surface. Such protection shall be maintained until temperature control is no longer required.

n. Forms shall remain in place until the estimated strength of the concrete surface exceeds 2500 psi based on the lowest indicated maturity from the data loggers and until the differential between the mean center temperature and ambient temperature is less than 30°F and decreasing. Ambient temperatures must be rising at the time of form removal. Forms shall not be removed prior to meeting all other requirements listed elsewhere in the Contract Documents.

o. Tenting, erecting windbreaks, covering with plastic or curing blankets or other means may be necessary to protect the concrete surface from rapid cooling after form removal. Any and all such measures shall be at no additional cost to the State.

p. Concrete surfaces shall be protected when the temperature differential between the peak temperature and ambient temperature is greater than 30°F.

q. Mass concrete temperature control procedures shall remain in effect until the temperature differential between the average peak temperature and the 3-day mean ambient low temperature is less than 35°F.

r. Mass concrete elements exposed to water shall have reached at least 28 days compressive strength as indicated by the approved Maturity Curve and shall have a peak temperature-to-water temperature differential less than 35°F prior to exposure.

s. Written approval shall be obtained from the Engineer before removing temperature control.

607.05.2 Curing. Curing requirements of **Subsection 601.03.8** and **Subsection 808.03.09** shall apply, except as follows:

Mass concrete placements shall be continuously moist cured for at least 14 days and until the 28 day compressive strength as indicated by the approved Maturity Curve is achieved. Maintaining moisture on the top surface with forms in place shall be considered adequate moist curing. If strength and thermal control are achieved prior to 14 days, forms may be removed but moist curing must be continued.

Water used for curing shall be fresh water and shall not contain any salts or other components harmful to concrete. The temperature of any water used for moist curing of mass concrete shall be controlled to within 30°F of the peak concrete temperature.

607.05.3 Temperature Control Failure. Failure to meet the temperature control requirements of this specification may be cause for rejection of the concrete. Subsequent mass concrete placements shall be immediately halted. The Contractor shall investigate the events that produced the failure, and shall submit a written report to the Engineer. The investigation shall include a thorough examination of the concrete placement, the reasons for non-compliance with these requirements and shall document the width and extent of all visible cracks (if any), after cleaning the surface to fully expose them. Surface crack intensity shall be measured after monitoring shows the temperature as measured by all sensors near the concrete surface has dropped to within 10°F of the concrete temperature, as measured by the sensors at the center of thermal mass. The investigation shall be conducted by a licensed Rhode Island Professional Engineer, and shall present crack repair options for approval by the Engineer in accordance with **Subsection 607.05.4**.

The Contractor shall remove all equipment and materials from the mass concrete element and clean the surface for the Engineer to verify the Contractor's measurements of the crack intensity. The Contractor shall provide safe access for the Engineer's inspection, at no additional cost to the State.

At the discretion of the Engineer, repair or removal and replacement of the rejected placement may be required of the Contractor. If required, repair, or removal and replacement of the rejected placement shall be performed at no additional cost to the State.

At the discretion of the Engineer, the Contractor shall be required to submit a revised Mass Concrete General Temperature Control Plan to address any deficiencies identified by the investigation, at no additional cost to the State.

Subsequent mass concrete placements shall not resume without written approval by the Engineer.

There shall be no claims for additional payment by the Contractor, nor will there be an extension of the project Completion Dates for any corrective actions required as a result of the rejected concrete and subsequent corrective measures to address any deficiencies identified by the investigation.

607.05.4 Crack Repairs. Cracking determined to be due to thermal issues shall be repaired by approved methods. Determination of when cracking is caused by thermal issues will be solely by the Engineer. No repairs shall begin until the Engineer has approved the repair plan.

In case of thermal cracking, the Contractor shall suspend further work on members of similar size and configuration, submit a written explanation of the thermal cracking and additional steps to be taken to eliminate future thermal cracking, and submit proposed modifications in writing to the Engineer for review. Concrete placement may not resume until the Engineer approves the proposed modifications.

607.06 METHOD OF MEASUREMENT. "Mass Concrete" will not be measured for payment.

607.07 BASIS OF PAYMENT. No separate payment will be made for this item. Compliance with the above requirements shall be considered incidental to placement of mass concrete. Costs for this item shall be included in the bid prices of the appropriate items as listed in the Proposal.

Revise **Section 701, Culverts and Storm Drains**, pages 7-1 through 7-7 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 701

CULVERTS AND STORM DRAINS

- **Replace Subsection 701.02.1, Non-Metallic Pipe in its entirety with the following.**

701.02.1 Non-Metallic Pipe. Concrete, Clay, Fiber, Vitrified Clay, Vitrified Clay Lined Concrete, and Plastic Pipe shall conform to applicable requirements of **Subsection M.04.01** of these Specifications.

a. Smooth Interior Corrugated Polyethylene Pipe and Smooth Interior Corrugated Polypropylene Pipe. Pipe, couplings and fittings for polyethylene pipe shall conform to the applicable requirements of AASHTO M294 and ASTM F2306. Pipe, couplings and fittings for polypropylene pipe shall conform to the applicable requirements of AASHTO M330 and ASTM F2881. The following provisions shall also apply:

1. The pipe shall be Type S, meet the requirements of the AASHTO NTPEP Quality Audit Program for High Density Polyethylene Pipe and polypropylene pipe, and shall be included in the Department's Approved Materials List.

2. The basic materials shall be virgin or cleaned, reworked polyethylene or polypropylene compounds. No recycled materials shall be used.

3. All joints shall be watertight in accordance with ASTM D3212, and shall be sealed with elastomeric gaskets that conform to ASTM F477.

- **Replace Subsection 701.03.6 with the following.**

701.03.6 Smooth Interior Corrugated Polyethylene Pipe and Smooth Interior Corrugated Polypropylene Pipe. The following additional requirements apply to these classifications of pipe.

a. Limitation of Use. Polyethylene and polypropylene pipe may only be used where the top of the pipe will be at least 3 feet below the finish grade.

b. Bedding for pipe diameters less than or equal to 24" shall be Class B or Class C as defined above in **Subsection 701.02.5**, except that Class B shall have 100 percent pass the 3" sieve. The choice of material will be approved by the Engineer.

Bedding for pipe diameters greater than 24" shall be excavatable Class I Controlled Low Strength Material (CLSM), as defined in **Subsection 603.01.1** of these Specifications.

c. Trench Excavation and Backfill. Trench excavation shall conform to the requirements of **SECTION 205** of these Specifications.

1. Where the Engineer determines the excavation to be in an area of high water table, an approved separation filter fabric shall be placed against the bottom and sides of the excavation to completely enclose the pipe embedment material, with a minimum 12-inch overlap, to a minimum height of 12 inches above the top of the pipe. After the Class C pipe embedment material is placed and compacted, the filter fabric shall be lapped to completely enclose the material.

2. The trench shall be excavated to a minimum depth below the specified bottom invert of the pipe of 4 inches in soil trenches and 6 inches in rock trenches. Bedding shall be placed and compacted to a height of one inch above the specified bottom invert of the pipe. The surface of the bedding shall be shaped to fit the contour of the pipe. The pipe shall be installed and be supported or constrained to prevent its movement as the trench is filled and the material compacted. Bedding material shall be placed and compacted simultaneously on both sides of the pipe within the pipe zone. Hand tamping shall be used as needed to fill and compact the haunch zone of the pipe. Placement and compaction shall be simultaneous on both sides of the pipe to prevent damage to or movement of the pipe. Bedding material shall continue to be placed, in 6-inch compacted lifts, to a minimum of 12 inches above the top of the pipe (initial backfill). The final backfill shall be placed in lifts no greater than 6 inches after compaction.

3. With the approval of the Engineer, Controlled Low Strength Material, Classification I, as defined in **Subsection 603.01.1** of these Specifications, may be used as pipe embedment and the remaining backfill.

d. Testing. No sooner than 30 days after the completion of the compaction of the backfill, the Contractor, under the direction of the Engineer, shall conduct mandrel testing or hand measurement of the pipe. Testing may be required for up to 25 percent of the total length of pipe. The Engineer shall determine the actual sections of pipe to be tested.

Mandrel testing shall be conducted for pipe diameters of 24-inches and less. The mandrel shall be rigid steel, with a pulling ring at each end, an odd number of legs (9 legs minimum), and an effective diameter at least 95 percent of the base inside diameter. (The base inside diameter is the nominal pipe size less a 1.5 percent fabrication tolerance.) Any pipe through which the mandrel fails to pass shall be removed and a replacement pipe installed by the Contractor.

Mandrel testing or hand measurement shall be conducted for diameters greater than 24-inches up to and including 36-inch diameter pipe.

Hand measurement of deflection shall be conducted for pipe diameters greater than 36-inches. Hand measurement shall be conducted every five (5) linear feet of a selected length of pipe. Minimum diameter measurements are shown in the table below and are based upon 5 percent maximum deflection and 1.5 percent manufacture fabrication tolerance.

<u>Nominal Pipe Diameter</u>	<u>Allowable Deflected Diameter</u>
27"	25.26"
30"	28.07"
36"	33.69"
42"	39.30"
48"	44.92"
54"	50.53"
60"	56.15"

Removed pipe may be reused as the replacement pipe only when it is deemed by the Engineer to be undamaged. Otherwise, the removed pipe shall be removed from the work site by the Contractor. All costs associated with mandrel or hand measurement testing, including the replacement of deflected pipe and any delays that are incurred shall be borne by the Contractor at no additional cost the State.

- **Replace Subsection 701.04.1, Culverts and Storm Drains in its entirety with the following.**

701.04.1 Culverts and Storm Drains. "Culverts and Storm Drains" of the various types of materials and sizes indicated on the Plans, both new and re-laid, including "Smooth Interior Corrugated Polyethylene Pipe," and "Smooth Interior Corrugated Polypropylene Pipe" will be measured in linear feet of continuous runs of such pipe actually installed in accordance with the Plans and/or as directed by the Engineer. Pipe with sloped or skewed ends will be measured along their respective inverts.

- **Replace Subsection 701.04.4(a) with the following.**

701.04.4 Bedding Material.

a. "Class A, B, C and CLSM Bedding Material" will be measured by the number of cubic yards of each type of bedding actually placed. When bedding is specified and no measurement method is shown on the Plans, bedding material shall be measured within the horizontal Pay Limits specified for Trench Excavation under **Subsection 205.04.2, Para. a** of these Specifications and vertically from 12 inches below grade to a height of 50 percent of the diameter of the pipe excluding, however, the volume occupied by the pipe.

- **Replace Subsection 701.05.1 with the following.**

701.05.1 Culverts and Storm Drains. The accepted quantities of the various types and sizes of "Culverts and Storm Drains" indicated on the Plans will be paid for at the respective contract unit prices per linear foot as listed in the Proposal. The prices so-stated constitute full and complete compensation for all trench excavation (except for Trench Excavation-Rock, Trench Rock Excavation-Mechanical, and excavation of unsuitable material below grade) to a depth equal to the invert of the proposed pipes when bedding material is not required, or to a depth sufficient to receive the appropriate layer of bedding material, of whatever class, when such material is required; for the shaping of either the bottom of the trench or the top of bedding material, whichever the case may be, to receive the bell of the pipe; for all dewatering, including pumping, draining, or bailing; for laying, setting and jointing all pipe, pipe couplings, fittings and gaskets, including connections to existing drainage structures or pipes; filter fabric; for placing and compacting backfill; for design and furnishing, placing and subsequently removing all temporary timber or steel sheeting, bracing, shoring or trench protection; for the legal disposal of all excess or unsuitable excavated materials; and for all other work and incidentals required to finish the work, complete and accepted by the Engineer.

a. **Smooth Interior Corrugated Polyethylene Pipe and Smooth Interior Corrugated Polypropylene Pipe.** The accepted quantities of the various sizes of "Smooth Interior Corrugated Polyethylene Pipe" and "Smooth Interior Corrugated Polypropylene Pipe" indicated on the Plans will be paid for at their respective contract unit prices per linear foot as listed in the Proposal. In addition to the above, the prices so-stated constitute full and complete compensation for all pipe embedment material,

CLSM, buoyancy constraint, post-installation mandrel testing or hand measurement, remedial work, including all labor, equipment, tools, and all incidentals required to finish the work, complete and accepted by the Engineer.

b. Trench Excavation-Rock, Trench Rock Excavation-Mechanical. “Trench Excavation-Rock,” “Trench Excavation-Mechanical,” and excavation of unsuitable material below grade will not be included in the contract unit prices for the various types and sizes of "Culverts and Storm Drains" but will be paid for separately as set forth in **Subsection 205.05.2** of these Specifications.

- **Replace Subsection 701.05.4(a) with the following.**

701.05.4 Bedding Material.

a. Class B bedding material, and all Class C and CLSM used for the installation of Smooth Interior Corrugated Polyethylene Pipe and Smooth Interior Corrugated Polypropylene Pipe will be paid for under the applicable "Culvert," "Storm Drains," or "Flared End Sections" Proposal items and, therefore, will not be paid for separately. The single exception relates to the replacement of unsuitable material. In this case, Class B bedding will be paid for separately as set forth in **Subsection 205.05.5** of these Specifications.

Remove **Section 714, Remove and Relocate Post Type Hydrants**, page 7-26 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 714

POST TYPE HYDRANTS

714.01 DESCRIPTION. This work consists of installing or removing and relocating post type hydrants to locations indicated on the Plans, or as directed by the Engineer, all in accordance with these Specifications.

714.02 MATERIALS. All materials shall conform to the applicable requirements established by both the water company or municipality that owns the particular system involved, and these Specifications. All new and relocated post type hydrants shall be a break-away type. The Contractor shall provide documentation to the effect that the hydrants, fittings and all appurtenances conform to the requirements of the respective manufacturers, water companies and municipalities.

714.03 CONSTRUCTION METHODS. The Contractor will be required to notify the applicable water company and/or municipality and the local fire company at least 24 hours in advance of any work involving the hydrants. All installations for new and relocated hydrants shall be subject to the approval of the applicable water company or municipality. Additional requirements for the installation of hydrants, including but not limited to pressure testing, disinfection, inspection and thrust block installations must be performed in accordance with the AWWA and the established practices and requirements of the owner.

714.03.1 Relocation of Post Type Hydrant. Hydrants to be relocated shall be carefully removed and transported to a stockpile location as directed by the Engineer. Upon removal of the hydrant, the Contractor shall note the depth of the standpipe section such that the proper height can be placed to ensure that the break-away coupling is at the proper height. At the stockpile area, the hydrants shall be cleaned and made ready for use. Hydrants shall be relocated and installed in accordance with the established practices of the water company or municipality that owns the water system.

714.03.2 New Hydrant Installation. Hydrants shall be installed in accordance with the established practices of the water company or municipality that owns the system. The Contractor is required to set the seating flange/breakaway coupling above finish grade within the limits shown on the Plans.

714.04 METHOD OF MEASUREMENT. "Remove and Relocate Post Type Hydrant" and "Post Type Hydrant" will be measured by the number of such assemblies actually relocated or installed in accordance with the Plans and/or as directed by the Engineer. Hydrants which have been set with the seating flange/breakaway coupling outside the limits shown on the Plans will not be accepted.

714.05 BASIS OF PAYMENT. The accepted quantities of "Remove and Relocate Post Type Hydrant" and "Post Type Hydrant" will be paid for at the contract unit price per each such assembly as listed in the Proposal. The prices so-stated shall constitute full and complete compensation for all labor, materials, tools and equipment, including excavation, removal, hauling, stockpiling, backfill, compaction, piping, plugs, disinfection, testing, thrust blocks, bedding materials and all other incidentals required to finish the work, complete and accepted by the Engineer and the respective water company or municipality.

In the event the relocated or newly installed hydrant requires a tapping sleeve and valve, these items will be paid for separately under the appropriate water service item in the Proposal.

Hydrants to be removed and disposed will be paid for separately under the appropriate item(s) in the Proposal.

CODE 803.0300

PARTIAL REMOVAL AND DISPOSAL OF EXISTING CONCRETE MASONRY

DESCRIPTION. This work shall consist of the removal and disposal of existing structure concrete and associated items as described herein to the payment limits as shown on the Contract Plans and/or as directed by the Engineer.

The areas of "Partial Removal of Existing Concrete Masonry" shall be the areas of deck, sidewalk, and parapet, concrete at fixed or expansion joints, and all joint hardware cast within or attached to the concrete, including adjacent traffic plates, trough assemblies, hardware at curbs and sidewalks/safety walks, reinforcing steel, and portions of granite bridge curbing (to the nearest joint) and other components, to the limits shown on the Contract Plans. This item of work shall not include removal of deteriorated concrete for deck repairs. Removal of concrete for deck repairs is paid for separately under the applicable deck repair items.

Stud shear connectors, if encountered, and longitudinal reinforcing steel in the deck are to remain in place unless the plans designate otherwise. Stud shear connectors damaged by the Contractor during the removal of concrete shall be replaced in accordance with the details on the Contract Drawings at no additional expense. Scuppers shall be removed and disposed when so specified on the Contract Drawings. Bridge rail shall be temporarily supported as required to complete the work. Bridge rail anchorage shall be replaced where required, and the rail shall be reset as an incidental item of work.

The areas of "Partial Removal of Existing Concrete Masonry" shall also include the removal and disposal of such items or portions of such items as backwall concrete, approach sidewalk concrete, parapets, walls, sidewalks, footings, abutments and associated reinforcing steel to the limits indicated on the Contract Plans.

All utility ducts and fittings in the sidewalks, safety walks and backwalls are to remain in place unless otherwise designated on the plans. Any damage to existing utility lines shall be repaired by the Contractor to the satisfaction of the Engineer and the respective Utility Company.

The work shall also include the cutting of reinforcing steel, where required, and the surface preparation of reinforcing steel and concrete prior to placing new concrete.

CONSTRUCTION METHODS. The concrete shall be saw cut square to a minimum depth of 3/4" along the limits of the concrete removal, as indicated on the Plans or as directed by the Engineer. The Contractor shall then remove all concrete, specified reinforcement, bridge curbs and deck joint hardware by means of suitable power and hand tools which will not cause over-breakage, and properly dispose of the material in a manner satisfactory to the Engineer. All repairs resulting from over-breakage shall be performed to the satisfaction of the Engineer at no additional payment. All work shall proceed in accordance with the Traffic Control plans and the Sequence of Construction, as per the Plans. The removal of concrete adjacent to the fixed or expansion joints, along with all associated hardware, shall be performed in stages as defined by the Plans and/or Sequence of Construction.

The Contractor shall submit to the Engineer for approval, at least 30 calendar days prior to the commencement of work, the methods and equipment to be used for the removal and disposal of the

items detailed in this Specification, including any special removal methods adjacent to existing utility lines, the disclosure of the Contractor's proposed disposal area(s), and the methods and shop drawings for temporary shielding. These approvals, however, shall in no way relieve the Contractor of sole liability for damages resulting from his operations.

When required by the Contract Documents, the Contractor shall erect and maintain a temporary shield system to insure that no materials, debris, or equipment will fall to the ground or below the structure, or damage the structure or utilities supported beneath the deck. Shop drawings shall be submitted for approval, showing the details and design of the shield system. The system shall be designed for the anticipated weight of all material to be supported, but not less than a live load of 100 psf. Any materials, debris, or equipment that accidentally fall to the ground below the structure shall be immediately retrieved and disposed of properly. At no time shall the temporary shield system extend below the bottom of the bottom flanges of the beams within the travel lanes of the roadway below. No concrete removal operations shall commence in areas where shielding is required until the shielding is installed to the satisfaction of the Engineer.

Care shall be taken during the removal of the designated portions of the structure to avoid damaging the portions that are to remain. The pneumatic hammer used to remove concrete near reinforcing steel that is to remain shall not be heavier than the nominal 30 pound class. Chipping hammers or mechanical chipping tools to remove concrete beneath reinforcing steel shall not be heavier than the nominal 15 pound class. These power-drive hand tools shall never be placed in direct contact with the reinforcing steel that is to remain. If in the opinion of the Engineer, the removal operation causes excessive damage to portions of the concrete which is to remain, the Contractor shall cease his operation until such time that an alternate removal method has been proposed by the Contractor and approved by the Engineer. Any resulting delays in the concrete removal operation shall be the sole responsibility of the Contractor.

All Utility Companies shall be given a minimum of forty-eight (48) hours advance notice of concrete removal operations to be performed adjacent to their respective utility lines. This notice will also apply in the case of any deactivation of utility lines which may be required by the Contractor. The Contractor shall confirm the location, materials, and status of each utility line with the respective Utility Companies prior to any concrete removal.

Special concrete removal methods shall be used during the locating and removal of concrete around existing utilities. These methods may be limited to chipping hammers or small pneumatic hammers posing minimal risk of damage to the utility lines. The Contractor shall submit these special removal methods to the Engineer for approval prior to any concrete removal. The Contractor may, at the discretion of the Engineer, leave a minimal cover of existing concrete around the ducts (thereby leaving the ducts in place), provided that the new concrete section is of adequate thickness (minimum 4" from top of existing concrete to top of proposed sidewalk), and that a suitable bonding agent is applied at the interface of the old and new concrete. When required, the Contractor shall provide temporary supports for any utility ducts left unsupported during construction.

All ducts, including inactive or empty ducts, which are damaged as a result of the Contractor's operations shall be repaired to the satisfaction of the Engineer and the respective Utility Company at no additional cost. This repair work may include the installation of expansion fittings, backwall sleeves and other incidental hardware, as required.

The remaining concrete surfaces shall be cleaned of oil, solvent, grease, dirt, dust, bitumen, laitance, loose particles, and other foreign matter. The surface cleaning shall be accomplished by means

of sandblasting, wire brushing, vacuuming, blowing the area with compressed air, or by a combination of these. When compressed air is used, care shall be taken to avoid deposits by the air pump. All sound concrete surfaces on which new concrete is to be placed shall be roughened by mechanical means approved by the Engineer.

Loose and small concrete fragments shall be cleaned from reinforcing steel, stud connectors, and girder top flanges left in place by means of sandblasting and vacuuming. Prior to sandblasting, all petroleum contamination shall be removed by appropriate solvent or detergent cleaning operations. Reinforcing steel and girder top flanges shall be sandblasted in accordance with SSPC-SP-6, Commercial Blast Cleaning, to remove all contaminants, rust and rust scale. Any surface contamination not removed during sandblasting shall be removed in accordance with SSPC-SP-1, Solvent Cleaning. When using sandblasting equipment, all work shall be shielded for the protection of the public.

Existing reinforcing steel to be embedded in new concrete shall not be bent or damaged during the removal operations. All damaged reinforcing steel shall, under the direction of the Engineer, be repaired or replaced by the Contractor at his own expense. Cutting of reinforcing steel shall be accomplished by a method approved by the Engineer. Flame cutting of reinforcing steel will not be permitted.

The Contractor shall insure that his removal and disposal operations do not cause damage to the existing structure or to adjacent property. Any resulting damage shall be repaired to the satisfaction of the Engineer and property owner(s) at the Contractor's expense.

All removed materials shall be taken from the site as the work progresses. Storing or burying of material/debris on site will not be permitted except with the prior approval of the Engineer.

All concrete removal or cleaning/sand blasting, etc., that effects the painted surfaces of the structural steel shall be performed in a manner that complies with all applicable State and Federal health and environmental regulations. Removal of asbestos materials or lead based paint if required, will be paid for separately under the applicable contract items.

The Contractor shall provide a means of dust control satisfactory to the Engineer, including the use of water and/or any alternate methods as may be specified in the Plans.

METHOD OF MEASUREMENT. "Partial Removal of Existing Concrete Masonry" will be measured for payment by the cubic yard (CY) of concrete removed and disposed of in accordance with the Plans and/or as directed by the Engineer.

BASIS OF PAYMENT. The accepted quantity of "Partial Removal of Existing Concrete Masonry" will be paid for at the contract unit price per cubic yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, tools, materials, equipment, disposal, saw cutting, surface preparation of reinforcing steel and concrete surfaces, removal of all concrete and incidental items, saw cutting of reinforcing steel, replacement of damaged studs and reinforcing steel, removal and disposal of scuppers, repair of damaged utility ducts, temporary utility supports, utility expansion fittings, sleeves, and incidental hardware, resetting of bridge rail, coordination with owners and agencies, water for dust control and all other incidentals necessary to finish the work as shown on the Plans and to the satisfaction of the Engineer.

Compilation of Approved Specifications

Date: 04/22/2016

Removal of asbestos materials or lead based paint, if required, will be paid for separately under the appropriate pay item(s) listed in the Proposal.

The installation and removal of temporary protective shielding if required, will be paid for separately under the appropriate pay item(s) listed in the Proposal.

CODE 803.0400

CLEANING BRIDGE BEAM SEATS

DESCRIPTION. Work under this item shall consist of cleaning the existing bridge beam seats at piers and abutments, and the disposal of sand, bird excrement, feathers, nests, etc. and all other debris resulting from the cleaning operation. Also included shall be the installation and removal of temporary protective shielding as shown on the plans, to prevent debris from falling onto adjacent waterways and/or roadways and sidewalks. The contractor is herewith advised that the debris to be removed from bridge beam seats may contain bird excrement, feathers, nests, etc, which may contain bacterium considered by OSHA to be an occupational hazard. The contractor shall adhere to the latest provisions of sections 5(a)(1), 1910.134, 1926.95, and 1926.103 of the Occupational Safety and Health Act of 1970 for protecting workers.

A beam seat consists of the entire horizontal surface from end to end of a pier or abutment. The area to be cleaned also includes the bearings and the immediate ends of beams, which may contain debris. This work shall include all materials, equipment, labor and other incidentals necessary to complete the work to the satisfaction of the Engineer.

MATERIALS. The Contractor shall supply water and chlorine bleach as required for the washing operation and for the spraying of debris. Plastic or Canvas tarps, plywood, or similar materials as specified in the contract provisions, shall be provided to contain debris.

CONSTRUCTION METHODS. Abutment and pier seats shall be thoroughly cleaned and all sand, debris, bird excrement, nests, feathers etc, be carefully removed and properly disposed. Prior to removal, all material shall be wet down using a pressurized garden tank type sprayer with a solution of 1 part chlorine bleach to 10 parts water to minimize any airborne dust potentially containing bacterium. Debris shall be removed by shoveling or scraping using hoes, shovels, or by other approved methods, after which all cleaned surfaces shall be high-pressure water washed (minimum pressure 1500 psi, maximum pressure 3000 psi).

The Contractor shall take all precautions and perform all work in such a manner as to prevent damage to the remaining portions of the structure. Temporary protective shielding shall be installed to the limits indicated on the plans to prevent the fall of material onto the waterway and/or roadway and sidewalk areas below. All damage incurred as a result of the Contractor's operations shall be repaired by the Contractor to the satisfaction of the Engineer at no additional expense to the Department.

The contractor shall also adhere to the latest OSHA Standards 1926.95 for worker personal protective equipment and 1910.134 and 1926.103 for respiratory protection and, is referred to OSHA Publications 3079 and 3151. Workers shall wear (HEPA filter) masks, gloves, goggles, protective suits and, use other personal protective equipment as necessary to conform with all applicable OSHA regulations. All material removed shall be packaged and transported in accordance with 49 CFR 172, 173, 177 and, 178 and, shall be disposed at a facility approved for disposal of hazardous material.

Upon completion of the work, all temporary installations and debris shall be removed and the work area restored to the satisfaction of the Engineer.

METHOD OF MEASUREMENT. “Cleaning Bridge Beam Seats” will be measured per each bridge cleaned in accordance with the Plans and/or as directed by the Engineer.

BASIS OF PAYMENT. The accepted quantity of “Cleaning Bridge Beam Seats” will be paid for at the respective contract unit price per each as listed in the Proposal. The price so-stated constitutes full compensation for all labor, tools, materials, equipment, removal and disposal of all sand, bird excrement, nests and all other material and debris resulting from the cleaning operation, installation and removal of temporary shielding, and all other incidentals necessary to complete the work to the satisfaction of the Engineer.

CODE 803.0500

TEMPORARY DECK UNDERSIDE & SIDE PROTECTIVE SHIELDING

DESCRIPTION: This work shall consist of designing, furnishing, fabricating, erecting, maintaining, removing, and disposing of temporary deck underside and deck side protective shielding at locations shown on the Plans and/or as directed by the Engineer.

The temporary deck underside and deck side protective shielding shall provide for the safe passage of vehicles, pedestrians, and shall provide protection for utilities. The use of the protective shielding is to insure that no debris falls to the roadway or sidewalks below the structure. This protective shielding is to be used for or in conjunction with deck demolition.

MATERIALS: At the discretion of the Contractor and as called for in the Contractor's design, deck underside and side protective shielding may be constructed from timber, steel, or aluminum. Steel and aluminum shall conform to the requirements of **SECTION M.05; METALS** of the Rhode Island Standard Specifications for Road and Bridge Construction, 2004 Edition, with all latest revisions.

Timber and hardware shall conform to the requirements of **SECTIONS M.11 and M.05**, respectively, of the Rhode Island Standard Specifications for Road and Bridge Construction, 2004 Edition, with all latest revisions. The material shall be structural lumber in accordance with the National Design Specifications for stress graded lumber recommended by the National Forest Products Association (NFPA). The grade shall be $F_b=1200$ psi minimum. Minimum lumber size for underside shielding shall be 3" x 8".

CONSTRUCTION METHODS: The deck underside and side protective shielding shall be erected at the locations and to the limits indicated on the contract drawings and/or as directed by the Engineer. All work shall be performed in accordance with the Maintenance and Protection of Traffic Plans, and in accordance with the demolition and construction sequences shown on the Plans and as specified in the Contract Documents.

All shielding shall meet or exceed the following requirements:

1. It shall be the Contractor's responsibility, as part of this item of work, to design and detail the protective shielding to conform to all Federal, State, and Local laws and regulations, as well as to the requirements contained here in this Specification.

2. The shielding shall extend under all areas of concrete decks, safety walks, and safety barriers to be removed. It shall extend horizontally a minimum of 3 feet beyond the bridge railings or safety barriers, and it shall extend vertically to a point 2 feet above the top of the bridge parapet, or to a point 4 feet above the top of bridge safety walks or decks, whichever is higher.

3. The Contractor shall submit shop drawings, stamped by a Professional Structural Engineer registered in Rhode Island, in accordance with **Subsection 105.02; Plans and Shop Drawings**, of the Standard Specifications, of all proposed shielding to the Engineer for his approval prior to installation. The drawings shall include details of all connections, brackets, and fasteners. The various components of the deck underside protective shielding system shall be designed for the anticipated weight of all material and debris to be supported, based on the Contractor's method and sequence of removal, but in

no case shall it be designed for less than 150 pounds per square foot. Vertical shielding shall be designed for anticipated loads, or a minimum of 30 pounds per square foot, whichever is higher.

4. The shielding shall be placed and secured in a manner as to prevent it from being blown out by wind. If, in the opinion of the Engineer, the shielding is not secure, then the Contractor shall remove and install it to the Engineer's satisfaction.

5. Shielding shall be placed so as to maintain the existing vertical clearance under the bridge.

6. The Contractor may utilize the existing steel or prestressed concrete beams as supports. However, the Contractor will not be permitted to drill or weld to any existing or new beams, unless otherwise noted on the Construction Drawings.

7. The protective shielding shall not contain any gaps or openings that would allow debris to pass through, and shall be sufficiently strong to support any debris or section of demolished concrete from falling onto the roadway or walkway below.

If the Contractor's operations damage any existing portions of the bridge that are not within the scope of the contract, such damage shall be repaired at the Contractor's expense, and to the satisfaction of the Engineer.

METHOD OF MEASUREMENT: "Temporary Deck Underside and Side Protective Shielding" will be measured for payment by the square foot of shielding installed, including the deck side protective shielding, as required by the stage construction sequences and in accordance with the plans and as directed by the Engineer.

BASIS OF PAYMENT: The accepted quantity of "Temporary Deck Underside and Side Protective Shielding" will be paid for at the contract unit bid price per square foot as listed in the Proposal. The actual square foot measurement will be determined by the pay limits specified herein. No payment will be made for additional shielding beyond these pay limits, regardless of the approved design. This payment shall constitute full and complete compensation for all labor, equipment, tools, accessories, hardware and incidentals necessary to complete the work, including design and detailing and all installation and removal of the protective shielding, including the deck side protective shielding, all as required by the stage construction sequences and complete and accepted by the Engineer.

Revise **Section 804, Driven Piles**, pages 8-4 to 8-27 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 804

DRIVEN PILES

- **Replace the first paragraph of Subsection 804.03.4(f) with the following.**

f. Placement of Reinforcement and Concrete. Accumulated soils and water shall be removed from driven shells before concrete is placed. The class of concrete shall be as specified in **Subsection M.07.08.2** of these Specifications, and arrangement of reinforcing shall be as shown and specified in the Plans. Reinforcing steel cages shall be fabricated, secured, and lowered down the shell pile in such a manner as to insure proper placement throughout the length of the pile, and to provide pile cap connections as shown in the Plans.

[Remainder of Subsection is unchanged]

- **Replace the first paragraph of Subsection 804.03.5(g) with the following.**

g. Placement of Concrete and Steel Reinforcement. Where driven steel pipe piles shall be concrete-filled and no interior steel reinforcement is to be installed except within 5 feet of the cut-off elevation, concrete shall be placed in one continuous operation with flow directed down the center of the pile to consolidate by impact. Vibration or rodding shall be required only to a depth of 5 feet below the design cut-off elevation. The class of concrete shall be as specified in **Subsection M.07.10.2** of these Specifications.

[Remainder of Subsection is unchanged]

- **Replace Subsection 804.04.4 with the following.**

804.04.4 Pile Cut-offs. Pile Cut-offs will not be measured separately for payment.

- **Replace Subsection 804.04.11 with the following.**

804.04.11 Incidental Items. The following items of work shall not be measured separately for payment, but shall be considered incidental to the other items of work inherent to this Section unless listed separately for payment in the contract documents: Wave Equation Analysis; Pre-Construction Survey and Monitoring; Layout, Elevation and Location Control; Templates and Support Spuds; Measurement and Marking; Pile Splices; Concrete Encasement for H-Piles; Cleanout and Dewatering of Shell Piles and Pipe Piles; Collars, Bands, Strapping and Trimming for Timber Piles; Extensions of Precast/Prestressed Concrete Piles; Hammer Cushions; Drive Heads; Pile Cushions; Pile Cutoffs; Leads; Followers; Jetting; Mobilization and Demobilization of equipment; and Steel Reinforcement Anchorages and Welding (materials and labor).

- **Replace Subsection 804.05.2 with the following.**

804.05.2 Pile Cut-offs. No separate payment will be made for this work, but will instead be included as an incidental under the payment for “Piles Furnished and Driven” or “Piles Driven” as appropriate, under **Subsection 804.05.1** of these Specifications

Remove **Subsection 805.05.7, Basis of Payment - Ground Anchors**, page 8-36 the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following:

SECTION 805

EARTH RETAINING SYSTEMS

805.05 BASIS OF PAYMENT

805.05.7 Ground Anchors. The accepted quantity of “Ground Anchors” shall be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, equipment, tools and materials, and all other incidentals required to furnish and install the ground anchors, including testing, complete and accepted by the Engineer.

Remove **Subsection 808.03.9, Curing Concrete**, pages 8-65 and 8-66 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following:

808.03.9

CURING CONCRETE

808.03.9 Curing Concrete. Portland cement concrete shall be cured in accordance with the requirements of **Subsection 601.03.8, Curing**, except that all placements designated as mass concrete shall follow the requirements of **SECTION 607**. The determination of what placements shall be treated as mass concrete shall be in accordance with the requirements of that section.

CODE 808.1860

**CONCRETE ARCHITECTURAL TREATMENT
FORM LINER FINISH**

DESCRIPTION. Work under this item shall include all labor, materials and equipment required to provide a Concrete Architectural Treatment on the exterior face of concrete surfaces indicated on the plans. The Architectural Treatment shall be achieved through the use of form liners as described herein and as shown on the contract plans.

MATERIALS.

Release Agent: Compatible with the form liner and all other components of this work.

Form Liner: Form liners shall be constructed of high-strength urethane and shall attach to the concrete formwork. They shall be of the single-use type and from the same manufacturer. Form liners shall produce a surface pattern as shown on the plans.

CONSTRUCTION METHODS. The Contractor shall be trained by the manufacturer in the use of form liners for the intended application. The form liner manufacturer and installer shall have a minimum of three (3) consecutive years experience in textured concrete construction. Evidence shall be furnished to the satisfaction of the Engineer that the products and their installation have been successfully utilized in similar applications.

Prior to construction, the Contractor shall present a sample panel to the Engineer for approval. The sample shall include a butt joint to ensure that the form liner panels produce a consistent surface pattern and appearance without any visible seams. The sample panel shall be a minimum size of five (5) square-feet.

The Contractor shall submit Shop Drawings for the entire Concrete Architectural Treatment system in accordance with the provisions of Subsection 105.02 of the Standard Specifications. The Engineer shall consult with the RIDOT Historical Preservation Specialist if required, and shall review the Shop Drawings and samples for compliance with the specifications.

The Concrete Architectural Treatment shall be applied to the exterior face of concrete surfaces within the limits shown on the Plans to a minimum of 1'-0" below the finish grade.

Form liners shall be applied per the manufacturer's recommendations, and in accordance with the following provisions:

Form liners shall be mated with the adjacent panels to produce a consistent pattern and shall be placed adjacent to each other with a 1/8" seam or less. The form liners shall be securely attached to the forms per the manufacturer's recommendations. Wall ties shall be coordinated with the form liner system.

Form liners shall be rigid and capable of withstanding the anticipated concrete placement pressures without leakage, which could cause physical or visual defects, and should be able to be

removed without causing concrete surface deterioration or weakness in the substrate. Form release agents, form stripping methods and patching materials, as well as related construction materials, shall be compatible with all other elements of Concrete Architectural Treatment.

Form liner butt joints shall be carefully blended into the approved pattern. No visible vertical or horizontal seams or conspicuous form marks created by butt-joined form liners will be accepted. The finished concrete surface shall have a finished texture and continuous pattern, in accordance with the information shown on the plans or as directed by the Engineer.

The use of wall ties that result in a portion of the tie being permanently embedded in the concrete shall require approval by the Engineer prior to the commencement of the work. Wall ties shall be provided with break set backs of 1" minimum from the finished concrete surface. The wall tie holes shall be placed in the high point of the rustication or mortar joint.

Concrete placement shall be in accordance with the provisions of Subsection 808.03.5 of the Standard Specifications, with an emphasis on the importance of proper vibration of the concrete next to the form liner to ensure that no honeycombs or other deficiencies occur in the face of the concrete.

After stripping the forms and form liners, the concrete surface shall be cleaned and shall be free of all laitance, dirt, dust, grease, release agents, efflorescence and any other foreign or deleterious materials.

Sandblasting shall not be permitted for cleaning concrete surfaces; pressure washing with water is the preferred method for removing laitance. When pressure washing is to be used, it shall be performed in accordance with specification 820.0200, High Pressure Water Cleaning of Concrete Surfaces. The completed surface shall be free of blemishes, discolorations, surface voids greater than 3/8" in diameter and conspicuous form marks. The cleaning process shall not diminish the "rustic" appearance created by the form liner.

Materials shall be furnished, prepared, applied, cured and stored according to the product manufacturers' directions.

When directed by the Engineer, the Contractor shall have the manufacturers' technical representatives available to answer questions and/or make recommendations prior to and during the work operations.

METHOD OF MEASUREMENT. "Concrete Architectural Treatment – Form Liner Finish" will be measured by the number of square feet complete, in-place and accepted in accordance with the Plans and/or as directed by the Engineer.

BASIS OF PAYMENT. "Concrete Architectural Treatment – Form Liner Finish" will be paid for at the contract unit price per square foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for furnishing and installing the Concrete Architectural Treatment and for all labor, materials, tools, equipment, and all other incidentals necessary to finish the work, complete and accepted by the Engineer. Pressure washing of concrete surfaces will be paid for separately under the applicable bid item(s) in the Proposal.

Remove **Section 809, Precast/Prestressed Structure Concrete Masonry**, pages 8-69 to 8-79 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following:

SECTION 809

PRECAST/PRESTRESSED STRUCTURE CONCRETE MASONRY

809.01 DESCRIPTION. The work of this Section consists of the provision of precast, prestressed, concrete elements, both pre-tensioned and post-tensioned, at the locations and to the details indicated on the Plans, all in accordance with these Specifications.

809.01.1 General. Prestressed concrete structural elements shall be manufactured in accordance with the publication of the Prestressed Concrete Institute titled **Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products**, MNL 116, current edition. This manual provides principles and guidelines for the manufacture of prestressed concrete products.

809.01.2 Compensation for Out-of-State Inspection Services.

a. Basis of Compensation. In the event that a Contractor selects a subcontracting company that is beyond a 50-mile radius of the Department's base of operation, deemed to be the State Office Building, the Contractor shall compensate the State for the costs of travel and inspection services, as outlined in **Subsection 809.05; Basis of Payment** for the days of inspection services as identified herein.

b. Definition of Inspection Services. The Department will conduct inspections of the plant and laboratory, witnessing of trial batches, full-time acceptance testing and part-time Independent Assurance Sampling and Testing (as defined in the Department's Materials Section Master Schedule) for all phases of production, repair of products, loading, shipping and any other related operations, including travel days, as deemed necessary by the Engineer. Inspection services days or part thereof shall also include weekends, holidays and shutdowns due to the Contractor's inability to produce.

809.02 MATERIALS.

809.02.1 Drawings.

a. Contract Plans. Plans which accompany the contract documents are designated as contract Plans. These are not intended to be shop drawings.

b. Shop Drawings. The Contractor shall submit complete and accurate shop drawings to the Engineer for approval in accordance with **Subsection 105.02, Plans and Shop Drawings**. The Contractor shall be responsible for modifying the dimensions of prestressed units to compensate for elastic shortening, shrinkage, grade corrections and other phenomena that make in-process fabricating dimensions different from those shown on the Plans. Approval of the shop drawings by the Engineer shall not relieve the Contractor from the responsibility for the correctness of all dimensions shown on these drawings. These drawings shall be made as soon as possible after the award of Contract and they

shall be designated as shop drawings. No fabrication shall take place until after the shop drawings have been approved and the Engineer has received prints made from the approved shop drawings.

1. Information Required on Shop Drawings. The shop drawings shall include but not be limited to the following information:

- (a) Plan layout of structure indicating the piece mark assigned to each precast/prestressed unit.
- (b) A tensioning and detensioning schedule for all products to be fabricated.
- (c) Complete details, including anticipated initial and shipping cambers, tensioning force (initial and final), concrete compressive strength for stripping of forms (for precast elements, load transfer strength for prestressed elements, handling strength and 28-day strength for shipping), class of concrete, and type and location of lifting devices.
- (d) Shop drawings shall clearly indicate all deviations from the precast/prestressed unit details shown on the Plans.
- (e) For drawings and other relevant documentation for prestressed concrete elements refer to "Prestressed Concrete Notes" indicated on the Plans.

2. Information Required with Shop Drawings. The following information shall be submitted with the shop drawings.

- (a) The name of the manufacturers of the reinforcing and prestressing steels, including alternate sources and appropriate Certificates of Compliance.
- (b) Material and manner of sealing the exposed portions of the prestressing steel.
- (c) Calculations of strand elongation for each unique casting length (grip-to-grip).
- (d) Proposed method of handling and transporting prestressed concrete units to the project site.
- (e) Submission for the Engineer's approval of a detailed plan for curing the precast/prestressed elements. This detail plan shall include the following:
 - (1) Curing Method.
 - (2) Providing for enclosures, indicating method of holding down enclosure safely in place.
 - (3) Heating devices, types and location around the structure.
 - (4) Method of monitoring time/temperature of hardened concrete.
 - (5) Backup systems as required.

The Engineer will review shop drawings within forty-five (45) calendar days. A set of shop drawings is deemed to be all drawings received by the Engineer from the Contractor for a particular contract on any calendar day. If the shop drawings are detained for examination for a period longer than

that stated above, such detention will be taken into account when considering application by the Contractor for an extension of time for the completion of the Contract.

809.02.2 Concrete. The Contractor shall be responsible for designing a concrete mix to produce the strength and other characteristics specified on the Plans in accordance with the applicable requirements of **SECTIONS 601** and **M.02; PORTLAND CEMENT CONCRETE.**

809.02.3 Steel. Except as noted herein, reinforcing steel shall conform to the requirements of **SECTION 810** of these Specifications and as shown on the Plans. All reinforcing steel used in the fabrication of precast/prestressed concrete structural elements shall be tested before being placed in any of the products.

a. Other Requirements. Steel components shall also conform to the following additional requirements.

1. Chairs or other devices necessary to ensure the proper placement of steel items shall be galvanized, plastic or epoxy coated and must be capable of supporting the loads without deformations, all as approved by the Engineer.

2. Prestressing steel shall meet the requirements of **Subsection M.05.03** of these Specifications.

3. Bearing plates, if required, shall meet the applicable requirements of **SECTION M.05; METALS**, of these Specifications.

4. Coated Steel. All breaks in coating shall be repaired with an approved patching material, used in accordance with the manufacturer's recommendations, before placement in the form. Coated tie wires shall be used in conjunction with coated rebars.

5. Any additional strands or reinforcing steel, wire mesh etc., shall be subject to approval of the Engineer and be provided at no additional cost to the State.

809.03 CONSTRUCTION METHODS.

809.03.1 Equipment Checks and Calibration. A calibration certificate indicating the load calibration of each gauge and hydraulic jack combination used for tensioning shall be provided. The gauge shall have clearly marked divisions of 2 percent of the final tensioning force that are easily readable at the initial and final tensioning force. The calibration of each combination gauge and hydraulic jack shall be made every 6 months. Any repair to the rams, such as replacing the seals or changing the length of the hydraulic lines requires the recalibration of the ram with a load cell.

The Contractor shall have a compressive strength testing machine conforming to the AASHTO T22 Specifications. The Contractor shall have the ability to make, store and cap the specimens in accordance with AASHTO Specifications. The compressive strength testing machine shall be calibrated at least once every 6 months and the calibration certificate submitted to the Engineer. The Engineer shall be provided full access to the compressive testing machine.

809.03.2 Inspection of the Plant and Facilities. Within 30 days after award of contract the Contractor shall notify the Engineer so that the plant and facilities to be used in fabrication of concrete structural elements may be inspected for approval. Fabrication of units will be monitored and inspected by the Engineer. The Contractor shall provide a plant laboratory conforming to the requirements of **SECTION 930, PLANT FIELD LABORATORY**, of these specifications. The Contractor shall notify the Engineer and receive confirmation from the Engineer of any work to be performed. The Contractor may perform work in the absence of the Engineer with the Engineer's prior written approval. The Contractor shall keep the Engineer informed of the day-to-day scheduling of operations. The Engineer shall be provided free access throughout the fabrication plant to observe that the work being performed is in conformance with the Contract Documents.

a. Required Notifications. Notification shall be given to the Engineer prior to:

1. Commencement of production: 1 month.
2. Resumption of work after a suspension of 48 hours or more;
 - (a) a minimum of 2 days when the Engineer is on site,
 - (b) a minimum of 2 weeks in the absence of the Engineer from the site.
3. Unit shipping;
 - (a) a minimum of 2 days when the Engineer is on site,
 - (b) a minimum of 2 weeks in the absence of the Engineer from the site.

The Contractor shall be aware that these requirements may have a direct impact on project schedules.

809.03.3 Concrete Forms.

a. General. Forms shall be constructed of various materials such as plywood, concrete, steel, plastic, polyester resins reinforced with glass fibers, plaster or a combination of these materials, all to the satisfaction of the Engineer. They must be carefully aligned, clean, rust-free, substantial and firm, securely braced and fastened together and sufficiently tight to prevent leakage of mortar. All wooden forms shall be sealed to prevent absorption. Wooden forms that are blistered, warped, delaminated or deteriorated such that they do not perform to the satisfaction of the Engineer shall be replaced by the Contractor. All drill holes or uneven surfaces shall be repaired. All forms shall be strong enough to withstand the action of mechanical vibrators. All forms for each unit shall be approved by the Engineer prior to placing concrete.

All form surfaces that come in contact with the concrete shall be thoroughly treated with a form release coating approved by the Engineer and in the manner and rate specified by the manufacturer. Forms so treated shall be protected against damage and dirt prior to placing concrete.

Any form release coating material that adheres to or discolors the concrete shall not be used.

b. Critical Dimensions. Prior to placing concrete, the Contractor shall verify that all critical dimensions, such as lengths, widths, cable locations, position of weld plates and bearing plates, bulkhead locations and dimensions, blockout locations, post tensioning duct locations, keyway dimensions, dimensions on skewed or battered ends, expansion duct locations, insert locations, fixed and expansion sleeve locations, locations of voids, location of drip grooves, sizes of voids and critical dimensions indicated on drawings shall conform to the tolerances indicated in the current edition of P.C.I. MNL 116.

c. Void-Producing Forms. Void-producing forms shall be constructed of a waterproof material and have a one inch diameter vent placed at each end of the void or as indicated on approved drawings. All voids shall be vented upon removing the concrete element from the form.

809.03.4 Reinforcement and Prestressing Steel. Prior to installation in the units, reinforcement and prestressing steel shall be free of rust, frost, dirt, oil, paint, corrosion, or any foreign material that may prevent bonding between the steel and the concrete, in accordance with **Section 810** of these specifications and to the satisfaction of the Engineer. Prestressing steel that has sustained physical damage at any time will be rejected. The development of pitting or other results of corrosion (other than rust stain) will be cause for rejection when so directed by the Engineer. Prestressing steel exhibiting rust stains shall be examined by the Contractor and the Engineer prior to its placement in the forms to determine if pitting exists. Any coil that is found to contain broken strands will be rejected and the coil replaced.

The splicing of prestressed strands inside the casting form is not permitted. Splicing of strands outside the casting form may be allowed only with prior written approval of the Engineer. Tack welding of bar reinforcement will not be allowed under any circumstances.

Placing and fastening of all steel reinforcement shall be in accordance with **Subsection 810.03.4** of these Specifications.

The Contractor shall furnish a manufacturer's Certificate of Compliance and a Mill test report per size, per heat number, per source and per load for all prestressing strands. The Engineer may obtain strand steel samples for verification testing.

809.03.5 Tensioning of Prestressing Strands. The prestressing elements shall be tensioned to provide the required prestress shown on the Plans and shall conform to the applicable requirements of the current edition of P.C.I. MNL 116.

All the strands of a pretensioned member shall be free from kinks or twists before tensioning operations are started. Any unwinding of the strand in excess of one turn, after tensioning operations are begun, shall not be permitted. All strands shall be tensioned to 20 percent of final jacking force before elongation readings are started, unless otherwise directed by the Engineer. The equipment for producing this initial tensioning load shall provide a means for accurately measuring the force. When the initial tensioning load is applied by pressure jacks, they shall be equipped with a proper gauging system for the initial force.

The pre-designated initial force shall be applied to each strand. This load shall be the starting point for measuring additional tensioning for tension determination by the elongation method.

When comparing theoretical gauge and actual gauge readings, and theoretical elongations and actual elongations, the requirements of the current edition of P.C.I. MNL 116 must be observed.

The elongation computation shall take into account strand anchorage slippage, horizontal movement of abutments, bed shortening and any change in temperature of the prestressing steel between tensioning and time when concrete takes its initial set if this change is expected to exceed 30°F. The final pretensioning shall not be done at temperatures below 20°F.

The strands that are draped shall be stressed no higher than required design stress minus the stress increase in the strand from forcing it into a draped profile.

If the strands are tensioned in their draped position, they shall be supported by rollers at each point of change in direction. The holdup rollers between members and at the ends of the members shall have either bronze bushings or roller bearings that shall be free running and kept well lubricated. Rollers at the hold-down points shall be free running and of a type that will produce a minimum amount of friction. If the load for a draped strand, as determined by elongation measurements, exceeds 5 percent less than that indicated by the jack gauges, the strand shall be tensioned from both ends of the bed and the load as computed from the sum of elongation at both ends shall agree within 5 percent of that indicated by jack gauges.

It is anticipated that there may be a discrepancy in indicated stress between jack gauge pressure and elongation. In such event, the load used shall produce a slight overstress rather than understress. When a discrepancy between gauge and elongation measurements of more than 5 percent occurs, the entire operation shall be carefully checked and the source of error determined and corrected before proceeding further. The use of a load cell may be required by the Engineer to check the applied load. The load cell shall be calibrated at least once every 6 months or whenever it is deemed necessary by the Engineer.

Prestressing steel strands in pretensioned members, if tensioned individually or in groups (i.e., more than one), shall be checked by the Contractor for loss of prestress not more than 3 hours prior to placing concrete. The method and equipment for checking the loss of prestress shall be subject to approval by the Engineer. All strands that show a relaxation loss of prestress in excess of 3 percent shall be retensioned to the designed final jacking force.

When stressing grouped strands simultaneously, each tendon must first be brought to initial tensioning load. The final tensioning load shall be applied to the group using a procedure approved by the Engineer.

During tensioning of any one strand, the process shall be so conducted that the applied load and the elongation of the strand may be measured at all times.

Any prestressed strand which has been tensioned for over 48 hours without the placement of concrete must be checked for elongation or loss of stress before placing of concrete. If losses occur the strands shall be detensioned and then retensioned in accordance with the design loading requirements.

809.03.6 Handling and Placing Concrete. No concrete shall be placed without the Engineer's approval. Concrete shall be handled and placed in accordance with the applicable requirements of

SECTIONS 601 and 808; PORTLAND CEMENT CONCRETE and CAST-IN-PLACE STRUCTURE CONCRETE MASONRY, respectively.

Suitable means shall be used for conveying and placing concrete without segregation. The concrete mixture shall not be dropped from a height greater than one foot above the top of the forms. Special care shall be taken to deposit the concrete in its final position in each part of the form.

The fresh concrete shall be consolidated in place by internal vibration and, if necessary, also by external vibration. The vibrators shall be of a type and design approved by the Engineer and the size of the vibrating head will be governed by the spacing of the prestressing and reinforcement. Handheld vibrators shall be equipped with rubber tipped heads when used to consolidate around epoxy-coated reinforcement. Vibrators shall be used only to consolidate the concrete after it has been properly placed and shall not be used for moving concrete along the forms.

The Contractor is responsible for the proper vibration and consolidation of concrete. Only properly trained personnel shall be used in the placing and finishing operations.

809.03.7 Finishing. After all the concrete has been placed and thoroughly compacted as required under **Subsection; 809.03.6** above, the tops of units shall be magnesium-float finished, unless specified otherwise. To assure production of well-formed concrete elements with an overall pleasing appearance, all surfaces of concrete shall be true and even, free from rough, open or honeycombed areas, depressions, air pockets or projections. All exposed surfaces shall be finished by bagging or as otherwise indicated. In addition, special care and effort shall be taken when finishing all fascia portions of concrete elements.

809.03.8 Curing. Curing shall conform to Section 601 and as modified herein.

a. Curing by Moist Method without Supplemental Heat. The exposed surfaces of precast/prestressed concrete elements cured without supplemental heat shall be kept continuously moist by fogging, spraying, covering with wet mat, or with an impermeable cover. The concrete unit must be kept at a temperature of not less than 50⁰F until such time as the compressive strength of the concrete reaches the strength specified for transfer of prestress or stripping.

b. Accelerated Curing System. Curing with Live Steam – Steam curing for precast/prestressed elements shall conform to the following provisions:

1. After placement of the concrete, elements shall be held for a minimum 4-hour pre-steaming period. If the ambient air temperature is below 50⁰F, steam shall be applied during the pre-steaming period to hold the air surrounding the element at a temperature between 50⁰F and 90⁰F.

2. To prevent moisture loss on exposed surfaces during the pre-steaming period, elements shall be covered as soon as possible after casting or the exposed surfaces shall be kept wet by fog spray or by wet blankets.

3. Enclosures for steam curing shall allow free circulation of steam about the element 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 condition and secured in such a manner to prevent the loss of steam and moisture.

4. Steam at the jets shall be low pressure and in a saturated condition. Steam jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam the temperature rise within the enclosure shall not exceed 40°F per hour. The curing temperature throughout the enclosure shall not exceed 150°F and shall be maintained at a constant level for a sufficient time necessary to develop the required transfer strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where the temperature is representative of the average temperature of the enclosure.

5. Calibrated temperature recording devices that will provide an accurate continuous permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 100 feet of continuous bed length and not less than two per bed, one at each end will be required for checking temperature.

6. Once minimum transfer compressive strength is achieved, members in tension shall be detensioned immediately after the termination of steam curing while the concrete and forms are still warm or the temperature under the enclosure shall be maintained above 60°F until the stress is transferred to the concrete.

7. Initial curing of precast/prestressed concrete will be considered complete once the minimum specified transfer or form stripping strength is verified by compressive strength cylinder test results.

8. Radiant heat may be applied by means of pipes circulating steam, hot water or oil, or by electric heating elements. Radiant heat curing shall be done under a suitable enclosure to contain the heat and moisture and minimize losses by covering all exposed concrete surfaces with plastic sheeting.

c. Other Curing Methods. If the Contractor proposes to cure the elements by any other method it must be submitted in detail to the Engineer for approval.

809.03.9 Testing.

a. General. Acceptance, Contractor quality control and Independent Assurance Sampling and Testing shall conform to the requirements of **Section 601** and as modified herein. All materials required for testing shall be furnished by the Contractor at his own expense. Acceptance test samples will be taken by the Engineer except where contractual restrictions are present, in which case sampling will be witnessed by the Engineer with samples immediately taken into custody by the Engineer. The Contractor shall have no claims for compensation or extension of time in the event his work is delayed while waiting approval of the materials furnished for testing.

b. Quality Control Testing. Quality Control Testing of concrete is a mandatory requirement, and shall be performed by the Contractor in conformance with the following provisions:

1. Cylinder specimens for form stripping, detensioning, handling, shipping and application of external loads shall be cast by the Contractor and shall be cured and tested in accordance with procedures outlined in **SECTION 601; PORTLAND CEMENT CONCRETE**, of these Specifications. The Contractor shall cast a sufficient number of concrete test cylinders to ensure that enough specimens are available to determine the necessary strength test requirements. Quality Control Cylinders shall be field cured under the same curing conditions as the precast/prestressed element. The Contractor shall be responsible for furnishing the cylinder molds for all compressive test specimens.

2. Quality control cylinders shall be cast and tested in the presence of the Engineer.

3. All cylinders shall be placed within 15 feet of each end of the casting bed or as determined by the Engineer.

One cylinder from each location shall be tested in immediate succession to verify form stripping (precast), transfer (prestressed) and 28-day strengths (shipping).

All cylinders must exceed the minimum strength required for form stripping (precast), transfer (prestressed), handling and 28-day strengths (shipping), respectively.

No structure shall be shipped from the plant to the project site unless it has obtained the minimum 28-day compressive strength. Furthermore, shipping shall not occur without the RIDOT Materials inspection stamp or other documented approval of the Engineer.

c. Acceptance Testing. Acceptance testing is performed only by the Engineer and is defined in **Subsection 601.03.7; Testing of Concrete**, and shall be the methodology for "Acceptance" of all concrete elements.

809.03.10 Transfer of Prestress. Transfer of prestress shall be accomplished in the presence of the Engineer and in accordance with the approved detensioning schedule and as soon as the transfer strength is achieved and verified. The detensioning schedule must consist of, but not be limited to, the following:

1. The order of detensioning, and;
2. Each strand must be detensioned at each end and/or between each element.

At the end of each prestressed element the concrete surrounding the individual strands shall be chipped back to sound material to a depth of between 3/4-inch to 1 inch. The strands themselves shall be cut back to the same depth. The edges shall be squared off so as not to produce a "feathered" edge. Cleaning shall be by wire brushing or abrasive sand blasting to remove all dirt and residue that is not firmly bonded to the metal or concrete surfaces. The ensuing void, including the end of the strand, shall be filled with an approved non-shrink grout whose surface shall be finished flush with that of the plane surface of the product.

809.03.11 Handling. All products shall be removed from the forms in the presence of the Engineer. Adequate notice shall be given to the Engineer so that he may witness the removal operation. Extreme care shall be exercised in handling and moving precast/prestressed concrete members. Precast girders and slabs shall be transported in an upright position and the points of support and direction of the reactions with respect to the member shall be approximately the same during transportation and storage as when the member is in its final position.

The location of all dunnage and pick-up points shall be as indicated on the Shop Drawings.

Care shall be taken during storage, hoisting and handling of the precast units to prevent cracking or damage. Damaged units shall be replaced or repaired at the Contractor's expense subject to approval by the Engineer.

809.03.12 Rejection of Units. Units not fabricated in accordance with the Contract Documents, Plans, or approved shop drawings will be subject to rejection by the Engineer.

The Engineer will make a preliminary determination as to whether spalled, cracked, honeycombed, or otherwise defective concrete shall be repaired or be subject to rejection. In the event that the unit is to be repaired, the Contractor shall submit a detailed non-conformance report and a detailed repair procedure to the Engineer for approval prior to commencement of repair work.

All repair work shall be performed at the expense of the Contractor and in the presence of the Engineer. Any repair work not done in the presence of the Engineer will not be accepted.

The repaired unit will then be reinspected for approval by the Engineer.

809.04 METHOD OF MEASUREMENT. “Precast, Prestressed Concrete Elements” will be measured for the particular item or items of work as specified, and as directed by the Engineer.

809.04.1 Incidental Items. All labor, equipment, tools and materials, including but not limited to backer rods, grouting between units, post tensioning, patching of duct pockets and all incidental items required to complete the work as specified, complete, in place and accepted by the Engineer, will not be measured separately for payment but will be considered incidental to the other items of work covered in this section.

809.05 BASIS OF PAYMENT. The accepted quantities of “Precast, Prestressed Concrete Elements” of the sizes and types specified, will be paid for at their respective contract unit prices per item or items of work as listed in the proposal. The prices so stated shall constitute full and complete compensation for all labor, equipment, tools and materials, including but not limited to backer rods, grouting between units, post tensioning, patching of duct pockets and all incidentals necessary to finish the work as specified, complete and accepted by the Engineer.

a. Payment for Compensation for Out-of-State Inspection Services. The Contractor shall pay for such out-of-state inspection services by the day (per diem) for each Department Engineer and/or Technician assigned to the plant for inspection of the project. The rates, which shall be established based on the radius, in miles, from the base of operations, shall be as follows:

Distance in Radial Miles	Rates per Inspector/Day
51-to-100 miles	\$150.00
Greater than 100 miles	\$500.00

There will be a maximum charge of one inspector for precast operations and two inspectors for prestress operations. The Contractor will be credited 50 percent when a plant is performing operations for two or more Department contracts.

The contractor will not be charged for an initial inspection of a company or a single follow-up inspection for plant approval prior to initial production.

The compensation payment for out-of-state inspection services will be paid as a progress payment deduction.

Remove **Section 810, Reinforcing Steel**, pages 8-79 through 8-84 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 810

REINFORCING STEEL

810.01 DESCRIPTION. This work consists of providing reinforcing steel, both plain and deformed, and uncoated and galvanized; spiral wire; and welded wire fabric of the quality, type, size and at the locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

This work also includes the drilling and grouting of reinforcing dowels.

810.02 MATERIALS. The following materials shall conform to the applicable requirements of the indicated **Subsections of PART M; MATERIALS:**

- a. **Subsection M.05.01, Bar Reinforcement.**
- b. **Subsection M.05.02.1, Wire Fabric.**
- c. **Subsection M.05.02.2, Spiral Wire.**
- d. **Subsection M.05.05, Galvanized Reinforcement.**

810.03 CONSTRUCTION METHODS.

810.03.1 Bar Schedules and Bending Diagrams. The Contractor shall prepare and submit complete bar schedules and bending diagrams, including material weights for all reinforcing steel on the project. Fabrication of the reinforcing steel shall not commence until written approval of the submittals has been granted by the Engineer. The Contractor is solely responsible for the accuracy of the schedules and diagrams.

810.03.2 Test Bars. The Contractor shall include extra bars for field sampling, for supplementary analyses; and for weight, tensile and bending tests, as required by the Engineer. In general, one bar size of a length sufficient for two separate 36 inch samples will be randomly selected by the Engineer for testing. The Contractor shall provide samples when and as directed by the Engineer.

If tests results do not conform to previous reports or to the minimum requirements of tensile and bending properties, those portions of the shipments affected will be rejected. However, the Contractor will be entitled to two additional tests of other bars in the same lot for each failed test, and if the average of all samples tested from the lot is acceptable, the material will be accepted. Any material unsuitable for use because of inaccuracies in bending, or other properties which render it unfit will be rejected.

The weight of test specimens shall be primarily used in calculations to determine the effective area for tensile tests. If the weight of test specimens exceeds the permissible lot variation from theoretical weights as specified in ASTM A615, sufficient material will be weighed to produce a reliable determination of effective area. The Contractor shall provide for the required handling without extra compensation.

810.03.3 Fabrication and Delivery.

a. Bending. Bent bar reinforcement shall be cut and cold bent to the shapes shown on the Plans. Fabrication tolerances shall be in accordance with ACI 315-92, "Detailing Manual." Bars partially embedded in concrete shall not be field bent except as shown on the Plans or as indicated elsewhere within this specification.

b. Hooks and Bend Dimensions. The dimensions of hooks and the diameters of bends shall be in accordance with the latest edition of the AASHTO LRFD Bridge Design Specifications or ACI 318/318R-95, "Building Code Requirements for Reinforced Concrete."

c. Identification. Bar reinforcement shall be shipped in standard bundles, tagged and marked in accordance with the Manual of Standard Practice of the Concrete Reinforcing Steel Institute (CRSI).

810.03.4 Handling, Storage, and Surface Condition of Reinforcement

a. Uncoated Bars. All reinforcement bar, wire, or fabric when unloaded at the site shall be stored above the ground on sills, blocking, or other supports and shall be protected from mechanical injury or corrosion causing conditions.

Immediately prior to placement of concrete, all reinforcement shall be free from dirt, loose rust or scale, mortar, paint, grease, oil, and other materials that would reduce bond. Rusted areas must be thoroughly hand-wire brushed just prior to installation. After hand-wire brushing, remaining rusted areas will be acceptable provided the minimum dimensions, cross sectional area, and tensile properties meet the physical requirements for the size and grade of steel specified.

b. Galvanized Bars. In addition to the above requirements for uncoated bars, the following apply for galvanized bars:

All systems for handling galvanized bars shall have padded contact areas for the bars wherever possible.

All bundling bands shall be padded and all bundles shall be lifted with a strongback, multiple supports, or a platform bridge to prevent bar to bar abrasion from sags in the bar bundle. The bars or bundles shall not be dropped or dragged.

Galvanized bars shall not be exposed outdoors for more than 2 months, or less if the initial presence of white oxide begins to form on the galvanized bars, unless these bars are protected per AASHTO M 284. Exposure time shall include storage time and any additional time for those sections of bars left exposed after casting.

810.03.5 Placing and Fastening.

a. Uncoated Bars.

1. General. Prior to ordering bar reinforcement, the Contractor shall carefully check all bar lists and assume full responsibility for their accuracy. All steel reinforcement shall be accurately placed in the positions shown on the Plans and firmly held in place during the placing and setting of concrete. When placed in the work reinforcement shall be free from dirt, rust, loose mill scale, paint, oil and other foreign deleterious materials.

2. Spacing and Cover. The spacing and cover of reinforcement shall be as indicated on the plans.

3. Support Systems. All bars shall be maintained the correct distance from the forms by means of blocks, hangers, chairs or other approved devices. The use of pieces of stone, brick, wood or metal pipe is not permitted. If required, precast concrete blocks placed with the small face down may be used. All metallic support systems shall have a protective coating for corrosion protection. For metallic support hardware resting against formwork, plastic tips shall be provided.

4. Fastening. Before the concrete is placed, all reinforcement shall be securely fastened together and supported with approved chairs or other approved devices. The chairs shall be properly sized and spaced to provide the specified minimum concrete clear cover. Bars shall be securely tied with wire at all intersections around the perimeter of each mat and within the interior at not less than 2.0-ft centers or at every intersection, whichever is greater. Bundles bars shall be tied together at not more than 6.0-ft centers. In any case, there shall be a sufficient number of intersections tied to prevent any movement of the mat or loose bars to the satisfaction of the Engineer.

All metallic wire ties and miscellaneous metallic hardware used for placement of reinforcing shall be plastic coated. For metallic hardware resting against formwork, plastic tips shall be provided.

All reinforcement shall be placed and tied, inspected and approved by the Engineer before placement of concrete commences.

5. Splicing Reinforcing Steel. All reinforcement bars shall be furnished in full lengths as indicated on the Plans. Splicing of bars and wire fabric reinforcing, except where so indicated, is not permitted without the written approval of the Engineer. Splices shall be staggered as far as possible. Splices shall not reduce the concrete clear cover. In addition to the above, the following shall also apply:

(a) Lap Splices. Lap splices shall be of the lengths specified on the plans. Lap splices shall not be used for bar sizes larger than No. 11. Mechanical splices shall be used for splices of bars greater than No. 11. If lap lengths are not specified on the plans, the length of each lap splice shall be in accordance with the applicable articles of the AASHTO LRFD Bridge Design Specifications for tension or compression splices. Lap splices shall be made by placing the bars in contact and wiring them together for the full lap length of the splice. Lap splices are not allowed in certain specific locations as described in the plans.

(b) Mechanical Splices. Mechanical splices shall be used if shown on the plans or approved in writing by the Engineer. For bars greater than No. 11, mechanical splices shall be used unless otherwise noted on the plans. Such mechanical splices shall develop in tension or compression, as required, at

least 125 percent of the specified yield strength of the bar being spliced. Mechanical splices shall be installed in accordance with the manufacturer's recommendations.

(c) **Welds.** Welds are not permitted unless indicated on the Plans or authorized in writing by the Engineer. Where welding is indicated it shall conform to the applicable requirements of ANSI/AWS D1.4, Structural Welding Code-Reinforcing Steel.

(d) **Wire Fabric.** Wire fabric of the various sizes shown shall be cut to the required dimensions and placed where indicated on the Plans. Sheets of welded wire fabric shall be spliced by overlapping each other sufficiently to maintain a uniform strength and shall be securely fastened at the ends and edges. The edge lap shall not be less than one mesh in width plus 2 inches.

b. Galvanized Bars. In addition to the applicable provisions of **Subsection 810.03.5(a)** above, the following apply to galvanized bars:

1. Field Bending. Galvanized bars shall not be bent in the field more than 10 degrees, regardless of the diameter of the bend. Where field bending of galvanized reinforcing bars in excess of this limitation is indicated on the Plans or allowed by the Engineer, these bars shall be touched-up after field bending with a zinc rich primer, in accordance with **Section 810.03.5(b)(5)**.

2. Splices.

(a) **Lap Splices.** Splices for bar sizes No. 11, or smaller, shall be made by either a lap splice or mechanical splice.

(b) **Mechanical Splices.** Mechanical splices are required for bars larger than No. 11. These splices shall be galvanized.

(c) **Welds.** Prior to welding of reinforcing fabric, the galvanized coating shall be removed for the length of the bar to be welded plus six inches on each side of the weld. After welding, all slag, weld spatter, and other foreign material shall be removed and the spliced area shall be cleaned and re-galvanized in accordance with the field repair procedure described in **Section 810.03.5(b)(5)**.

3. Placement. Prior to placing galvanized reinforcement, all grease, dirt, mortar, and any other foreign substance must be removed from the bars. Galvanized reinforcement shall be placed in the position indicated in the contract documents and within ACI tolerances.

4. Hazardous Materials. The Contractor's operations shall conform with all OSHA regulations that apply to working with zinc based materials. Contractor's operations which may be affected by these regulations include, but are not limited to, welding splices and coating repair.

5. Field Repair. The Contractor shall field-repair damage to the galvanized coating done during shipping and handling, and replace bars that are not field repairable as described herein. Repairable damage is defined as any bare or loose spots, or breaks in the coating which affects an area smaller than one square inch.

Field repair will be allowed only when the total number of repairable damaged areas in a 10 foot length of bar is less than 6. Material with a total number of damaged areas greater than the amount specified above, or material with a damaged area greater than one square inch, will be rejected and shall be immediately removed from the work site and replaced by the Contractor at no cost to the State.

The galvanized coating shall be repaired with a zinc-rich paint by the following method:

(a) Clean the damaged area by power disk, wire brushing, sand or grit blasting, or any other suitable method approved by the Engineer to a near-white metal condition in accordance with SSPC-SP10 (1 to 2 mil anchor pattern), as a minimum. The surface shall also be clean, dry and free of oil, grease, flux residue, corrosion products, and any other foreign substance.

(b) Using a minimum of two coats, and the methods recommended by the manufacturer of the zinc-rich paint, spray or brush apply the zinc-rich paint to the area in a manner to achieve the applicable ASTM adherence and quality requirements of the original coating, and a minimum dry film thickness of 4 mils. Paint shall be applied immediately after surface preparation is complete.

(c) If the reinforcing bar needs to be cut in the field, prior to application of the zinc-rich paint, the end shall be ground smooth and the edge chamfered to ensure a uniform thickness of paint.

(d) These repair procedures are only allowed for field repairs. These procedures are not allowed for shop repairs. All repairs shall be made at no cost to the State.

810.03.6 Drill and Grout Reinforcing Dowels. Provisions for drilling and grouting dowels are set forth in **SECTION 819** of these Specifications and the applicable sections above.

810.04 METHOD OF MEASUREMENT.

810.04.1 Bar Reinforcement and Spiral Wire. "Bar Reinforcement" and "Spiral Wire", both plain and deformed and galvanized and uncoated, will be measured by the total number of pounds of each type actually placed in accordance with the Plans and/or as directed by the Engineer. The weight of plain or deformed bars will be computed using the unit weights indicated in the AASHTO LRFD Bridge Design Specifications. The weight of clips, ties, separators, chairs, mechanical splices, or other material used for fastening the reinforcing in place shall not be included for payment. No allowance will be made for the weight of the galvanizing in computing the weight of galvanized bar reinforcement.

810.04.2 Wire Fabric Reinforcement. "Welded Wire Fabric Reinforcement," galvanized and uncoated, will be measured by the number of square feet actually installed in accordance with the Plans and/or as directed by the Engineer. Galvanized coating of fabric reinforcement will not be measured separately for payment.

810.05 BASIS OF PAYMENT.

810.05.1 Bar Reinforcement and Spiral Wire. The accepted quantities of "Bar Reinforcement" and "Spiral Wire" will be paid for at their respective contract unit prices per pound as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials, equipment and incidentals required to finish the work, complete and accepted by the Engineer.

810.05.2 Wire Fabric Reinforcement. The accepted quantities of "Wire Fabric Reinforcement" will be paid for at their respective contract unit prices per square foot as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials, equipment and incidentals required to finish the work, complete and accepted by the Engineer.

Remove **Section 812, Waterstops and Flashings**, pages 8-86 to 8-88 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 812

WATERSTOPS

812.01 DESCRIPTION. This work consists of the furnishing and installation of waterstops in various types of concrete joints at the locations shown on the Plans or as directed by the Engineer, all in accordance with these Specifications.

812.02 MATERIALS.

Polyvinyl Chloride (PVC) Waterstops. PVC waterstops shall be manufactured by the extrusion process from an elastomeric plastic compound, the basic resin of which shall be PVC. The compound shall contain any additional resins, plasticizers, stabilizers, or other materials needed to assure that, when the material is compounded, it will meet the performance requirements given in the table below. No reclaimed PVC or other material shall be used.

The PVC material shall comply with the following physical requirements when tested under the indicated ASTM test method.

Specific Gravity	ASTM D792	Max 1.35
Durometer Hardness	ASTM D2240	75 +/- 5
Tensile Strength	ASTM D412	Min 1.8 ksi
Elongation	ASTM D412	Min 350%
Cold Brittleness	ASTM D746	-35° F
Stiffness in Flexure	ASTM D747	Min 0.350 ksi

812.03 CONSTRUCTION METHODS. Waterstops shall be installed at locations indicated on the Plans. Where movement at the joint is provided for, the waterstop shall be capable of accommodating such movement without injury. Waterstops shall be spliced, welded or soldered to form durable continuous watertight joints.

Precautions shall be taken so that the waterstops shall be neither displaced nor damaged by construction operations or other means. Damaged components shall be repaired to the satisfaction of the Engineer at no additional cost to the State. All surfaces of the waterstops shall be kept free from oil, grease, dried mortar, or any other foreign matter while the waterstop is being embedded in concrete. Means shall be used to ensure that all portions of the waterstop designed for embedment shall be tightly enclosed by dense concrete per the manufacturer's recommendations.

A Certificate of Analysis from an approved independent testing laboratory shall be provided to the Engineer. The certificate shall state that the material furnished conforms without exception to all the requirements specified herein; and shall also include all qualitative and quantitative test results.

a. Waterstops. A manufacturer requesting approval of a waterstop shall furnish to the Engineer a 3-foot length of each type of PVC waterstop he intends to supply for approval.

b. Installation of Waterstops. The Contractor shall demonstrate proven ability and competence in the installation of these products, in conformance with the manufacturer's printed instructions.

If any part of this work is found defective at any time before the final acceptance, the Contractor, at his own expense, shall correct each defect to the satisfaction of the Engineer.

1. Preparatory Work. All waterstops shall be protected from oil, dirt, concrete spatter, damage, and shall be clean to receive concrete forms. Particular care shall be taken during installation of waterstops to eliminate all deficiencies that may cause leakage. Waterstops shall be positioned so as not to create interference with reinforcing bars and slip during installation.

2. Methods. Different methods may be used to fasten the waterstop in position. All waterstops shall be held rigidly in place by extending through slots in keyways; held by split bulkheads; tied to reinforcing bars; or other adequate methods as necessary to ensure proper support and embedment during the concreting process. The method used shall not cause damage to the waterstops or in any way compromise the integrity of the watertight seal.

3. Splicing. PVC waterstops may be butt-spliced on the job in accordance with the manufacturer's recommendations. The Contractor shall demonstrate to the Engineer that all persons who are responsible for performing splices are capable of creating the proper joint. Upon request the manufacturer shall demonstrate the splicing method for producing a strong, water-tight butt weld. Elbows, tees and crosses may also be produced by this method.

812.04 METHOD OF MEASUREMENT. Unless covered by a Special Provision, together with a corresponding Proposal Item, waterstops will not be measured separately for payment.

812.05 BASIS OF PAYMENT. Unless covered by a specific Proposal Item, waterstops will not be paid for separately and are deemed incidental to the respective pay item for the concrete listed in the proposal.

Remove **Section 813, Waterproofing and Dampproofing**, pages 8-88 through 8-93 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following:

SECTION 813

WATERPROOFING AND DAMPPROOFING

813.01 DESCRIPTION. This work consists of providing dampproofing and waterproofing systems on concrete bridge decks and other surfaces at the locations indicated on the Plans and as directed by the Engineer, all in accordance with these Specifications.

813.01.1 Systems.

a. Dampproofing shall consist of mopped applications of approved bituminous materials.

b. Waterproofing shall consist of the application of a preformed membrane; a rubberized liquid asphalt membrane, or a cold applied liquid membrane, all as set forth below.

813.01.2 Dampproofing. This type of dampproofing consists of a prime coat and two mopped applications of an approved bituminous material.

813.01.3 Preformed Waterproofing Membrane. This type of waterproofing system consists of applying a preformed bituminous membrane of approved manufacture to concrete surfaces in strict compliance with the manufacturer's recommendations.

813.01.4 Rubberized Liquid Asphalt Membrane. This type of waterproofing system consists of applying a hot, liquid asphalt membrane of approved manufacture to concrete surfaces in strict compliance with the manufacturer's recommendations.

813.01.5 Cold Applied Liquid Membrane. This type of waterproofing system consists of applying a spray applied plural component resin based elastomeric membrane of approved manufacture to concrete surfaces in strict compliance with the manufacturer's recommendations.

813.02 MATERIALS.

813.02.1 General. Materials for dampproofing and waterproofing systems shall be delivered in original, tightly sealed containers or unopened packages, clearly labeled with manufacturer's name, brand name and number, and batch number of the material where appropriate. Prior to delivery, the manufacturer shall submit to the Engineer a notarized certificate attesting that the material conforms to these Specifications in every respect.

813.02.2 Dampproofing.

a. Prime Coat. The prime coat shall conform to the requirements of **Subsection M.12.01.1** of these Specifications.

b. Mop Coats. The mop coats shall conform to the requirements of **Subsection M.12.01.2** of

these Specifications.

813.02.3 Preformed Waterproofing Membrane. The primer and sheet membrane materials of this system shall conform to the respective requirements of **Subsection M.12.02.2** of these Specifications.

813.02.4 Rubberized Liquid Asphalt Membrane. The surface conditioner, membrane, and protective sheet materials of this system shall conform to the respective requirements of **Subsection M.12.02.1** of these Specifications.

813.02.5 Cold Applied Liquid Membrane. The primer and membrane materials of this system shall conform to the respective requirements of **Subsection M.12.02.3** of these Specifications.

813.03 CONSTRUCTION METHODS.

813.03.1 Surface Preparation for All Types. New concrete shall have cured a minimum of 7 days in accordance with ACI-308. New or existing surfaces shall be free of oil, grease, curing compounds, algae, moss, laitance, friable matter, bituminous products and previous waterproofing membranes. If required, degreasing shall be performed with detergent washing in accordance with ASTM D4258. Concrete surfaces shall be abrasively cleaned in accordance with ASTM D4258 and all spalls repaired with concrete patch materials per the Engineer's and Manufacturer's recommendations. Voids and blowholes on vertical surfaces shall be repaired in the same manner.

Areas of minor surface deterioration or depression of 0.5-inch and greater in depth shall be brought to grade with an approved patching mortar. Cracks and joints shall be treated in accordance with the manufacturer's recommendations as approved or directed by the Engineer.

The applicator shall be responsible for the protection of equipment and adjacent areas from overspray or other contamination that may be caused by application of the dampproofing or waterproofing.

813.03.2 Dampproofing.

a. Limitations. No dampproofing shall be applied in wet weather, nor when the temperature is below 35°F. Should the surface of the concrete become temporarily damp, it shall be covered with a 2-inch layer of hot sand, which shall be allowed to remain in place long enough to produce a warm and dry condition. The sand shall be swept back, uncovering sufficient area for commencing work. The operation may be repeated as the work progresses.

b. Prime Coat. Immediately after the surface is prepared and in order to insure a proper bond between the dampproofing material and the concrete, a prime coat shall be applied. The primer shall be sprayed or brushed on the surface at a rate of approximately 1/10 of a gallon per square yard so as to cover it completely and uniformly. The quality of the primer and the method of application shall be approved by the Engineer.

c. Application. Concrete or other surfaces which are to be protected by dampproofing shall be mopped or brushed with two coats of an approved bituminous material for absorptive treatment. The bituminous material shall be heated to a temperature between 300°F and 350°F. The material shall be stirred frequently to avoid localized overheating. The heating kettle shall be equipped with thermometers. The bituminous material shall be applied with suitable mops or brushes. Each coat shall

be mopped over the surface, completely covering same with a continuous heavy film. When any breaks or thin spots show in the dampproofed surface after drying, they shall be retouched to secure an even impervious coating. The interval between successive applications shall not be less than 18 hours. The completed dampproofing shall be protected by the Contractor from damage by subsequent construction operations.

813.03.3 Preformed Waterproofing Membrane. Concrete surfaces that are to receive this type of waterproofing shall have a wood float or trowelled finish.

a. Manufacturer's Representative. The Contractor shall furnish the services of a competent field representative of the approved manufacturer to be present at the work site prior to any use of materials. The representative shall instruct the Contractor and the Engineer on installation and inspection procedures and to inspect the condition of the prepared surfaces. The representative shall be present at the job site until the completion of the work.

b. Application. The prime coat is to be applied only to areas that will be covered with membrane within the following 24 hours. Any areas not covered within 24 hours must be reprimed. The primer material and rate of coverage shall meet the specifications of the manufacturer. The primer shall be allowed to dry one hour or until tack free before placing the membrane. The membrane shall not be applied at temperatures below 40°F. All corners such as at curbs shall be double covered by using an initial strip of 12-inch minimum width, placed along the axis of the corner. Inside corners shall be finished with a fillet, and outside corners shall be rounded. Areas around drains or other protrusions shall be double covered with the membrane for a minimum of 6 inches in each direction, then liberally coated with an approved mastic. The membrane shall be laid from the low point to the high point with the membrane overlapped a minimum of 4 inches. Misaligned or inadequately lapped seams must be repaired. The wearing surface shall be placed as soon as possible after application of the membrane. A careful inspection must be made before covering the membrane, and any tears or holes must be repaired with necessary patches.

813.03.4 Rubberized Liquid Asphalt Membrane.

a. Manufacturer's Representative. The requirements for the Manufacturer's Representative are the same as set forth above in **Para. a** of **Subsection 813.03.3**.

b. Sample Area. At the option of the Engineer, the Contractor shall apply the liquid membrane on a sample area not less than 10 square feet in size. When approved, the sample area shall serve as a standard of acceptance for all membrane work.

c. Mixing. All mixing and application of the liquid membrane system shall be done in strict accordance with the printed instructions of the approved manufacturer and as directed by the Engineer. The Contractor shall submit evidence to the Engineer indicating that the proposed membrane applicator subcontractor is fully qualified to perform the work, and any proposed subcontractor found not qualified shall, at the written request of the Engineer, be removed forthwith by the Contractor.

d. Application. The surface conditioner shall be applied evenly, using a low pressure sprayer, to all surfaces at a rate not exceeding one gallon per 300 square feet or not less than one gallon per 600 square feet, depending on the concrete surface. The conditioner shall be allowed to dry before application of the membrane.

Cakes of membrane shall be melted in an approved double shell melter under continuous

agitation until the material can be drawn free-flowing and lump-free at a temperature not exceeding 425°F. Membrane shall be applied evenly at the rate of one pound per square foot to provide a continuous coating not less than 1/8-inch thick and averaging 3/16-inch thick. The areas to be waterproofed will be inspected during application of the liquid membrane system by the Engineer to ensure that the membrane thickness is in accordance with the paragraph directly above. Any deficiencies shall be repaired at the expense of the Contractor.

e. Protection. Immediately following application of the membrane, and before it cools and before vehicular or foot traffic is allowed on the membrane, the entire waterproofed bridge deck shall be covered with rolled asphalt sheets. Protective sheets shall be laid parallel to the center line of the bridge roadway. The protective sheets should not be allowed to overlap at either the longitudinal or transverse joints. The joint shall be a tight butt type. The maximum allowable space between sheets is 1/4-inch. The entire application of protective sheets shall be free of wrinkles, bubbles, fishmouths or other defects. Following placement of the protective sheet, a bead of hot membrane shall be placed along the joint where the sheet terminates at the face of the curb. The bead shall be continuous to prevent water from entering between the protective sheet and membrane.

f. Testing. During the waterproofing work, field samples of the membrane material may be taken for evaluation by the Engineer. Tests shall include penetration, flow, low temperature flexibility and adhesion and elasticity, all as specified herein.

813.03.5 Cold Applied Liquid Membrane.

a. Manufacturer's Representative. The requirements for the manufacturer's representative are the same as set forth above in **Para. a of Subsection 813.03.3**.

b. Surface Preparation. In addition to the requirements of **Subsection 813.03.1**, all steel surfaces shall be prepared to a near white metal finish per SSPC-10 and overcoated with primer within 4 hours.

c. Testing. Random tests for adequate tensile bond strength shall be conducted on the substrate by the applicator on site using an Elcometer Adhesion Tester Model 106 or similar at a minimum frequency of three tests per 5,000 square feet. Smaller areas shall receive a minimum of three tests. Should the tensile bond strengths be lower than 100 psi on concrete (or failure within the concrete) or 290 psi on steel, the Engineer may request further surface preparation.

d. Application. Application shall only proceed while air and substrate temperature are between 32°F and 104°F providing the substrate is above the dew point. Outside these temperatures the manufacturer shall be consulted. Work shall not proceed without written documentation from the manufacturer approving the modified acceptable substrate temperature. All components of the system shall be measured and mixed strictly in accordance with the manufacturer's recommendations. Mixing shall be done with either an air driven high-speed paddle or an explosion proof mixer. Prior to the application of any materials, the surface must be clean and free from loose debris, moisture, oil, grease or other contaminants.

1. Primer. A single coat of spray, roller or brush applied primer is required for all steel and concrete surfaces. This primer shall cure tack free before application of the waterproofing membrane.

2. Membrane. The waterproofing membrane shall be spray applied with suitable equipment, approved by the manufacturer. The membrane system shall pass ASTM C 836Crack Bridging Test at 80

mils, or the thickness applied shall be at least equal to the thickness used by the manufacturer for the ASTM C836 Crack Bridging Test. Perform film thickness tests in accordance with SSPC-PA2 Measurement of Dry Coating Thickness, using 1/8 inch thick (minimum) steel coupons sprayed during the deck application so as to accurately represent the application procedure. The membrane shall cure between coats and before application of the tack coat.

3. Tack Coat. A tack coat, supplied by the same manufacturer, shall be applied directly to the waterproofing membrane prior to surfacing.

e. Repairs.

1. Patching. If an area is left untreated or the membrane becomes damaged, a patch repair shall be carried out to restore the integrity of the system. The damaged area shall be cut back to sound material and wiped with solvent (e.g., acetone) up to a width of at least 4 inches on the periphery, removing tack coat and any contaminants. The substrate shall be primed, if necessary, followed by the application of membrane. A continuous layer shall be obtained over the substrate with a 4-inch overlap onto the existing membrane.

2. Overlapping. Where the membrane is to be joined to existing cured material and at day joints, the new application shall overlap the existing one by at least 4 inches. No preparation shall be necessary unless the existing materials are contaminated with tack coat or dirt in which case the repair/overlap area shall first be wiped with solvent (e.g., acetone).

f. Protection. During all stages of application, the membrane shall be protected by the Contractor from damage by construction operations.

g. Final Review. The Engineer and the applicator shall jointly review the deck area(s) in which the completed system has been installed, prior to surfacing. Any irregularities or other items which do not meet the requirements of the Engineer shall be addressed at this time.

813.04 METHOD OF MEASUREMENT. "Dampproofing," "Preformed Waterproofing Membrane," "Rubberized Liquid Asphalt Membrane," and "Cold Applied Liquid Membrane," will be measured by the number of square yards of each system actually placed in accordance with the Plans and as directed by the Engineer.

813.05 BASIS OF PAYMENT. The accepted quantities of "Dampproofing," "Preformed Waterproofing Membrane," "Rubberized Liquid Asphalt Membrane," and "Cold Applied Liquid Membrane," will be paid for at their respective contract unit prices per square yard as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials, equipment, and all other incidentals required to finish the work, complete and accepted by the Engineer.

Revise **Subsection 814.03, Placement of Concrete Bridge Decks – Construction Methods**, pages 8-94 through 8-101 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 814

PLACEMENT OF CONCRETE BRIDGE DECKS

- **Replace the fourth paragraph of Subsection 814.03. 8(b) with the following.**

All concrete shall be kept continuously moist and protected against any drying for a minimum period of 14 consecutive days after placement of concrete. The burlap covers shall be kept moist for the entire 14 day curing period, and under no circumstances shall the concrete be allowed to be exposed to an alternating wet and dry condition.

- **Replace the first paragraph of Subsection 814.03.8(c), page AC-61 of the January 2011 Compilation of Approved Specifications with the following.**

814.03.8 Curing.

c. Falling Temperatures. The Contractor shall provide suitable measures to maintain the concrete surface temperature between 50°F and 85°F which shall be monitored by a continuously recording thermometer. The minimum 50°F temperature requirement shall be continuously maintained around the forms and deposited concrete for 7 days after concrete placement and above 40°F for the remaining 7 days of the curing period.

- **Replace Subsection 814.03.9(a), Bridge Decks with Exposed Concrete Surfaces with the following.**

814.03.9 Final Finish. Unless otherwise shown on the Plans, the final finish required shall be as follows:

a. Bridge Decks with Exposed Concrete Surfaces. The final concrete surface shall consist of diamond grinding and texturing Portland cement concrete bridge decks longitudinally to establish proper riding characteristics to the deck surface. The diamond grinding shall be take place prior to the installation of asphaltic expansion joint systems.

1. Equipment. The equipment shall be suitable and appropriate for the task at hand and shall be approved by the Engineer. The equipment shall possess a positive means of removing the diamond grinding residue from the deck surface leaving the surface in a clean, near dry condition.

2. Surface Preparation – Disposal of Construction debris. Prior to the start of work the Contractor shall submit to the Engineer, a debris handling and management plan indicating quantities of residue that are expected to be generated; locations for temporary storage for drying or settling of fines, if necessary, and the location acquired or designated for disposal of residue debris.

The contractor shall be responsible for both the proper management of and legal disposal of all debris from the diamond grinding operations. All costs associated with said management and legal disposal such as tipping fees, disposal permits or applications for permits shall be considered as incidental to the concrete work and will not be paid for separately.

3. Construction Methods. The entire bridge deck area shall receive the diamond grinding. No spot diamond grinding will be allowed. Diamond grinding shall be accomplished in a manner that establishes proper riding characteristics to the deck surface while providing positive lateral drainage by maintaining a constant cross-slope between diamond grinding extremities in each lane. The operation shall result in a bridge deck that conforms to the typical cross-section and the requirements specified for the final surface finish.

The diamond grinding process shall produce a pavement surface that is true to grade with the ground area consisting of a longitudinal corduroy-type texture. The grooves shall be between 0.10 and 0.15 inches wide. The land area between the grooves shall be between 0.065 and 0.125 inches. The peaks of the ridges shall be approximately 2/32 inch higher than the grooves with 53 to 57 evenly spaced grooves per foot. Adjusting the blade spacing may be necessary to achieve the specified texture. The tolerance for the above dimensions is 1/64 of an inch.

Immediately after diamond grinding, the pavement shall be left in a washed and clean condition, free of all residue and slurry. Residue shall not be permitted to flow across lanes used by the traveling public or into gutters or drainage facilities.

4. Quality Assurance [JOB-SPECIFIC SPECIFICATION ONLY]

(a.) Quality Control (QC). Prior to the beginning of diamond grinding operations, the Contractor shall submit a Quality Control Plan to the Engineer for approval. The Contractor's QC plan shall describe and outline the method and frequency of testing that the contractor intends to exercise during the production stage of the diamond grinding operations.

The plan shall include checks of the diamond ground surfaces to be taken behind the diamond grinding operations at regular intervals throughout the process using a standard commercial tire tread gauge, micrometer, or other approved instrument. The location of the measurements shall vary at regular measurement intervals. Readings shall be made to the nearest 0.063 (2/32) inch. If two consecutive readings fall outside the specified limits, adjustments shall be made by the Contractor to bring the diamond grinding operations back into compliance. The tolerance for the above dimensions is 1/32 of an inch.

The Contractor shall regularly inspect the ground surface during the course of the work to determine whether raveling, spalling, faults or cracking are occurring. Particular attention shall be required at transverse and longitudinal joints. If raveling, spalling, faults or cracking are occurring the Contractor shall stop operations at no cost to the Department and take immediate steps to resolve the problem to the satisfaction of the Engineer.

The Contractor shall perform Quality Control in accordance with the methods and frequency described in its approved Quality Control Plan. QC testing shall be performed for the full duration of the work and over the full area of the project. Failure to comply with the QC plan will result in:

- Suspension in progress payments
- \$2,000.00 penalty per occurrence

(b.) Acceptance. Depth measurements of the diamond ground surface texture will be conducted on a daily basis by the Department. Each day the acceptance testing will be conducted at a minimum of five randomly selected locations. Acceptance testing will be conducted using one or more of the following methods:

1. Groove Depth Measurements;
2. Sand patch texture Depth Measurements (ASTM E965)
3. CT Meter Texture Depth Measurement (ASTM E2157)

At each selected location, the minimum number of measurement (5 for Groove Depth Method and 3 for Sand patch and CT Methods) will be taken. Under each of the methods the average of the measurements will be determined. If the Average Depth of the average MTD (mean texture depth) of the Sand Patch or CT methods is outside the specified depth limits, two additional measurements will be conducted in the vicinity to ascertain non-compliance (i.e., consistently too shallow or too deep). Area that does not meet the specified minimum groove depth or specified MTD will be subject to corrective action by the Contractor. Area that exceeds the specified maximum groove depth or specified maximum MTD will be subject to a price adjustment of a 1% reduction of the concrete cost for that area of diamond grinding performed that day.

• **Replace Subsection 814.03.10 with the following.**

814.03.10 Application of External Loads. No construction work (including placement of sidewalk, curbing, railing, bituminous pavement, concrete overlays, grooving, etc.), shall be allowed on the newly placed bridge deck until concrete has cured for a minimum of 14 days and has attained the minimum required 28-day compressive strength. No heavy equipment or traffic of any description will be permitted on the concrete deck until authorized by the Engineer.

Delete **SECTION 815, Latex Modified Concrete for Bridge Overlays**, pages 8-102 through 8-105 of the RI Standard Specifications for Road and Bridge Construction in its entirety.

SECTION 815

LATEX MODIFIED CONCRETE FOR BRIDGE OVERLAYS

[SECTION DELETED]

Revise **Section 817, Repairs to Structure Concrete Masonry**, pages 8-110 to 8-116 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 817

REPAIRS TO STRUCTURE CONCRETE MASONRY

- **Replace Section 817.01 with the following.**

817.01 DESCRIPTION. This work consists of making repairs to structure concrete masonry by removing and disposing deteriorated concrete, preparing bonding surfaces of concrete and reinforcing steel, and replacing the deteriorated concrete with approved mortar or concrete to the lines and grades specified and at the locations indicated on the Plans or as directed by the Engineer all in accordance with these Specifications.

- **Replace Subsection 817.02.5 with the following.**

817.02.5 Form and Cast-in-Place Concrete. Concrete shall conform to Class HP(AE) 3/8" concrete in accordance with the applicable provisions of **SECTION 601; Portland Cement Concrete** and **SECTION 604; Class HP Portland Cement Concrete**, of these specifications.

- **Replace Subsection 817.03.4b with the following.**

b. Placing and Consolidation. Prior to placing the patching mortar, an epoxy bonding agent conforming to **Subsection 817.02.4** of these Specifications shall be applied to all exposed reinforcing and mating concrete surfaces.

The Contractor shall follow the manufacturer's recommendations for application and curing of the epoxy bonding agent prior to placing the patching mortar. The patching mortar shall not be placed if the epoxy bonding agent has exceeded the manufacturer's recommended contact time. If the epoxy bonding agent has exceeded its contact time, the Contractor shall follow the manufacturer's recommendations for re-application. An epoxy bonding agent with an extended contact time should be used if required by the timing of concrete placement and/or weather conditions.

The patching mortar shall be placed in accordance with the manufacturer's recommendations, otherwise it shall be placed in maximum 1-inch lift layers within 5-to-10 minutes after mixing water is added to avoid the rapid setup of the material.

If more than one lift layer is required to perform the repair, the previously placed lift layer shall not be allowed to dry. Its surface shall be roughened prior to placing the next layer.

- **Add the following new Subsection 817.03.5.**

817.03.5 Application of Form and Cast-in-Place Concrete

a. General. Repairs accomplished by the form and cast-in-place method shall be performed in accordance with the applicable requirements of **Section 808, CAST-IN-PLACE STRUCTURE CONCRETE MASONRY** of these specifications.

b. Bonding to Existing Surfaces Prior to placing the Cast-in-Place Concrete an epoxy bonding agent conforming to **Subsection 817.02.4** of these Specifications shall be applied to all exposed reinforcing and mating concrete surfaces.

The Contractor shall follow the manufacturer's recommendations for application and curing of the epoxy bonding agent prior to placing the cast-in-place concrete. The cast-in-place concrete shall not be placed if the epoxy bonding agent has exceeded the manufacturer's recommended contact time. If the epoxy bonding agent has exceeded its contact time, the Contractor shall follow the manufacturer's recommendations for re-application. An epoxy bonding agent with an extended contact time should be used if required by the timing of concrete placement and/or weather conditions.

c. Final Finish. All repaired surfaces shall be finished straight and true, approximating the original contour as close as practicable. The final finish shall have a steel trowel, wood float, or other finish approximating the existing adjacent concrete finish.

- **Replace Sections 817.04 and 817.05 with the following.**

817.04 METHOD OF MEASUREMENT. "Repairs to Structure Concrete Masonry - Pneumatically Applied Mortar", "Repairs to Structure Concrete Masonry - Patching Mortar" and "Repairs to Structure Concrete Masonry - Form and Cast-in-Place Concrete" will be measured by the number of cubic feet of the respective mortars or concrete actually applied in accordance with the Plans and/or as directed by the Engineer.

817.05 BASIS OF PAYMENT. The accepted quantities of "Repairs to Structure Concrete Masonry - Pneumatically Applied Mortar", "Repairs to Structure Concrete Masonry - Patching Mortar" and "Repairs to Structure Concrete Masonry - Form and Cast-in-Place Concrete" will be paid for at the respective contract unit prices per cubic foot as listed in the Proposal. The prices so stated shall constitute full and complete compensation for all labor, materials, equipment described above, including scaffolding, and all other incidentals required to finish the work, complete and accepted by the Engineer.

Remove **Section 818, Portland Cement Concrete Bridge Deck Repair**, pages 8-116 through 8-119 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace with the following.

SECTION 818

PORTLAND CEMENT CONCRETE BRIDGE DECK REPAIR

818.01 DESCRIPTION. This work consists of removing deteriorated concrete from bridge deck surfaces, erecting form-work and the placement of new Portland cement concrete, all as indicated on the contract drawings and in accordance with these Specifications.

a. Partial Depth Removal. The limits of partial depth concrete removal shall be those areas for which deteriorated concrete extends less than 50 percent of the depth of the original deck as indicated on the contract drawings.

b. Full Depth Removal. The limits of full depth concrete removal shall be those areas for which deteriorated concrete extends more than 50 percent of the depth of the original deck as indicated on the contract drawings.

818.02 MATERIALS. Materials shall conform to the following requirements:

818.02.1 Concrete shall conform to the requirements for Class HP material as set forth in **Subsections 601.01.1 and 601.03.1; Classification and Proportioning**, of these Specifications, with the exception that the coarse aggregate gradation shall meet the requirements of **Subsection M.02.03** for aggregate size 1/2" or 3/8". The size used shall be at the discretion of the Contractor.

818.02.2 Epoxy Adhesive shall be an all-purpose, high-strength, moisture-insensitive, rigid epoxy adhesive. Such adhesive shall be listed on the Department's approved materials list. The Contractor shall ensure that the material used is compatible with the surfaces to be bonded.

818.02.3 Reinforcement shall conform to the requirements for ASTM 615 Grade 60 Reinforcing Steel as set forth in Section 810 of these Specifications.

818.03 CONSTRUCTION METHODS.

818.03.1 Removal of Deteriorated Concrete. Removal of concrete shall be performed in a workmanlike manner to prevent damage to the bridge deck that is to remain. Any damage to remaining portions of the bridge deck or to the structural girders caused by the Contractor's operations shall be repaired or replaced by the Contractor, at his own expense and to the satisfaction of the Engineer.

All loose, deteriorated or unsound concrete shall be removed as designated by the Engineer. A saw cut to an approximate depth of 3/4-inch shall be made along all boundaries of the repair patches prior to removal, except those patches bounded by the bridge curbing. Particular care shall be taken not to cut into the top mat of bridge deck reinforcing steel.

Concrete removal shall be performed in a manner that will not damage reinforcing steel or saw cut areas at the repair boundaries. Any damage caused by the concrete removal process shall be repaired at the Contractor's expense.

The concrete deck shall be removed to a minimum depth of 1 inch. "Jackhammers" heavier than nominal 30-pound class shall not be used. "Chipping Hammers" heavier than a nominal 15-pound class shall not be used to remove concrete from areas beneath reinforcing bars. Hand tools such as hammers and chisels shall be provided for removal of particles of unsound concrete or to achieve the required depth throughout the repair areas, including the saw cut edges. In no case shall pneumatic tools be placed in direct contact with reinforcing steel so as to damage its bond to the surrounding concrete.

In areas where reinforcing steel is found to be surrounded by deteriorated concrete or where at least one-half of its surface area is exposed, the depth of concrete removal shall be such to include all deteriorated concrete but not less than that depth necessary to allow for 3/4-inch clearance below the primary reinforcing bars in the top mat of reinforcing steel. Should removal extend deeper than 50% of the original deck thickness solely for obtaining the aforementioned 3/4-inch clearance, the repair shall still be considered a partial-depth repair. It is not necessary to remove concrete underneath any temperature and distribution reinforcement which has at least one half of its surface area exposed. Reinforcing bars that have lost 1/4 or more of their original diameter shall be supplemented by new bars spliced in place. In splicing new bars, they shall be lapped sufficiently (30 diameters on both sides of the effected areas) to develop the full strength of the bar and, if necessary, additional concrete removal will be required to provide this lap. Dual bars of equivalent or greater section may be used.

a. Deck Removal by Hydro Demolition. Deck removal by hydro demolition shall be performed in accordance with the provisions of **SECTION 840** of these Specifications.

818.03.2 Preparation of Sound Concrete and Reinforcing. All exposed reinforcing bars and newly exposed concrete shall be thoroughly cleaned by sandblasting or other mechanical abrasion methods approved by the Engineer.

The exposed concrete and reinforcing steel surfaces shall be free of rust, oil, solvent, grease, dirt, dust, bitumen, loose particles, and other foreign matter just prior to the application of the epoxy adhesive. A large sized vacuum cleaner and/or an air jet shall be used to remove dust and other particles just prior to placing the epoxy adhesive.

818.03.3 Forms for Full Depth Removal. Forms used for the patching work shall be capable of supporting the quantity of fresh concrete needed to install the patch and shall otherwise conform to the applicable requirements of **Subsection 808.03.4** of these Specifications.

818.03.4 Epoxy Adhesive shall be applied to the substrate with a stiff-bristled broom to a thickness of approximately 20 mils or in accordance with the recommendations of the manufacturer of the material.

The Contractor shall follow the manufacturer's recommendations for curing the epoxy adhesive prior to placing the concrete.

818.03.5 Placing and Finishing Concrete. The new concrete shall be hand manipulated and struck off slightly above the final grade. It shall then be mechanically consolidated and screeded to a final grade.

A mechanical or hand trowel finish shall be provided to produce a tight and uniform surface.

As soon as finishing has been completed, all vertical joints with adjacent concrete shall be sealed by painting with thinned grout.

White pigmented liquid curing compound shall be applied immediately after the joint application is completed. The rate of application shall be 15 square yards per gallon, applied evenly and uniformly over the surface area. If the curing compound is not applied within 10 minutes after the final screeding, the finished concrete surfaces shall be immediately covered with wet burlap until the application of curing compound can be made. Failure to apply either curing compound within 10 minutes or burlap within 30 minutes after the concrete is deposited on the floor shall be cause for rejecting the work so effected. Repaired concrete in the rejected areas shall be removed, and the re-repair shall be implemented at no additional cost to the State.

Traffic or external loads from heavy equipment such as pavers shall not be allowed on the repaired deck surfaces until the concrete has reached a minimum of 95 percent of its twenty-eight (28) day compressive design strength.

818.04 METHOD OF MEASUREMENT. "Portland Cement Concrete Deck Repairs (Partial Depth Removal)" and "Portland Cement Concrete Deck Repairs (Full Depth Removal)" will be measured by the number square feet of such repairs actually made in accordance with the Plans and/or as directed by the Engineer.

818.05 BASIS OF PAYMENT. The accepted quantities of "Portland Cement Deck Repairs (Partial Depth Removal)" and "Portland Cement Concrete Deck Repairs (Full Depth Removal)" will be paid for at the respective contract unit prices per square foot as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, tools, materials and equipment, and all other incidentals required to finish the work, complete and accepted by the Engineer. Supplemental reinforcing bars shall be paid for separately by force account in accordance with the provisions of **Subsection 109.04** of these Specifications.

a. Reinforcing Bar Clearances. Existing reinforcing steel clearances indicated on the contract drawings are nominal and may vary due to the as-built conditions. An adjustment in the bid price for partial depth removal based on the percentage increase in depth of removal will be made should concrete need to be removed beyond the depth indicated by the contract drawings.

Revise **Subsection 820.02, Concrete Surface Treatment Protective Coating – Materials**, page` 8-120 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 820

CONCRETE SURFACE TREATMENT PROTECTIVE COATING

820.02 MATERIALS. Concrete protective sealers shall conform to the requirements of **Subsection M.12.03** of these Specifications.

820.02.1 Film Forming Sealers. Concrete surface protective sealers applied to concrete median barriers shall be of the film forming sealer type and conform to the requirements of **Subsection M.12.03** of these Specifications.

CODE 820.0200

HIGH-PRESSURE WATER CLEANING OF CONCRETE SURFACES

DESCRIPTION. This work shall consist of removing dirt, organic growth such as moss or lichens, efflorescence and all other accumulated foreign matter from concrete surfaces through the application of a high-pressure water spray to the affected surfaces. The limits of this work shall be as indicated on the plans and/or as directed by the Engineer, and shall be completed to the satisfaction of the Engineer prior to beginning any repair or rehabilitation work. The intent of this work is to produce a sufficiently clean surface for color matching of replacement and repair work, the application of concrete sealers, or other structural repair or rehabilitation work as specified in the contract documents.

EQUIPMENT. Equipment shall be operated by qualified personnel. The high-pressure water cleaning equipment shall have sufficient controls to vary the water pressure such that it can be adjusted to clean the concrete surfaces without damaging the surface being cleaned. The equipment shall produce a maximum pressure of up to 3000 psi, and shall have a functional pressure gauge and control incremented in a manner such that the pressure can be adjusted and maintained consistently. A sufficient variety of nozzle tips and accessories shall be available to ensure that the spray can be applied uniformly to all applicable parts of the structure. The tip shall not concentrate the spray at less than 25 degrees to the surface.

CONSTRUCTION METHODS. The Contractor shall, in the presence of the engineer, perform a test cleaning in an inconspicuous area of the structure for the purpose of establishing the appropriate pressure to produce a sufficiently clean and undamaged surface. The initial pressure for the test area shall start at approximately 500 psi and be gradually increased as necessary until the surface has been adequately cleaned to the satisfaction of the engineer. When the test area has been sufficiently cleaned, the engineer shall record the pressure, nozzle used, angle of impingement of the water stream, approximate cleaning rate per square foot, and other pertinent information for reference and inspection during the course of the cleaning operations. The contractor shall provide a supply of clean potable water for the operation. No additives such as de-greasers, chemical cleaners, detergents, or abrasives shall be combined with the water used for cleaning. Cleaning of concrete surfaces shall be accomplished by moving the wand in a smooth stroke to achieve uniform and thorough cleaning over the entire surface without pitting or marring.

The Contractor shall exercise due caution and take all necessary precautions to prevent property damage and to protect the general public from exposure to spray, debris and any other potentially hazardous conditions. In cases where the plans and/or contract documents specify the use of temporary shielding or other similar measures to protect property and/or the general public, the Contractor shall install, at all designated locations, the required temporary protective measures as indicated and detailed on the plans. The installation of temporary protection shall be considered incidental to the cleaning operation.

METHOD OF MEASUREMENT. “High Pressure Water Cleaning of Concrete Surfaces” will be measured by the number of square feet of surface actually cleaned in accordance with the Plans and/or as directed by the Engineer.

BASIS OF PAYMENT. “High Pressure Water Cleaning of Concrete Surfaces” will be paid for at the contract unit price per square foot as listed in the proposal. The price so-stated constitutes full and complete compensation for all materials, tools, equipment, labor and all incidentals, including the installation and removal of temporary protective measures, necessary to finish the work, complete and accepted by the Engineer.

CODE 820.0300

HIGH-PRESSURE WATER CLEANING OF BRIDGE STRUCTURES

DESCRIPTION. This work shall consist of the removal of all dirt, organic growth, efflorescence and all other foreign particles, including sand, salt and other debris from steel or concrete bridge girders, cross frames, trusses, pier tops, utility supports, utility pipes and conduits, bearing devices, beam seats, scuppers and other bridge components through the application of a high-pressure water spray to the affected surfaces. The limits of this work shall be as indicated on the plans and/or as directed by the Engineer.

The Contractor shall not remove or attempt to remove paint, sealant, or any other weatherproof material or waterproof coating.

MATERIALS AND EQUIPMENT. The cleaning equipment shall include the necessary high-pressure water cleaning equipment and all ancillary equipment necessary to flush, clean and remove all foreign material from the bridge structure, including hand tools, compressors, water tanks and water pumps. The contractor shall determine the method and equipment, subject to the Engineer's approval, which is best suited to successfully complete the cleaning operation.

The high-pressure water cleaning equipment shall have sufficient controls to vary the water pressure such that it can be adjusted to clean the surfaces without damaging the structure. The equipment shall be capable of producing a water pressure of up to 3000 psi, and shall have a functional pressure gauge incremented in a manner such that the pressure can be adjusted and maintained consistently. A sufficient variety of nozzle tips and accessories shall be available to ensure that the spray can be applied uniformly to all applicable parts of the structure. The tip shall not concentrate the spray at less than 25 degrees to the surface.

CONSTRUCTION METHODS. The equipment shall be operated by qualified and experienced personnel.

When required by the engineer, the contractor shall conduct a test cleaning in an inconspicuous area of the structure for the purpose of establishing the appropriate pressure to produce a sufficiently clean and undamaged surface. The initial pressure for the test area shall start at approximately 500 psi and be gradually increased as necessary until the surface has been adequately cleaned to the satisfaction of the engineer. The water pressure shall be sufficient to remove the accumulated material without damaging the paint coverage of structural steel. When the test area has been sufficiently cleaned, the engineer shall record the pressure, nozzle used, angle of impingement of the water stream, approximate cleaning rate per square foot, and other pertinent information for reference and inspection during the course of the cleaning operations.

The cleaning shall proceed in an orderly manner, subject to the limitations of traffic control. No residue from the cleaning operation shall be left on the surfaces to be cleaned at the completion of the operation. The Contractor shall provide a supply of clean water for the operation. No additives such as degreasers, chemical cleaners, detergents, or abrasives shall be combined with the water used for cleaning. Cleaning of concrete surfaces shall be accomplished by moving the wand in a smooth stroke to achieve uniform and thorough cleaning over the entire surface without pitting or marring.

The solid material removed from the bridge structure by the cleaning operation shall be collected and disposed of at approved waste sites in accordance with all applicable Federal and local regulations. Under no circumstances will any wastewater or debris from the cleaning operation be allowed to enter adjacent water bodies.

The Contractor shall exercise due caution and take all necessary precautions to prevent property damage and to protect the general public from exposure to spray, debris and any other potentially hazardous conditions. In cases where the plans and/or contract documents specify the use of temporary shielding or other similar measures to protect property and/or the general public, the Contractor shall install, at all designated locations, the required temporary protective measures as indicated and detailed on the plans. The installation of temporary protection shall be considered incidental to the cleaning operation.

METHOD OF MEASUREMENT. “High-Pressure Water Cleaning of Bridge Structures” will be measured by the number of bridge(s) actually cleaned in accordance with the Plans and/or as directed by the Engineer.

BASIS OF PAYMENT. “High-Pressure Water Cleaning of Bridge Structures” will be paid for at the contract unit price per each as listed in the proposal. This price so-stated shall constitute full and complete compensation for all materials, labor, tools, equipment and all incidentals, including the installation and removal of required temporary protective measures, necessary to finish the work, complete and accepted by the Engineer.

Revise **Section 823, Roadway Joints – Expansion and Fixed**, pages 8-125 to 8-131 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 823

ROADWAY JOINTS – EXPANSION AND FIXED

- **Add new paragraph (f) to Subsection 823.03.3.**

823.03.3 Asphaltic Expansion Joint System.

f. Temporary Bituminous Joint System. A temporary bituminous joint system must be installed if the contractor is unable to complete the installation of the asphaltic expansion joint system prior to the ambient temperature falling below the minimum manufacturer recommendation. The temporary joint system must include the galvanized steel backing plate and be filled with compacted bituminous asphalt. A joint one-half the depth of the wearing surface shall be sawed and sealed along the temporary joint centerline from curb to curb.

The contractor shall remove and dispose of all unnecessary materials, repair any damage caused by the installation or removal of the temporary system and leave the joint in a condition acceptable for the installation of the final joint system per the manufacturer's recommendations. The contractor may elect to reuse the steel backing plate(s) if the warranty standards can be met; otherwise the Engineer will determine if the plate(s) may be reused or must be replaced.

- **Replace Subsection 823.05.3 with the following.**

823.05 BASIS OF PAYMENT

823.05.3 Asphaltic Expansion Joint System. The Accepted quantities of "Asphaltic Expansion Joint System" of various widths will be paid for at their respective contract unit prices per linear foot as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials and equipment, the temporary bituminous joint, including the sawed and sealed joint, and for all other incidentals required to finish the work, complete and accepted by the Engineer.

CODE 823.1755

**ASPHALTIC EXPANSION JOINT SYSTEM
AND MATERIALS AND WORKMANSHIP WARRANTY**

DESCRIPTION. The work consists of the placement of a 20-inch nominal width, or as specified on the plans, of a special asphalt material with elastic properties over concrete deck joints in the space usually occupied by the bituminous wearing surface. This deck joint system is a commercial product and must be installed in strict accordance with the manufacturer's recommendations. Manufacturers of this joint system are included in the RIDOT's List of Approved Materials and Suppliers. The asphaltic expansion joint system shall also be fabricated and installed in accordance with the Plans or as directed by the Engineer, and in accordance with these Specifications.

LIMITS OF WARRANTED WORK. The warranted work includes all asphaltic expansion joint systems within the project limits unless otherwise indicated on the proposal. This includes all necessary Maintenance and Protection of Traffic (M&PT), all M&PT incidentals, and any uniformed traffic control personnel required to complete the warranted work. The M&PT shall be designed and implemented in accordance with the Contract requirements and with the latest edition of the Manual of Uniform Traffic Control Devices (MUTCD) Part 6, including all addenda.

WARRANTED PERIOD. The length of the warranty will be three (3) years from the acceptance date of Construction, as specified in the following sections of this specification.

AMOUNT OF WARRANTY BOND. The Contractor will supply a warranty bond equal to 100% of the warranted work for asphaltic expansion joint systems, as described in the above section "Limits of Warranted Work."

MATERIALS.

a. Backer Rod. The backer rod material shall be an expanded closed cell polyethylene foam capable of withstanding the temperature of the hot binder material, shall have a diameter 150 percent the width of the joint opening and shall have the following properties:

- Density - 2.0 lbs./cu.ft. min. ASTM D1622
- Tensile Strength - 25 psi min. ASTM D1623
- Water Absorption - 1-percent of weight max. ASTM C509

b. Asphaltic Joint System. The materials for the joint system, both aggregate and binder, shall be provided by one of the manufacturers included in the RIDOT's List of Approved Materials and Suppliers.

1. Binder. The binder shall be a hot applied polymer modified bituminous material conforming to all specifications as detailed in ASTM D6690, and manufactured under strict quality control procedures as approved by the Engineer and meet the following specifications:

- Softening Point, (ASTM D36).....180°F min.

2. Aggregate. The aggregate shall be of the Basalt, Gabbro or Granite groups, meeting the manufacturer's size and gradation requirements. All stones shall be crushed, double-washed, dried and delivered to the site pre-weighed in labeled packs. When tested in accordance with AASHTO T-11, the material passing the #200 sieve will be no more than 0.3% by weight of the stone. The broadcast stone for the surface of the joint system will be basalt and shall be sized as to pass the #8 sieve and be retained on the #16.

c. Steel Backing Plate. The backing plate shall conform to requirements of AASHTO M270, Grade 36, Steel, minimum 1/4" thick and shall be galvanized in accordance with AASHTO M232. Holes for locating pins shall be approximately 1-foot center to center along the centerline of the plate, unless indicated otherwise on the Plans.

d. Locating Pins. Locating pins shall be 16d common nails or larger and shall be hot-dipped galvanized in accordance with ASTM A153.

CONSTRUCTION METHODS.

a. Removal of Bituminous Pavement. Saws shall be set to cut the full depth of the bituminous concrete and any membrane present. Bituminous concrete pavement shall be removed from those areas where asphaltic joint material is to be placed by the use of saws and pneumatic hand tools. Variations in the thickness of the bituminous concrete across the road should be considered to ensure that the deck is not damaged.

b. Joint Preparation.

1. Cleaning. The entire joint must be thoroughly cleaned and dried using a Hot Compressed Air Lance immediately prior to tanking. All loose debris shall be removed from the gap. Care must be taken to ensure that the sawcut surfaces have been thoroughly cleaned of any dust or wet paste from the cutting operation.

2. Caulking. The joint gap shall be caulked with a backer rod as shown on the Plans. It shall be placed in such a manner as to allow for the appropriate placement of the required binder material.

3. Tanking. Immediately after cleaning/caulking, the bottom of the blockout area shall be coated with a layer of hot binder that has been heated in accordance with the manufacturer's recommendations. If a delay greater than one (1) hour occurs between cleaning and tanking, the joint shall be re-cleaned using a Hot Compressed Air Lance as described above.

4. Plating. The gap shall be bridged with three to four feet long steel backing plates. Steel plates shall be located with pins along the centerline. The plates shall be butted to each other and shall not be overlapped. Immediately coat the walls of the blockout area and the bridging plates with binder, making sure that the plate is entirely encapsulated by the binder.

c. Asphaltic Joint Material Preparation.

1. Aggregate. The aggregate must be dried, cleaned and heated in a drum mixer by hot compressed air. The stone shall be heated to a temperature between 375°F (190°C) and the maximum safe binder temperature, as specified by the manufacturer. The temperature shall be monitored with a calibrated infrared thermometer. Under no circumstances shall the binder be mixed with the aggregate if

its temperature is above the maximum. All tangible signs of dust must be removed prior to mixing of the binder with the aggregate.

2. Binder. The binder shall be heated to and maintained at the manufacturer's recommended placement temperature in excess of 350°F (177°C). At no time shall the manufacturer's recommended safe heating temperature be exceeded.

d. Material Installation. The method used shall be according to the manufacturer's recommended procedure. Variations from the manufacturer's procedure or from this specification must be approved by the Engineer prior to commencement of work.

1. Placement of the aggregate/binder mix into the blockout area. Binder material shall be added to the mixer just sufficient to thoroughly coat the aggregate. The coated aggregate shall be placed into the blockout in layers as recommended by the joint material manufacturer. The blockouts shall be overfilled with coated aggregate as required to compensate for compaction. Equipment for compaction shall be capable of sufficient compaction force as recommended by the joint manufacturer. Additional binder material shall be screeded over the compacted joint to fill any surface voids.

2. Surface Layer. Accurately measured quantities of hot aggregate shall be mixed with the binder in a rotating drum mixer. The binder should be at the approved temperature to insure complete coating of all the stone. This mix shall be transferred to the joint and leveled to be slightly higher than the adjacent road surface.

3. Compaction. Compaction shall begin immediately after the placement of the material in the blockout, using equipment as specified by the joint system manufacturer and the joint surface made flush with the existing road surface.

4. Screeding. Prior to the final screeding, the surface of the joint and surrounding road shall, if necessary, be dried and cleaned with a Hot Compressed Air Lance. Immediately thereafter a single screed of hot binder shall be applied to fill all surface voids.

5. Joint Sealing. The interface between the joint and the pavement shall be sealed with a 2-inch wide band of the binder, centered on the interface, for the entire length of the joint on both the leading and trailing edges, relative to traffic. The surface adjacent to the interface shall be heated with a Hot Compressed Air Lance to promote adhesion of the binder. Immediately after the application, while the binder is still hot, basalt stone shall be broadcast onto the band. It shall cover 75% of the surface of the band.

6. Opening to Traffic. The joint shall not be opened to traffic before the surface reaches a temperature of 120°F or 30 minutes has elapsed from placing the basalt stone.

e. Equipment. The following equipment is required for the proper installation of asphaltic bridge deck joints:

1. A manually propelled, high speed water-cooled saw with diamond tipped blades capable of cutting to the full depth required in one pass.

2. A pneumatic compressor of 185 CFM capacity to power drills and breakers of various sizes with suitable size bits.

3. Two Hot Compressed Air Lances (HCA Lances), each capable of delivering a flame retarded air stream with a temperature of 3,000°F (1,648°C), at a speed of 3,000 feet per second. The use of a torch rather than a Hot Air Lance to heat the block out surfaces is not allowed.

4. A 200-gallon air-jacketed, trailer-mounted melter with two flame baffled L.P. ribbon type burners rated a minimum output of 175,000 BTU which shall apply indirect heat to the melting chamber. The unit shall have automatic temperature controls which can accurately maintain the material temperatures between 100°F and 650°F (38°C and 343°C). A temperature gauge, calibrated to $\pm 10^\circ\text{F}$ of actual, must be provided and mounted such that the temperature is clearly visible to the operator and the Engineer.

The burner system shall have a safety pilot capable of shutting off the base supply in the event of a flame-out.

The melter shall be equipped with a horizontally mounted double-paddle, full sweep reversible agitation system which runs the length of the melting chamber and is driven hydraulically with a dedicated engine and compressor. Material delivery shall be by an angled 3-inch discharge port.

5. Storage tanks capable of holding a minimum of 600 pounds propane, 600 pounds oxygen, 200 pounds acetylene.

6. A dedicated drum mixer, with compressed hot air apparatus sufficient to heat the aggregate and aggregate/binder mix in the drum to the specified temperature range.

7. Acetylene cutting torches.

8. An arc welder powered by a suitable generator.

9. 500-gallon capacity water tank fitted with suitable spigots.

10. A hand-held infrared thermometer, calibrated to $\pm 10^\circ\text{F}$.

11. A vibratory plate compactor.

12. A powered roller sufficient to span the width of the joint system in a single pass.

13. In the event of equipment failure during installation, backup equipment must be available, or in the case of a major breakdown, replacement equipment should be on site within 48 hours.

f. Submittals. The Contractor shall submit to the Engineer, for approval at least thirty (30) days prior to start of work, the following:

1. The name of Manufacturer.
2. The Manufacturer's Warranty Certificate.

METHOD OF MEASUREMENT: "Asphaltic Expansion Joint System" will be measured by the number of linear feet of such joints actually installed in accordance with the Plans and/or as directed by the Engineer.

BASIS OF PAYMENT: The accepted quantities of "Asphaltic Expansion Joint System" will be paid for at their respective contract unit prices per linear foot as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials, and equipment, and for all other incidentals required to finish the work as shown on the Plans and as described herein, complete and accepted by the Engineer.

WARRANTY PARAMETERS. Condition parameters are used to measure the performance of the asphaltic expansion joint system during the warranty period. Each condition parameter has a threshold limit that defines when corrective action (warranty work) is required.

DEFINITIONS.

a. Debonding. Physical separation of the asphaltic expansion joint from the adjacent vertical face of the pavement or the bridge deck.

b. Transverse crack. Any open crack that extends more in the transverse (perpendicular to traffic flow) than in the longitudinal direction.

c. Longitudinal crack. Any open crack that extends more in the longitudinal (parallel to traffic flow) than in the transverse direction.

d. Perviousness. Absence of watertightness.

e. Rutting. Depression, displacement, or dislodgment of the asphaltic expansion joint surface.

WARRANTY REQUIREMENTS. The table lists the allowable threshold limit for each condition parameter for each asphaltic expansion joint. If any of the warranty requirements are not met as a result of a defect in materials and/or workmanship, corrective action (warranty work) is required.

<u>Condition Parameter</u>	<u>Threshold Limit for each Asphaltic Expansion Joint</u>
Debonding (either edge)	5% total for the joint, with no debond greater than two (2) feet.
Transverse cracking	5% total for the joint, with no crack greater than two (2) feet.
Longitudinal cracking	3 times joint longitudinal dimension
Perviousness	Visible seepage of water
Rutting	Maximum depth 1/2"

CORRECTIVE ACTIONS. The following corrective actions are required to outline typical acceptable treatments for the various condition parameters. The Department will accept the listed corrective action if the action addresses the cause of the condition parameter. The Contractor may use an alternative action subject to the Department's approval. All corrective actions shall include all incidentals necessary to complete the work, all M&PT, all M&PT incidentals and any uniformed traffic control personnel required. The M&PT shall be designed and implemented in accordance with the Contract and the latest edition of the Manual of Uniform Traffic Control Devices (MUTCD), Part 6, including all addenda.

CORRECTIVE ACTIONS

Condition Parameter

Required Action

Debonding:	Sawcut and remove the affected area; Replace with new asphaltic expansion joint system as shown on the Plans and described in this Specification.
Transverse cracking:	Sawcut and remove the affected area; Replace with new asphaltic expansion joint system as shown on the Plans and described in this Specification.
Longitudinal cracking:	Seal
Perviousness:	Seal
Rutting:	Sawcut and remove the affected area; Replace with new asphaltic expansion joint system as shown on the Plans and described in this Specification.

MATERIALS AND WORKMANSHIP WARRANTY

DESCRIPTION. The materials and workmanship pavement warranty shall consist of the warranty bond and the terms of this special provision in its entirety. This special provision establishes the common terms and definitions applied to all projects requiring a warranty (the warranted work). The previous sections of this specification contains information unique to the asphaltic expansion joint system. The Materials and Workmanship Warranty warrants the Department against defects in materials and workmanship.

DEFINITIONS.

1. Materials & Workmanship Warranty. The Contractor is responsible for correcting defects in the asphaltic expansion joint system caused by elements within the Contractor's control (i.e., the materials supplied and the workmanship) during the warranty period. The Contractor is also responsible for all necessary Maintenance and Protection of Traffic (M&PT), all M&PT incidentals, and any uniformed traffic control personnel required to complete said corrections. The M&PT shall be designed and implemented in accordance with the Contract and the latest edition of the MUTCD Part6, including all addenda. Since the Department is responsible for the bridge design, the Contractor assumes no responsibility for defects that are design related. If a defect is attributable to both the materials and/or workmanship and the design, responsibility for correcting the defect shall be shared by the Department and the Contractor; the Contractor is responsible for the percentage of fault attributable to the workmanship and/or materials, and the Department is responsible for the percentage of fault attributable to the design.

2. Acceptance Date of Construction. The date when the warranted work is complete and confirmed, in writing, on the initial acceptance document by the Department to be in compliance with the contract specifications and is open to traffic. This is the date of initial acceptance and constitutes the start date for the warranty period. There may be more than one acceptance date of construction for a project.

3. Warranty Bond. A bond issued by a surety which guarantees that the warranty requirements will be met.

4. Warranty Work. Corrective action taken to bring the warranted work into contract compliance.

INITIAL ACCEPTANCE. The Department and the Contractor shall jointly review all completed warranted work, or a portion thereof, as determined by the Department. If the work does not meet contract requirements, the Contractor shall make all necessary corrections, at their expense, prior to initial acceptance. Initial acceptance will occur as soon as the Department confirms, in writing, on the initial acceptance form that contract requirements have been met for the warranted work. The date on which initial acceptance occurs is termed the Acceptance Date of Construction.

Initial acceptance will be documented and executed jointly by the Department and the Contractor on a form furnished by the Department. A copy of the form will be sent to the Contractor's warranty bond surety agent by the Department. Neither the initial acceptance nor any prior inspection, acceptance or approval by the Department diminishes the Contractor's responsibility under this warranty.

The Department may accept the work and begin the warranty period, excluding any area needing corrective work, to accommodate seasonal limitations or staged construction.

Acceptance of material, in penalty, under the Department's quality assurance program will not relieve the Contractor from meeting the material and workmanship warranty requirements for the accepted material.

WARRANTY BOND. The Contractor shall furnish a single term warranty bond, in an amount stipulated in the "Amount of Warranty Bond" subsection of this Specification, prior to contract award. The effective starting date of the warranty bond shall be the Acceptance Date of Construction. The warranty bond will be released at the end of the warranty period or after all warranty work has been satisfactorily completed, whichever is latest.

RIGHTS AND RESPONSIBILITIES OF THE DEPARTMENT.

The Department:

1. Reserves the right to approve the schedule proposed by the Contractor to perform warranty work.
2. Reserves the right to approve all materials and specifications used in warranty work.
3. Reserves the right to determine if warranty work performed by the Contractor meets the contract specifications.
4. Reserves the right to perform, or have performed, routine maintenance during the warranty period, which routine maintenance will not diminish the Contractor's responsibility under the warranty.
5. Reserves the right, if the Contractor is unable, to make immediate emergency repairs to the asphaltic expansion joint system to prevent an unsafe road condition as determined by the Department. The Department will attempt to notify the Contractor that action is required to address an unsafe condition. However, should the Contractor be unable to comply with this requirement, to the Department's satisfaction and within the time frame required by the Department, the Department will perform, or will have performed any emergency repairs deemed necessary. Any such emergency repairs undertaken will not relieve the Contractor from meeting the warranty requirements of this Special Provision. Any costs associated with the emergency repairs will be paid by the Contractor if it is determined the cause was from defective materials and/or workmanship.
6. Is responsible for monitoring the asphaltic expansion joint system throughout the warranty period and will provide the Contractor all written reports of the system's condition related to the warranty requirements. The Contractor shall not be relieved of any responsibility based upon a claim that the Department failed to adequately monitor the asphaltic expansion joint system to report its findings to the Contractor.
7. Is responsible for notifying the Contractor, in writing, of any corrective action required to meet the warranty requirements.

RIGHTS AND RESPONSIBILITIES OF THE CONTRACTOR.

The Contractor:

1. Shall warrant to the Department that the warranted work will be free of defects in materials and workmanship for a period of five (5) years from the Acceptance Date of Construction, as defined in previous sections of this Specification. The warranty bond shall be described on a form furnished by the Department. The completed form shall be submitted to the Department prior to award of contract.

2. Is responsible for performing all warranty work, including but not limited to, all M&PT, all M&PT incidentals, and any uniformed traffic control personnel required to complete the warranty repairs or replacement work, and restoring all associated bridge and pavement features, at the Contractor's expense.

3. Is responsible for performing all temporary or emergency repairs, resulting from being in non-compliance with the warranty requirements, using Department approved materials and methods. Upon receipt of a notice of non-compliance with the warranty requirements from the Department, shall submit to the Department within 21 calendar days a written course of action for performing the warranty work with all work items broken out, and the materials and methods to be used. All of the said warranty work shall be completed within 30 calendar days of the date of the submittal or as agreed to by the Department.

4. Shall follow a Department approved maintaining traffic plan when performing warranty work. All warranty work shall be performed under permit issued by the Department.

5. Is required to supply to the Department original documentation that all insurance required by the contract is in effect during the period(s) that warranty work is being performed, as required by subsection 107.13 of the standard specifications.

6. Shall furnish to the Department, in addition to the regular performance and lien bond for the contract, supplemental performance and lien bonds covering any warranty work being performed. These supplemental bonds shall be furnished prior to beginning any warranty work, using Department approved forms. These supplemental bonds shall be in the amount required by the Department to cover the costs of warranty work.

7. Shall complete all warranty work prior to conclusion of the warranty period, or as otherwise agreed to by the Department.

8. Shall be liable during the warranty period in the same manner as Contractors currently are liable for their construction related activities with the Department pursuant to the Standard Specifications. This liability shall continue until the warranty work is accepted by the Engineer. This liability is in addition to the Contractor performing and/or paying for any required warranty work, and shall include liability for injuries and/or damages and any expenses resulting which are not attributable to normal wear and tear of traffic and weather, but are due to non-compliant materials, faulty workmanship, and to the operations of the Contractor.

QUALITY CONTRAL. The Contractor shall provide an affidavit from the joint manufacturer certifying that the aggregate meets all requirements, and a certificate of compliance from the binder manufacturer certifying that the binder conforms to these Specifications.

At the direction of the Engineer, the Contractor shall arrange for, and have present at the time the first joint-sealing operation is to be performed, a manufacturer's representative knowledgeable in the methods of installation of the joint system. The Contractor shall also arrange to have the representative present at such other times as the Engineer may request.

EVALUATION METHOD. The Department will conduct evaluations of each asphaltic expansion joint system installed under this contract.

WARRANTY REQUIREMENTS. Warranty work will be required when the threshold limit for a condition parameter is exceeded as a result of a defect in material and/or workmanship.

Specific threshold limits and segment limits and other items that the Contractor is responsible for are covered in the previous sections of this specification.

To determine whether the failure to meet the warranty criteria is a result of defects in materials and/or workmanship, a joint field investigation by the Department and the Contractor will be conducted. The Department and Contractor may elect to have a forensic investigation conducted. The decision to undertake a forensic investigation, the scope of it, and the selection of the party to conduct it will be agreed to by the Department and the Contractor. All costs related to the forensic investigation will be shared proportionately between the Contractor and the Department based on the determined cause of the condition.

During the warranty period, the Contractor will not be held responsible for distresses that are caused by factors unrelated to materials and workmanship. These include, but are not limited to: chemical and fuel spills, vehicle fires, snow plowing, and quality assurance testing such as coring. Other factors considered to be beyond the control of the Contractor which may contribute to distress will be considered by the Engineer on a case by case basis upon receipt of a written request from the Contractor.

EMERGENCY REPAIRS. If the Department determines that emergency repairs are necessary for public safety, the Department or its agent may take repair action.

Prior to emergency repairs, the Department will document the basis for the emergency action. In addition, the Department will preserve evidence of the defective condition.

NON-EXTENSION OF CONTRACT. This Special Provision shall not be construed as extending or otherwise affecting the claim process and statute of limitation applicable to this Contract.

MEASUREMENT AND PAYMENT. All costs, including engineering and all necessary Maintenance and Protection of Traffic (M&PT), all M&PT incidentals, and any uniformed traffic control personnel required to complete the warranted work associated with meeting the requirements of this special provision are considered to be included in the Contract unit price for the warranted work item regardless of when such costs are incurred throughout the warranty period. These costs include but are not limited to, all materials, labor and equipment necessary to complete required warranted work.

**RHODE ISLAND DEPARTMENT OF TRANSPORTATION
INITIAL ACCEPTANCE FOR WARRANTY**

CONTRACT ID:
CONTRACT SECTION: JOB NUMBER:
SURETY NAME:
SURETY ADDRESS:
CONTRACTOR NAME:
CONTRACTOR ADDRESS:

<i>IDENTIFY EACH JOB NUMBER, LOCATION AND WORK SEPARATELY</i>					
<i>JOB NUMBER</i>	<i>ROUTE NUMBER</i>	<i>CONTROL SECTION</i>	<i>WORK TYPE</i>	<i>DATE ACCEPTED</i>	<i>PROJECT ENGINEER</i>

INITIAL ACCEPTANCE OF WARRANTY WORK APPROVAL
CONTRACTOR'S SIGNATURE:
ENGINEER'S SIGNATURE:
ACCEPTANCE DATE:

**RHODE ISLAND DEPARTMENT OF TRANSPORTATION
WARRANTY BOND**

Bond Number _____

KNOWN ALL MEN BY THESE PRESENTS:

That we, _____ (hereinafter called the "Principal"), and _____, a corporation duly organized under the laws of the State of _____ and duly licensed to transact business in the State of Rhode Island (hereinafter called "Surety"), are held and firmly bound unto the Rhode Island Department of Transportation (hereinafter called the "Obligee"), in the sum of _____ Dollars (\$), for the payment of which sum well and truly to be made, we, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the said Principal has heretofore entered into a contract with the Rhode Island Department of Transportation dated _____ under Rhode Island Contract No. _____ and;

WHEREAS, the said Principal is required to guarantee the _____ installed under said contract, against defects in materials or workmanship which may develop during the period(s) of _____ years beginning the date(s) of the Acceptance Date of Construction by the Obligee.

In no event shall losses paid under this bond aggregate more than the amount of the bond.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if said Principal shall faithfully carry out and perform the said guarantee, and shall, on due notice, repair and make good at its own expense any and all defects in materials or workmanship in the said work which may develop during the period specified above or shall pay over, make good and reimburse to the said Obligee all loss and damage which said Obligee may sustain by reason of failure or default of said Principal so to do, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

PROVIDED HOWEVER, that in the event of any default on the part of said Principal, a written statement of the particular facts showing such default and the date thereof shall be delivered to the Surety by registered mail, promptly in any event within ten (10) days after the Obligee or his representative shall learn of such default and that no claim, suit or action by reason of any default of the Principal shall be brought hereunder after the expiration of thirty (30) days from the end of the warranty period as herein set forth.

Signed this _____ day of _____, _____.

Contractor _____

By _____

Surety _____

By _____

Attorney-In-Fact

Remove **Subsection 824.03.11c, Surface Preparation for Weathering Steel – Final Cleaning**, page 8-148 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following:

SECTION 824

STRUCTURAL STEEL CONSTRUCTION

824.03.11 Surface Preparation for Weathering Steel

c. Final Cleaning. After the deck is in place and all formwork has been removed, the steel surfaces will be inspected for stains, discoloration, and any other deleterious materials which may affect the weathering of the steel in a uniform manner. Stains, discoloration, and any other deleterious materials on exterior surfaces of fascia girders shall be removed by high pressure (5000-10,000 psi) water cleaning. It may be necessary to add a chemical cleaning agent, with the approval of the Engineer, to the high pressure cleaning to remove staining. If high pressure water cleaning does not remove the stains, the Contractor shall propose an alternate cleaning method, subject to the approval of the Engineer. Once the final cleaning is accomplished no further use of the structural steel for attachment or support will be allowed.

Remove **Section 825, Painting Structural Steel**, pages 8-152 through 8-161 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following:

SECTION 825

PAINTING STRUCTURAL STEEL

825.01 DESCRIPTION. This work consists of the thorough cleaning, preparation of surfaces, painting or repainting of new or existing steel, galvanized and metalized structures, its components or other steel materials. The above shall be performed at the locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

825.01.1 Submittals. The items listed below, but not limited to, are required to be submitted to the Department for approval prior to performing any work. This list does not include required submittals that are part of other related Specifications:

- Contractor applicator qualifications and material certifications. Refer to **Subsection 825.01.5** and **M.06**.
- Topcoat color samples.
- Product Data Sheets (PDS) and Safety Data Sheets (SDS) in accordance with **M.06**.
- Quality Control Plan in accordance with **Subsection 825.03.7**.
- Scaffolding/Work Platforms.
- Removal/repair procedures for unsatisfactory material (if required).

825.01.2 Toxic Caveat. The Contractor is hereby notified that existing paint systems on the State's bridges may contain toxic substances such as lead, chromium or cadmium, and that these substances are considered to be hazardous to personnel, the environment, and the public proximate to the project. The Contractor must plan and take appropriate precautions during the painting operations and for waste disposal to meet the State and Federal requirements for the protection of workers, the public and the environment. Details of these requirements are provided in **SECTION 826; PERSONNEL AND ENVIRONMENTAL PROTECTION**, of these Specifications.

825.01.3 Protection of Personnel, Public, Environment and the Structure. This provision covers the requirements for removal and containment of paint and/or corrosion products from any steel bridge or other specified appurtenances during cleaning and painting operations. Conduct all activities associated with the coating work described and specified herein in accordance with all applicable Federal, state and local regulations, **SECTION 826; PERSONNEL AND ENVIRONMENTAL PROTECTION**, the Contract Special Provisions and SSPC-PA Guide 10, "Guide to Safety and Health Requirements for Industrial Painting Projects."

Furnish and have available to the Engineer at all times during the painting operations, and at no additional expense to the Department, four approved respirators for the intended purpose, and other safety equipment needed to permit proper inspection of ongoing work. Furnish the required safety equipment before the start of work. Provide scaffolding and rigging, as needed, in compliance with OSHA regulations to enable safe and ready access to all work areas for inspection purposes.

Protect pedestrians, vehicular, and/or other traffic on or under the bridge or structure, surrounding property, surfaces, buildings, grounds, etc., against damage or disfigurement from surface

preparation media, or spatters, splashes, overspray and smears of paint or material. Furnish adequate containment materials for protection.

Remove paint drips, spills or overspray from concrete or other surfaces not designated to receive coatings. Remove and dispose of debris from cleaning operations, empty paint containers, and other refuse at no additional cost to the State. Damage caused by the Contractor's operation shall be corrected at no additional cost to the Department.

825.01.4 Pollution Controls. Prevent environmental pollution of air, soil and water caused by surface preparation media, paint spills or overspray, paint chips, dust or other harmful materials. Comply with the regulations of Rhode Island Department of Environmental Management (RIDEM) and provide notification as required. No extension of contract time or claims for costs will be allowed in order to comply with requirements of regulatory agencies.

825.01.5 Contractor Applicator Qualification. When the contract requires painting more than 1,500 square feet of steel surface, the contractor(s) performing coating application must demonstrate qualification by obtaining either The Society for Protective Coatings (SSPC) QP 1 "Standard Procedure for Evaluating Painting Contractors (Field Application to Complex Industrial Structures)" for field painting and SSPC QP-3 "Certification Standard for Shop Application of Complex Protective Coating Systems" as appropriate, or the American Institute of Steel Construction (AISC) Sophisticated Paint Endorsement (SPE). Contractors involved in the removal of paint containing lead or other toxic metals shall be certified SSPC QP2, "Standard Procedure Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint." Qualification must be maintained throughout the painting portion of the project. If it expires or is revoked for any reason, the Engineer shall be notified and may require that a qualified contractor complete the coating portion of the project.

825.02 MATERIALS. Provide materials that conform to the applicable provisions of **SECTION M.06; PAINT**, of these Specifications and to manufacturer's recommendations as applicable. In the event of a conflict between the manufacturer's recommendations and the requirements of this Section, comply with this Section unless the requirements of the manufacturer are more restrictive. In these cases, advise the Engineer of the discrepancies, in writing, and comply with the Engineer's written resolution. The decision of the Engineer in such cases shall be final.

825.02.1 Paint Supplier. Provide all paint material products including primer, intermediate coat, topcoat and thinners from the same paint supplier to ensure compatibility of components. Use the same paint manufacturer throughout all work. Provide paints that are lead and chromium free. The coating system shall be an approved NEPCOAT Qualified Product from List A or B, or other system, in accordance with **SECTION M.06; PAINT**.

825.02.2 Topcoat Color. Provide a semi-gloss topcoat in the color specified on the plans, in the Special Provisions, or elsewhere in the contract documents. Provide color chips and the Munsel and/or Federal Standard color designation for verification of the color of the topcoat. The color of the primer shall not affect the color of the topcoat.

825.02.3 VOC Compliance: All paint products must conform to all Federal, State and local requirements at the point of application as determined using EPA Method 24.

825.03 CONSTRUCTION METHODS.

825.03.1 Surface Preparation.

a. General Requirements. Surface preparation shall be in accordance with the most recent edition of the Society of Protective Coatings Specifications and additional requirements contained in the Contract Documents.

b. Engineer's Access. Provide safe access and time for the Engineer or his authorized representative(s) for inspection of all phases of work, including but not limited to surface preparation, the application of each coat of paint, including stripe coats, and for the inspection of the completed system. Provide access for sampling and testing paint material components. Samples may be subject to chemical and physical testing. Materials found to be of unsatisfactory quality will be rejected.

c. Surface Anomalies.

Corner Condition – Remove all sharp corners of steel created by flame cutting or shearing using a grinder. For organic zinc-rich primers, stripe-coat all corners resulting from sawing, burning, or shearing operations.

Preparation of Thermal Cut Edges – Thermal cut edges shall be softened before blast cleaning, as necessary to achieve proper blast profile.

Base Metal Surface Irregularities – Remove all visually evident surface defects in accordance with ASTM A6 or AASHTO M 160 prior to blast cleaning steel. When material defects exposed by blast cleaning are removed, the blast profile must be restored by either blast cleaning or by using mechanical tools in accordance with SSPC-SP 11 “Power Tool Cleaning to Bare Metal.”

Weld Irregularities or Spatter – Remove or repair all sharp weld prominences, weld deficiencies (overlap, rollover, excessive concavity, convexity, or roughness) and all heavy, sharp, or loose weld spatter. Occasional individual particles of rounded tight weld spatter may remain, but widespread, sharp, or clustered particles of tight weld spatter must be removed. The removal of weld irregularities and spatter shall be removed to a flush surface.

d. Pre-Cleaning. Remove all oil, grease, and other adherent deleterious substances from areas to be painted, in accordance with SSPC-SP 1 “Solvent Cleaning”, prior to abrasive blast cleaning.

e. Abrasive Blast Cleaning. Abrasive blast clean the entire surface in accordance with the cleanliness and profile required by the manufacture's Product Data Sheet. The profile shall be assessed per ASTM D 4417. All new structural steel shall be cleaned in accordance with SSPC SP-10, “Near White Blast Cleaning”. The abrasive blast media shall meet SSPC-AB1 “Mineral & Slag Abrasives”, SSPC-AB 2 “Cleanliness of Recycled Ferrous Metallic Abrasives”, or SSPC-AB3 “Ferrous Metallic Abrasives.” If the material for the project is heavily rusted or pitted, or as directed by the Engineer, measure the non-visible contaminant and remove in accordance with SSPC-Guide 15 “Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates” to ensure detectable chloride levels are less than 10 micrograms per square centimeter.

Compressed air supply lines shall be equipped with oil traps and moisture separators. Conduct a white blotter test in accordance with ASTM D 4285 to verify the cleanliness of the compressed air. Conduct the test at least once per shift for each compressor system. Sufficient freedom from oil and moisture is confirmed if no soiling or discoloration is visible on the paper.

f. Lighting: Provide adequate lighting for all surface preparation, paint application, and inspection work. Maintain a minimum of 10 foot-candles for surface preparation and painting, and a minimum of 30 foot-candles of general area lighting for inspection. Increase the lighting if workers or other personnel have difficulty seeing. Use explosion-proof lighting.

825.03.2 Paint Application.

a. General Requirements. Apply coatings in accordance with the contract requirements, SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel" and the manufacturer's recommendations. Apply the coating to provide a continuous, uniform film of the specified thickness that is well bonded to the substrate or previously applied coating; is free of laps, streaks, sags, separation, unevenness, discoloration, and other visually evident defects; and applied within the manufacturer's specified pot life. Areas that fail any required test shall be repaired as outlined in "Removal/Repair of Unsatisfactory Material."

b. Coating Material Storage. Paint shall be stored in accordance with SSPC-QP3, SSPC-PA 1, and the manufacturer's recommendations. Record the daily storage temperature range for coating materials and verify conformance with the coating manufacturer's recommendations. Inventory the components to ensure they are used within the shelf life prescribed by the manufacturer. Record the coating batch numbers from each mixed component, the amount and type of thinner used, and the date of application.

Paint in storage shall not be exposed to temperatures lower than those recommended by the paint manufacturer. Paint exposed to temperatures lower than specified is subject to rejection or retesting.

When paint is rejected, painting operations shall cease until the rejected paint is removed from the project site.

c. Conditions for Application. Apply the paint material to clean dry surfaces. Comply with the atmospheric conditions specified below, or the written recommendations of the manufacturer, whichever is most stringent. Do not apply materials when:

- The temperature of the air or substrate is below 40°F or greater than 100°F, or is forecasted to drop below 40°F before the coating dries in accordance with the dry times specified in the manufacturer's recommendations.
- The surface temperature is less than 5°F above the dew point.
- The relative humidity is above 85%.
- There is or will be rain, mist, fog or snow during application and/or cure.
- The manufacturer's requirements for reaction time after mixing are not satisfied.

d. Methods of Application. Use brushes, rollers, spray equipment, or any combination of equipment recommended by the manufacturer and authorized by the Engineer that provides a finish that is acceptable to the Department.

e. Stripe Coats. Apply a stripe coat to corners, weld seams, around nuts and bolts or as otherwise directed in the contract documents. Do not apply the full coat of primer any sooner than 15 minutes after the application of the stripe coat, or any later than the manufacturer's recommended recoat times. Inspection personnel shall be notified and be given ample time to verify and approve the stripe coat application. Do not apply the full coat of primer until the Engineer has approved the striping. The

coating material used for the stripe coat is typically the intermediate coat, but for painting metalizing or galvanize, the urethane finish coat is striped.

f. Intermediate and Topcoat. The color of the topcoat shall be as specified in the contract documents. The intermediate coat color shall contrast with both the primer and topcoat. Stripe coats may be tinted as necessary to assure proper coverage. Coating materials used to apply piece marks shall be compatible with the existent and any subsequent coats.

g. Recoat Interval. Comply with the coating manufacturer's minimum and maximum recoat interval for each coating layer. Ensure that each coating layer is sufficiently cured before applying the next scheduled coating layer.

h. Field Applied Coatings-Touchup of Primer and Intermediate Coat(s). Prior to applying field touch-up coatings, verify that all surfaces, including installed bolts, nuts and zinc-rich primer around connection plates are thoroughly cleaned of grease, oil, chalk, bird droppings, lubricants and other surface interference material. Use pressure washing or solvent cleaning, as appropriate, to remove the interference material. Use hand and power tool cleaning for spot repair of localized damage to the coating system. Pressure wash, using 1500 psi water pressure, all surfaces primed with zinc-rich primer to remove zinc salts. Do not proceed with touchup and painting until the Engineer has accepted the surface cleaning. Repair any damaged areas of coating and reapply all affected coating layers. Perform field touchup in areas around bolts, nuts, connection plates, and other areas that had not previously been painted.

i. Field Applied Coatings-Topcoat Application. Apply topcoat in the field after the Engineer has accepted the touch up (primer and intermediate) and after the structure has been erected on the project site. Verify that the amount of time between the application of the intermediate and the topcoat is within the coating manufacturer's maximum recoat time, as stated in manufacturer's recommendations. Verify that the surface is clean and dry prior to the application of the topcoat. If grease, oil, or other contaminants become deposited on the intermediate coat, remove it in accordance with SSPC-SP1 prior to the application of the topcoat.

j. Removal/Repair of Unsatisfactory Material. The coating system is unsatisfactory if any of the following defects occur: abrasion damage, peeling, blistering, wrinkling, excessive runs or sags. It is also unsatisfactory if there is evidence of application under unfavorable conditions; the workmanship is poor; unauthorized coating material was used; or for other reasons determined by the Engineer. Repair procedures for unsatisfactory material shall be submitted to the Department for approval prior to performing related work. Remove and replace unsatisfactory coating layers at no additional cost to the Department as specified below.

- **Bare steel exposed less than 4"x4" area.** When the defective paint or damage extends to the bare steel or bare steel is exposed in areas less than 4" x 4" in size, clean the surface by power tool cleaning to SSPC-SP11. Feather the surrounding paint to expose a minimum of ½" of each coat and to provide a smooth transition into the surrounding intact, adherent material. Select a primer recommended by the manufacturer of the intermediate and topcoat. For new steel, apply a spot coat of zinc-rich primer to the prepared surface. Follow with a spot coat of the intermediate and topcoat.

- **Bare steel exposed greater than 4"x4" area.** When the defective paint or damage extends to the bare steel in areas greater than 4" x 4" in size, blast clean the area in accordance with SSPC SP10, feather the surrounding paint and repair as described above.

- **Primer or intermediate coat exposed.** When the damaged or defective paint extends to the primer or intermediate coat, and for primed areas around and on connection plates, clean the surface by hand or power tool cleaning. Clean in accordance with SSPC SP2 or SSPC SP3 to remove oxidation, zinc-salts, or contamination from the surface. Do not burnish or polish the surface. Supplement hand and power tool cleaning with pressure washing (1500 psi minimum) accompanied by scrubbing with stiff bristled brushes or other means as necessary. Feather the surrounding material to expose a minimum of 1/2" of each coat and to provide a smooth transition into the surrounding intact, adherent coating material.

- **All repairs.** For all repairs, roughen the paint in overcoat areas with 80 grit sandpaper to assure good adhesion of the overcoat material to the underlying paint. Also, solvent clean in accordance with SSPC SP1 and re-paint the affected areas with the intermediate and topcoat.

k. Scaffolding. Use rubber rollers or other protective devices to prevent damage to the finished coatings. In particular, sufficient support pads shall be utilized for bracing on fascias. Temporary supports or attachments for scaffolding or forms shall not damage the coating system. Areas damaged by scaffolding shall be repaired in accordance with "Removal/Repair of Unsatisfactory Material" in **Subsection 825.03.2(j)** above.

l. Technical Supervision. Coating manufacturer's representation is required for shop and field applications. The coating representative shall be present to provide the Contractor with an evaluation of the surface preparation and to provide such aid and instruction in the application of the coating system as required to obtain a satisfactory result that meets the approval of the Engineer and the manufacturer's representative. At a minimum, the services of this representative are required at the startup of all shop and/or field operations. In addition, services may be required on an "as needed" basis until painting is satisfactorily completed. The Contractor/fabricator is responsible for securing the services of the technical representative, the services of which shall be at no additional cost to the State.

825.03.3 New Steel Structures. In addition to the above, work under this paragraph shall include only those structures being built new or structures whose superstructure is being replaced in its entirety. New steel utilized in partial replacement or rehabilitation shall be addressed in **Subsection 825.03.4; Existing Steel Structures**, and in the Contract Documents.

a. General. The coating system shall be an approved Northeast Protective Coating Committee (NEPCOAT) three-coat system and shall conform to the requirements of **SECTION M.06; PAINT**, of these Specifications and the following:

Exterior Steel Surfaces. The system shall consist of a prime coat, intermediate stripe coat, intermediate coat, and topcoat.

Interior Steel Surfaces. The coating system for the interior surfaces such as: open box girders, arch ribs and ties and tubular wind bracing shall consist of a two-coat NEPCOAT exterior system. This system contains a zinc-rich primer and intermediate coat. Select the same primer and intermediate coat for application to both interior and exterior surfaces of the same steel member. Interior surfaces require no topcoat. The intermediate coat applied to interior surfaces shall be white.

b. Priming Faying Surfaces. Coatings applied to contact surfaces of bolted connections between primary members shall satisfy the requirements of the Research Council on Structural Connections (RCSC). The coating system for faying surfaces shall have a slip coefficient of Class B unless otherwise noted in the contract documents. Prior to shop bolting, verify that the coating on faying

surfaces is applied at the recommended dry film thickness and the temperature adjusted cure time for shop and field slip critical bolted faying surfaces are within the range previously validated through testing by the applicator’s QC person or as given by NEPCOAT. Verify cure in accordance with ASTM D 4752 or the manufacturer's requirements.

Apply the zinc-rich primer to all surfaces. Do not apply intermediate and topcoats to faying surfaces, connection areas, and within 2” of a connection area that is to be welded. Mask or otherwise protect these surfaces to prevent the application of intermediate and topcoats. Unless noted otherwise in the contract documents, zinc-rich primer is not allowed on flange surfaces that will be embedded in concrete, although overspray is allowed on these flange surfaces.

Apply the topcoat to the same surfaces coated with the intermediate coat, except those surfaces that will be embedded in concrete.

c. Bolts (Fasteners). Bolts installed and final tightened before priming shall be prepared as necessary so as that after the steel is abrasive blast cleaned, exposed bolt surfaces shall satisfy the requirements in Table 1. Black bolts, nuts, and washers, including flat faces of nuts and bolt heads facing adjacent material, may require spot blast cleaning or other surface preparation before general blast cleaning in order to assure that the proper surface profile to obtain adhesion of the primer, has been achieved.

**TABLE 1
SURFACE PREPARATION REQUIREMENTS FOR FASTENERS & BOLTS**

Item	Fasteners Installed Prior to Cleaning & Primer Application		Fasteners Installed After Primer Application	
	Coating System	Surface Preparation	Coating System	Surface Preparation
Black Iron Bolts	OZ or IOZ, I, T	SSPC-SP10	IOZ, OZ, I, T	SSPC-SP 1 & 10
Galvanized (Mechanical or Hot Dip)	OZ or IOZ, I, T	SSPC-SP 1	I, T	SSPC-SP 1 & 2/3

OZ= Organic Zinc-Rich Primer

IOZ= Inorganic Zinc-Rich Primer

I= Intermediate Coat

T= Topcoat

If the zinc coating on shop-installed galvanized bolts is damaged during shop abrasive blast cleaning or tightening, it may be left “as is” only if the entire coating system (including the zinc-rich primer) will be applied over the fasteners.

Remove the lubricant from bolts. The Contractor shall obtain from the Fabricator the identity of solvents and methods needed to remove the lubricant. The Contractor and/or its Fabricator shall also consult with the coating supplier to assess the compatibility of the coating with any lubricant residue. The

Contractor and/or its Fabricator shall supply to the shop and field painters, the Engineer and other interested parties the information concerning the lubricant removal and the cleanliness necessary for satisfactory adhesion of the subsequent coat as described in Table 1.

Any dye coloring remaining on galvanized nuts after weathering or after removing the lubricant is not believed to be detrimental to coating performance or appearance. Use a white cloth wipe test with no color transfer to confirm that all lubricant and non-absorbed dye has been removed; only residual “stain” is permitted to remain on the surface.

d. Shipping, Storage, and Erection of Steel. Use extreme care in handling, storing, shipping and erecting the steel to avoid damage to the coating system. Do not move coated steel in the shop until sufficient cure time has elapsed to ensure that no damage will be done to the fresh coating. The steel shall not be shipped from the shop to the field until the last coating has fully cured.

Install padding on hooks and slings used to hoist the steel and use softeners approved by the Engineer to insulate the steel from binding chains. Place small structural pieces in such a manner that no rubbing will occur during shipment.

Store the steel at the job site on pallets or by other means to prevent members from resting directly on the ground or from falling onto each other.

825.03.4 Existing Steel Structures. Work under this section includes only those structures that are not included under **Subsection 825.03.3**. Specific requirements may also be found in the Contract Documents.

a. Protection of Painted Surfaces. Protect freshly coated surfaces and those surfaces not scheduled for painting from over blast and stray abrasive during blast cleaning operations. Previously coated surfaces damaged by subsequent blast cleaning operations shall be cleaned in accordance with SSPC SP10 and recoated in accordance with this specification.

b. Surface Preparation. Obtain the Engineer's approval of the preparation of all surfaces to be painted before applying any paint.

Surface preparation and coating requirements are dependent upon the scope of work and the type and condition of the existing coating system. Table 2 provides the required surface preparation methods for four scenarios. Detailed descriptions of the surface preparation methods follow the table. Specific coating material requirements for each surface preparation method are provided in **SECTION M.06, PAINT**, of these Specifications.

**TABLE 2
SURFACE PREPARATION METHODS FOR SPOT, ZONE, AND OVERCOATING¹**

Scope of Work	Surface Preparation	Existing Coating System
Spot Prime and Overcoat	Method 1	Alkyd Coatings
Spot Prime and Overcoat	Method 2	Zinc-rich or Metalizing/Galvanizing with Topcoat
Zone Painting	Method 3	Alkyd Coatings
Zone Painting	Method 3 or Method 4	Zinc-rich or Metalizing/Galvanizing with Topcoat

1. The surface preparation methods shall be in accordance with the paint manufacturer’s recommendations unless the requirements in this table exceed the manufacturer’s recommendations. In case of conflict, the most stringent surface preparation methods shall govern as determined by the Engineer.

Method 1: Spot Prime and Overcoat an Existing Alkyd Coating System. Localized areas of corrosion or coating breakdown shall be spot cleaned using vacuum shrouded power tools in accordance with SSPC-SP3, “Power Tool Cleaning”. Feather the edges of the power tool cleaned areas. The intact alkyd coating shall be prepared for overcoating by cleaning in accordance with Low-Pressure Water Cleaning (LP WC) of SSPC-SP12. The minimum acceptable water pressure is 1500 psi. Use low pressure water cleaning to remove chalk, pigeon droppings, dirt and other deleterious materials from the surface.

Method 2: Spot Prime and Overcoat an Existing Coating System that consists of a zinc-rich primer or metalizing and a topcoat. Localized areas of corrosion or coating breakdown shall be spot cleaned using vacuum shrouded power tools in accordance with SSPC-SP11, “Power Tool Cleaning to Bare Metal” or using vacuum blast cleaning equipment in accordance with SSPC-SP10, “Near White Blast Cleaning”. Feather the edges of the repaired area. The intact topcoats (epoxies or urethanes) shall be prepared for overcoating by hand sanding to roughen the surface.

Method 3: Abrasive Blast Clean to remove all coating material from a well-defined zone (portion of the structure). Blast clean steel in accordance with SSPC SP10, “Near White Blast Cleaning”. The surface area of the steel to be blast cleaned shall be no greater than the surface area of steel that can be primed during the same day. The maximum time lapse between surface preparation and application of the prime coat shall not be greater than 8 hours, unless atmospheric controls are used to prevent “rust back”. Should any "rust back" occur prior to priming, re-clean surfaces to provide the specified degree of cleanliness. The abrasive blast profile shall be in accordance with the manufacturer’s requirements as stated on the product data sheets.

Method 4: Water Wash and Ultrahigh Pressure Water Clean in a well-defined zone (portion of the structure). Thoroughly pressure wash all surfaces in the zone that will be coated, including areas of limited access such as crevices between back to back angles. Low pressure washing to remove the loose debris, followed by ultrahigh pressure water cleaning to remove all existing coating and corrosion from the steel surfaces scheduled to be coated. Comply with the requirements of SSPC-SP 12, “Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating”. Cleaned steel surfaces that are to be painted shall conform to the Visual Surface Preparation Definitions of the surface condition WJ-3 in SSPC SP12. The use of rust inhibitors is prohibited. Steel surfaces not primed within 72 hours shall be re-cleaned by water jetting. Collect all water and paint chips dislodged by the water cleaning process. Use potable filtered water for the washing to achieve a surface that is free of paint, corrosion and other visible contaminants. Measure the

non-visible contaminant and remove in accordance with SSPC-Guide 15 to ensure detectable chloride levels are less than 10 micrograms per square centimeter.

c. Limited Access Areas. The design of the structure may create areas of limited access which cannot be cleaned to the specified degree of surface preparation across every square inch of the surface. In these cases provide surface preparation as follows:

Thoroughly clean all areas that can be viewed without the use of mirrors to the specified degree of cleanliness. Localized areas of limited access due to the configuration of the structure may prevent the specified degree of cleanliness from being achieved. In these instances, at a minimum, remove all loose coatings. Inspect the surfaces by touch, using a putty knife, and by using inspection mirrors, optical or digital scopes. Cleaning and painting of these areas may require the use of specialized equipment. If the limited access area is a crevice or gap from which pack rust cannot be removed such as between mating plates, between back-to-back angles, or between structural members, apply sealants/caulks in order to seal the top and side surfaces to prevent moisture intrusion. Do not caulk the bottom crevice. Use sealants/caulks compatible with the coating system and provide written verification from the coatings manufacturer as to the compatibility of the sealant/caulk with the coating.

825.03.5 Painting Metalized or Galvanized Surfaces. The coating system shall be an approved NEPCOAT system and shall conform to the requirements of **SECTION M.06; PAINT**, of these Specifications and the following. The zinc-rich primer is not required for metalized or galvanized surfaces.

Galvanizing must be prepared in accordance with SSPC SP-16 prior to painting. White corrosion deposits such as wet storage stains must be removed before coating. Overcoat with any of the NEPCOAT approved intermediate coats followed by the application the compatible NEPCOAT approved topcoat.

The natural profile of metalized surface will not require any surface preparation.

Any process that reduces the metalize or galvanize thickness below the specification limit requires removing and re-applying the metalize or galvanize, as applicable, to meet the specification.

Apply the intermediate coat to the surface as soon as possible after the Engineer has accepted the metalizing or galvanizing surface preparation and no later than 8 hours after the metalizing application or galvanizing surface preparation, as applicable. If more than 8 hours elapses, provide written recommendations from the intermediate coat manufacturer that indicate what steps must be taken to compensate for any oxidation and make the surface suitable for the intermediate coat application. Do not implement the steps without written approval from the Engineer. Apply a stripe coat of urethane to all edges bolted connections, and other areas followed by a full finish coat of urethane.

825.03.6 Stenciling of Topcoat. After the topcoat has fully cured, provide stencil information on the inside surface of the fascia member at each abutment location unless directed otherwise by the Engineer. Use suitable black paint, or other color as approved by the Engineer to contrast with topcoat for visibility, to stencil uniform block lettering on the surface, two to three inches in height, with the following information:

- The bridge identification number as shown on the Plans,
- The month and year of completion of the coating system (MM/YYYY),
- The SSPC identification of the cleaning method, and

- Identification of the coating system (for example: IOZ/OZ, E, U) with the name of manufacturer. The following designations shall be used:
 - IOZ=Inorganic Zinc Rich Primer
 - OZ=Organic Zinc Rich Primer
 - M=Metalized
 - G=Galvanized
 - E=Epoxy
 - U=Urethane

825.03.7 Quality Control. The Contractor is responsible for performing quality control. Document and conduct an on-going quality control plan for the process and inspection of the materials, surface preparation, coating applications storage, and shipping of components as necessary to assure that all work is performed in strict compliance with these specifications, the Contract Documents, and the manufacturer's recommendations. This plan, at a minimum, shall address the following:

:

- Qualifications and responsibilities of the QC Manager
- Qualifications, responsibilities, and training for workers. This shall include the frequency of checks on the quality of work.
- Documentation of the proposed equipment and calibration records.
- How the QC documentation and supporting records are maintained.
- How the surface preparation of the steel prior to the application of the paint system, especially the profile, is verified and monitored (i.e. frequency). For galvanized steel, this would include the method of profiling.
- How the environmental conditions (i.e. ambient temperature, dew point, relative humidity, etc.) for various stages of the paint process are monitored and maintained throughout the duration of the project.
- How the coating materials and abrasives are verified and monitored for receipt, storage, and control.
- How the coating materials are verified and monitored for batch numbers, mixing, pot life, mix reaction time, dry time, curing, recoat time, and cleanliness of each coat prior to the application of the subsequent coat.
- How the coating materials, including galvanize and metalize, are inspected and accepted for appearance, film thickness, adhesion, etc. For galvanized surfaces, this includes the galvanize thickness after the surface preparation.
- How the coating films are inspected for defects.
- How the faying surfaces are treated and protected.
- How the coatings of steel components are protected from damage during storage, shipping, and erection.

825.03.8 Equipment and Standards. If requested by the Engineer, furnish the following Equipment and Standards. All equipment must be maintained by the Contractor and in working order at all times. Failure to do so will result in stoppage of the work until deficiencies are corrected at no additional cost to the State. These items will be returned to the Contractor when the Engineer is finished with the inspection:

- PTC Surface Temperature Thermometer.
- Psychron 566 Psychrometer (Battery Operated) with two sets of new batteries.
- Psychometric Charts for Dew Point and Relative Humidity.
- SSPC VIS Standard appropriate for the specified degree of cleaning:

SSPC VIS 1, "Visual Standard for Abrasive Blast Cleaned Steel"

SSPC VIS 3, Visual Standard for Power- and Hand-Tool Cleaned Steel"

SSPC VIS 4/NACE VIS 7, "Guide and Reference Photographs for Steel Surfaces Prepared by Waterjetting."

- Wet film thickness gage.
- Positector 6000 Coating Thickness Gauge, with probes suitable for the surface to be measured.
- NIST (NBS) Calibration Standards.
- SSPC Surface Preparation Standards appropriate for the surface preparation requirements of the Contract Documents.
- Tooke guage.

825.03.9 Pre-Painting Meeting. The Contractor shall arrange for a meeting at the site where the surface preparation and painting is to be performed. Arrange the meeting at least 1 month in advance of starting the work to discuss the project requirements with the Department and the manufacturer's technical representative to allow for an examination of the surface preparation and paint application equipment. The meeting shall address methods of operation; weather-related concerns; health and safety; proper storage of material and equipment; location of recycling and dust collection and storage equipment; treatment of inaccessible areas; and visual standards to be satisfied. The quality control plan shall be provided to the Engineer for review at least two weeks prior to this meeting. Work shall not proceed until this meeting has been completed to the satisfaction of the Engineer.

825.04 METHOD OF MEASUREMENT.

825.04.1 Painting Structural Steel. "Painting Structural Steel," i.e., new steel, will be measured by the number of square feet of steel actually painted in accordance with the Plans and/or as directed by the Engineer. Cleaning, surface preparation and paint systems will be considered as incidental to the painting work and, therefore, will not be measured separately.

825.04.2 Painting Existing Structural Steel. "Painting Existing Structural Steel" will be measured by the number of square feet of steel actually painted in accordance with the Plans and/or as directed by the Engineer.

a. Surface Preparation. "Surface Preparation" will be measured by the number of square feet of steel surface actually prepared in accordance with the Plans and/or as directed by the Engineer. Separate levels of surface preparation necessary to accomplish the final specified surface preparation shall not be measured separately for payment but shall be considered included in the single square foot measurement.

825.04.3 Lump Sum Alternative. In certain cases any or all of the above items of work may be paid on a lump sum basis. In such cases, no measurement will be required.

825.04.4 Personnel and Environmental Protection. "Personnel and Environmental Protection" shall be measured in accordance with the appropriate paragraphs in **SECTION 826** of these Specifications.

825.05 BASIS OF PAYMENT.

825.05.1 Painting Structural Steel. The accepted quantity of "Painting Structural Steel" will be paid for at either the contract unit price per square foot or the contract lump sum price, as the case may be, as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment including cleaning, surface preparation, selection of paint system, painting and all incidentals required to finish the work, complete and accepted by the Engineer.

825.05.2 Painting Existing Structural Steel. The accepted quantity of "Painting Existing Structural Steel" will be paid for at either the contract unit price per square foot or the contract lump sum price, as the case may be, as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, equipment, selection of paint system, and all incidentals required to finish the work, complete and accepted by the Engineer.

a. Surface Preparation. The accepted quantity of "Surface Preparation" will be paid for at either the contract unit price per square foot or the contract lump sum price, as the case may be, for the final level of surface preparation as listed in the Proposal. Separate levels of surface preparation necessary to accomplish the final specified surface preparation will not be paid for separately but will be considered included in the single square foot or lump sum for payment. The price so-stated constitutes full and complete compensation for all labor, materials, equipment, and incidentals required to finish the work, complete and accepted by the Engineer.

Add the following new **Section 841, Pre and Post-Construction Condition Surveys** to the RI Standard Specifications for Road and Bridge Construction.

SECTION 841

PRE- AND POST-CONSTRUCTION CONDITION SURVEYS

841.01 DESCRIPTION. The work to be performed under this item consists of all labor, equipment, and materials associated with conducting pre and post-construction condition surveys of all structures and/or properties identified in the Contract Documents.

In addition, structure condition surveys shall be conducted of all structures within 200 feet, unless otherwise noted, for all vibration-inducing activities resulting from the Contractors means and methods, in accordance with the Contract Documents.

Items for which condition surveys shall be conducted include but shall not be limited to, the following:

- Existing bridge foundations, abutments and piers, and superstructures;
- Private commercial and residential buildings and other structures;
- Retaining Walls;
- Culverts

The Contractor shall submit a comprehensive list of all affected properties and structures as part of the project schedule development process Contractor's Submittal List.

Pre-construction surveys shall be conducted in accordance with the Contract Documents, and shall be conducted prior to the commencement of construction operations and vibration-inducing activities. This includes driving and removal of piles and sheeting, drilling, boring, blasting, structural demolition, and any other vibration-inducing activity resulting from the Contractor's means and methods. Work which may result in damage to properties or structures may not commence until all pre-construction survey reports have been submitted by the Contractor and approved by the Engineer.

Post-construction surveys shall be performed upon substantial completion of the contract, with the consent of the Engineer, and shall follow the same procedures and protocols utilized for the pre-construction surveys.

All damage sustained by the properties or structures surveyed due to construction operations shall be repaired by the Contractor to the satisfaction of the Engineer at no additional cost to the State or property owner.

841.02 QUALIFICATIONS AND SUBMITTALS.

841.02.1 Qualifications. Pre- and post-construction surveys shall be conducted by a Professional Engineer, licensed by the State of Rhode Island, who possesses relevant experience in performing structure condition surveys.

841.02.2 Submittals. The Contractor shall submit to the Engineer for approval the following:

a. Documentation substantiating the qualifications of the survey engineer in accordance with **Subsection 841.02.1 Qualifications.**

b. For both the pre- and post-construction condition surveys, the Contractor shall submit an original report and copies with all of the documentation to the Engineer for review. Each report shall also contain a DVD or CD with a complete electronic version of the report in PDF format and all video and still photography taken during the survey.

c. The pre-construction surveys shall be provided to the Engineer a minimum of two (2) weeks prior to starting work.

d. The Contractor shall keep on file, one copy of all results of the pre- and post-construction surveys in a suitable location on site. The documents shall be kept available for viewing during normal working hours. No duplicates, other than as specified above, of any of the survey information will be allowed without the expressed written consent of the Engineer and the property owner.

841.03 CONSTRUCTION METHODS. Pre-construction surveys shall be conducted prior to the commencement of construction operations and all vibration-inducing activities.

Documentation shall include photographs, video, sketches, and a written report of findings. Visual imaging for pre- and post-construction surveys shall include high resolution color image acquisition in a format compatible with subsequent image enhancement analysis and feature extraction. Adequate lighting shall be provided equivalent to a minimum of 55-Watt bulb illumination during still and video photography. Particular attention shall be paid to, but not necessarily limited to, the following:

1. Locations and sizes of cracks in interior and exterior walls, floors and ceilings; and missing mortar, plaster or other surface materials;

2. Damaged masonry, chimney liners and flues, and roofing, including evidence of leakage or poor roof/gutter drainage, such as staining;

3. Damaged or out-of-square doorways and windows including tightness of fit and ease of operation;

4. Walls that are not plumb, floors or ceilings that are not level, and walls, floors or ceilings that are uneven and the extent to which they are not planar;

5. Condition of the foundation walls and basement floors, especially cracking, differential movements, and signs of dampness or moisture;

6. Condition and grading of the ground surface around the exterior of the structure including evidence of drainage towards walls, low spots that pond water, cracks and irregularities in asphalt, concrete, brick or stone pavements, sidewalks, and steps and;

7. Evidence of previous repairs to the structures.
8. In the case of post-construction surveys, note all changes from the pre-construction survey.

A post-construction survey shall be performed upon substantial completion of the contract.

In the event the Contractor and/or survey engineer are unable to gain access, encounter difficulty or be refused entry to a property, they shall document the said refusal in the report and inform the Contractor and Engineer of the incident in writing. Absent a resolution, the survey engineer shall limit the structural condition survey to information that may be gained from observations outside the structure or property boundary, and document the situation in the final report.

841.04 METHOD OF MEASUREMENT. "Pre- and Post-Construction Condition Surveys" will not be measured for payment.

841.05 BASIS OF PAYMENT. "Pre- and Post-Construction Condition Surveys" will be paid for at its respective "Lump Sum" contract price as listed in the Proposal. The price so stated shall constitute full and complete compensation for all labor, materials, tools and equipment, and all incidentals required to complete the work as described in this Specification and elsewhere in the Contract Documents, complete in place and accepted by the Engineer.

Add the following new **Section 842, Ant-Graffiti Coating** to the RI Standard Specifications for Road and Bridge Construction.

SECTION 842

ANTI-GRAFFITI COATING

842.01 DESCRIPTION. This item of work consists of furnishing and installing an anti-graffiti coating system on exterior exposed surfaces of all material types as designated on the Contract Drawings, elsewhere in the Contract Documents and/or as directed by the Engineer, all in accordance with these Specifications.

842.02 MATERIALS.

Anti-Graffiti System. The system shall be as specified in **Section M.19**.

842.03 CONSTRUCTION METHODS.

842.03.1 Submittals. The Contractor shall submit to the Engineer for approval, the manufacturer's specifications, which shall include product data sheets for installation requirements, application procedures and coverage rates, and the applicator's qualifications. Upon approval of the Engineer, manufacturer's specifications do thereby become a part of this Specification and shall be used as the basis for approval or rejection of the work carried out in this Section.

The Contractor shall provide documentation of quantities of each product used in the work. This information is required as a pre-requisite to job acceptance and final payment.

842.03.2 Quality/Process Control. The application shall be performed in strict conformance with the manufacturer's specifications. At no time shall the number of coats and coverage rates be less than those recommended in the manufacturer's technical data sheets. The Contractor shall submit evidence of the applicator's qualifications and experience for the Engineer's review and approval prior to commencing work.

The manufacturer shall be available to make recommendations specific to the project, substrate, coating appearance and cleaning options.

842.03.3 Anti-Graffiti Coating.

a. Surface Preparation. All substrates to receive the coating shall be structurally sound, dry, clean and free of paint not specified to remain, dust, dirt, grime, oils, scale, rust, silicones, curing compounds, alkali, acid residues or any other material that may act to inhibit bond.

Surface preparation and application of subsequent coats for all substrates shall be in strict accordance with the manufacturer's specifications. In addition, the product shall not be applied to surfaces below 45 degrees F or above 90 degrees F.

In addition, the following shall apply:

1. New concrete masonry and cement plaster to receive the system shall be cured as per the manufacturer's specifications, but no less than a minimum of thirty (30) days.
2. The moisture content of all bare masonry surfaces to receive the system, as indicated on a calibrated moisture meter, shall not exceed the manufacturer's maximum allowable percentage or shall be no higher than 15% if no manufacturer guidance is given.

b. Application. The Contractor shall follow the manufacturer's current instructions for application at all times and allow the coating to cure before applying subsequent coats so as to achieve a uniform and continuous coating free of pinholes and holidays.

c. Cleanup and Protection. The Contractor shall remove discarded coating materials, rubbish, cans, and rags at end of each workday. All such materials shall be disposed of properly, in accordance with all local, state and federal laws.

The Contractor shall protect all adjacent areas not to be coated, against damage by the coating and finish work. The Contractor shall correct all damage it causes by cleaning, repairing or replacing, and recoating, as is acceptable to the Engineer, at no additional cost to the State.

842.04 METHOD OF MEASUREMENT.

842.04.1 Anti-Graffiti Coating. This item will be measured for payment under Item "ANTI-GRAFFITI COATING" by the "Square Foot" of anti-graffiti coating actually applied in accordance with the Contract Documents and/or as directed by the Engineer.

842.05 BASIS OF PAYMENT.

842.05.1 Anti-Graffiti Coating. The accepted quantity of "ANTI-GRAFFITI COATING" will be paid for at its respective contract unit price per "Square Foot" as listed in the Proposal. The price so stated shall constitute full and complete compensation for all labor, materials, tools and equipment, and all incidentals required to complete the work as described in this Specification and elsewhere in the Contract Documents, complete in place and accepted by the Engineer.

CODE 901.0198

GUARDRAIL END TREATMENT - NON-ENERGY ABSORBING TERMINAL

CODE 901.0199

GUARDRAIL END TREATMENT - ENERGY ABSORBING TERMINAL

DESCRIPTION. Work under these items shall consist of furnishing and installing NCHRP 350 Test Level 3 (TL-3) approved guardrail end terminal sections at the locations designated on the plans or as directed by the Engineer.

MATERIALS. The energy and non-energy absorbing guardrail end terminals shall be products listed on the Department's approved materials list, or approved equals. Any products not included on the approved materials list shall be tested and verified as meeting all the criteria for NCHRP350, Test Level 3.

CONSTRUCTION METHODS. The guardrail end treatments shall be installed per the manufacturer's recommendations. Prior to installation, the Contractor shall furnish three (3) copies of the manufacturer's installation manual to the Engineer.

Shop Drawings for the guardrail terminal sections shall be submitted by the Contractor in accordance with the provisions of **Subsection 105.02** of the Standard Specifications.

METHOD OF MEASUREMENT. "Guardrail End Treatment - Non-Energy Absorbing Terminal" and "Guardrail End Treatment - Energy Absorbing Terminal" will be measured by the number of units installed in accordance with the Plans and/or as directed by the Engineer.

BASIS OF PAYMENT. The accepted quantities of "Guardrail End Treatment - Non-Energy Absorbing Terminal" and "Guardrail End Treatment - Energy Absorbing Terminal" will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, tools, materials, equipment, accessories, hardware and all other incidentals required to finish the work, complete and accepted by the Engineer.

Add the following subsections for Temporary Chain Link Fence and Gate to **Section 903; Fences**, pages 9-5 through 9-7 of the RI Standard Specifications for Road and Bridge Construction.

SECTION 903

FENCES - TEMPORARY CHAIN LINK FENCE AND GATE

903.01 DESCRIPTION.

903.01.1 Temporary Chain Link Fence. This work consists of the furnishing, installation and removal of temporary chain link fencing for purposes of protecting and controlling access to areas of the project as indicated in the contract documents and/or as directed by the Engineer. This work shall also include the relocation of temporary fencing to various locations within the project limits over the duration of the project, as provided for in the contract documents and/or as directed the Engineer, or as necessary to accommodate the Contractor's operations.

903.02 MATERIALS.

903.02.1 Temporary Chain Link Fence. Temporary chain link fencing, gates, posts, fittings and related hardware shall conform to the requirements of **Subsection M.08.02** of these specifications. Fittings and other hardware not specifically included in these specifications shall be standard commercial grade.

903.03 CONSTRUCTION METHODS.

903.03.7 Temporary Chain Link Fence. Temporary chain link fence may be supported by fence posts set in the ground, or means of concrete blocks or metal feet which shall provide adequate support. When utilized, fence posts set in the ground may be stabilized with grout or concrete, or may be supported by holes cored into bituminous or concrete pavement when specified in the contract or permitted by the Engineer.

Temporary fence sections may be fabricated in modular panels provided the panels are fastened together with approved clamping devices.

903.04 METHOD OF MEASUREMENT.

903.04.4 Temporary Chain Link Fence and Gate. "Temporary Chain Link Fence" will be measured in Linear Feet, end to end along the top of fence, of continuous sections actually installed in accordance with the provisions of contract and/or as directed by the Engineer.

"Temporary Chain Link Gate" will be measured by the number of such units actually installed in accordance with the provisions of contract and/or as directed by the Engineer.

903.05 BASIS OF PAYMENT.

903.05.4 Temporary Chain Link Fence and Gate. “Temporary Chain Link Fence” will be paid for at the respective unit price per linear foot as listed in the Proposal. The price so stated shall constitute full and complete compensation for all labor, material, tools, equipment and all incidentals required to complete the work, complete and accepted by the Engineer.

“Temporary Chain Link Gate” will be paid for at the respective unit price per each as listed in the Proposal. The price so stated shall constitute full and complete compensation for all labor, material, tools, equipment and incidentals required to finish the work, complete and accepted by the Engineer.

No separate payment will be made for relocating and resetting fencing required by the contract or to accommodate the Contractor’s operations, or for removal at the conclusion of the project.

Add the following subsections for Split Rail Fence and Gate to **Section 903, Fences**, pages 9-5 through 9-7 of the RI Standard Specifications for Road and Bridge Construction.

SECTION 903

FENCES - SPLIT RAIL FENCE AND GATE

903.01 DESCRIPTION.

903.01.2 Split Rail Fence. This work consists of constructing split rail fencing and gates, including posts, post foundations and all necessary hardware in close conformity with contract documents and/or as directed by the Engineer, all in accordance with these Specifications.

903.02 MATERIALS.

903.02.2 Split Rail Fence. Materials for split rail wood fences, gates, posts, and all related hardware shall conform to the applicable requirements of **Subsections M.08.04 and M.08.06** of these specifications. The type of wood to be utilized for fencing, including gates and posts, shall be as specified in the contract documents and conform to AASHTO M168. Timber preservatives, when specified, shall conform to AASHTO M133.

903.03 CONSTRUCTION METHODS.

903.03.8 Split Rail Fence. Split Rail Fencing, including the placement and spacing of posts, shall be installed at the locations shown on the plans or as directed by the Engineer. Posts shall be set plumb at a minimum depth of 3'-0" in concrete footings or in holes backfilled and compacted, and shall be set in alignment with horizontal rail elements in accordance with the dimensions shown on the plans.

903.04 METHOD OF MEASUREMENT.

903.04.5 Split Rail Fence and Gate. "Split Rail Fence" will be measured in Linear Feet along the top of fence between post centerlines, for sections actually installed in accordance with the provisions of contract and/or as directed by the Engineer.

"Split Rail Gate" will be measured by the number of such units actually installed in accordance with the provisions of contract and/or as directed by the Engineer.

903.05 BASIS OF PAYMENT.

903.05.5 Split Rail Fence and Gate. "Split Rail Fence" will be paid for at the respective unit price per linear foot as listed in the Proposal. The price so stated shall constitute full and complete compensation for all labor, material, tools, equipment and all incidentals required to complete the work, complete and accepted by the Engineer.

Compilation of Approved Specifications

Date: 04/22/2016

“Split Rail Gate” will be paid for at the respective unit price per each as listed in the Proposal. The price so stated shall constitute full and complete compensation for all labor, material, tools, equipment and incidentals required to finish the work, complete and accepted by the Engineer.

Remove **Section 905, Sidewalks and Driveways**, pages 9-9 through 9-12 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 905

SIDEWALKS AND DRIVEWAYS

905.01 DESCRIPTION. This work consists of constructing sidewalks, wheel chair ramps, and driveways on prepared gravel bases at the locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

Sidewalks and driveways may be constructed of either bituminous concrete or Portland cement concrete, as indicated on the Plans.

905.02 MATERIALS.

905.02.1 Portland Cement Concrete. Portland cement concrete for sidewalks, wheel chair ramps, typical driveways and commercial driveways shall conform to the requirements as set forth in **Subsections 601.01.1; Classification, and 601.03.1; Proportioning**, of these Specifications. Concrete for sidewalk applications shall be modified by the addition of 10% to 20% ground granulated blast furnace slag (GGBFS) or fly ash as a replacement for Portland cement per **Section 602** of these Specifications.

905.02.2 Bituminous Concrete. Bituminous concrete for sidewalks, wheel chair ramps, and driveways shall be as noted on the plans and shall conform to the applicable requirements of **Subsection 401.02** of these Specifications. Coarse and fine aggregates, mineral filler, and asphalt cement shall be combined to produce sidewalk and driveway pavements in accordance with the requirements listed under the column heading entitled, "CLASS I-2 or SIDEWALK" in **Subsection M.03.01** of these Specifications.

Performance-graded asphalt cement shall conform to the requirements of **Subsection M.03.02.1** of these Specifications.

905.02.3 Other Materials.

a. Gravel Borrow shall conform to the requirements set forth in **Subsection M.01.02** of these Specifications.

b. Reinforcing, when required, shall be wire-fabric that conforms to the requirements of **Subsection M.05.02.1** of these Specifications.

905.03 CONSTRUCTION METHODS.

905.03.1 Scheduling Sidewalk Construction. The Contractor shall schedule sidewalk construction activities such that no areas are left without paved sidewalks for more than seven consecutive calendar days. This means that once the Contractor commences the removal of existing sidewalks at any location

within the project, the construction of new sidewalks at that particular location must be completed within seven consecutive calendar days.

Removal of sidewalks shall be performed in accordance with the provisions of **Subsection 201.03.7** of these Specifications.

The Contractor may be required to saw cut and remove the existing sidewalk 2 feet behind the face of the curb and complete curb-related activities prior to removing the adjacent remaining sidewalk area. Should this work be noted on the plans and/or in the specifications, then saw cutting and any required temporary sidewalk patching material will be paid for under separate and appropriate pay items as noted in the contract's proposal.

a. Failure to Comply. If the Contractor fails to complete the construction of any portion of new sidewalks in accordance with this **Section 905**, the daily charge set forth in **Special Provision Code 905.1000** will be deducted from monies then due the Contractor as a charge for failure to comply with these Specifications. Moreover, the stated daily charge will apply for every calendar day that the Contractor fails to comply with this specification.

905.03.2 Compliance with the Americans with Disabilities Act. To comply with the requirements of the Americans with Disabilities Act (ADA), sidewalks shall provide a minimum clearance of 36 inches of width at point of narrowing, excluding the curb width, and 48 inches of continuous width elsewhere. The Contractor shall verify with the Engineer that these requirements can be met prior to completing the construction of new sidewalks. Under no circumstances shall any sidewalks be constructed without prior approval of the Engineer if it is determined that these requirements cannot be attained.

905.03.3 Portland Cement Concrete Sidewalks and Driveways.

a. Excavation. Excavation shall be made to the required depth and to a width that will permit the installation and bracing of the forms. All existing material, including gravel borrow, shall be excavated to the limits indicated on the Plans. The foundation shall be shaped and compacted to a firm even surface conforming to the section shown on the Plans. All unsuitable material shall be removed and replaced with acceptable material.

b. Gravel Borrow Subbase. The gravel base shall be placed in layers not over 6 inches in depth and compacted to the specified depth below finish grade.

c. Forms. Forms shall be of wood or metal and shall extend for the full depth of the concrete. All forms shall be straight, free from warp and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

d. Box forms. Box forms shall be formed around all appurtenances extending into and through the sidewalk. The contractor shall fill all box forms with sand immediately upon placement of the sidewalk. Sand shall be flush with the sidewalk surface. There will be no separate payment for either the material, placement or removal of the sand placed in box out areas, these costs shall be considered incidental to this contract. The final material used to fill inside the box form areas shall be the same as that specified for the sidewalk.

e. Placing Concrete. The foundation shall be thoroughly moistened immediately prior to the placing of the concrete. The proportioning, mixing and placing of the concrete shall be in accordance with the requirements for the class of concrete specified.

f. Finishing. The surface shall be finished with a wooden float. No plastering of the surface will be permitted. All outside edges of the slab and all joints shall be edged with a 1/4-inch radius edging tool.

g. Joints. Expansion joints shall be of the dimensions specified, and shall be filled with an approved type of premoulded expansion joint filler. Sidewalks and driveways shall be divided into sections by dummy joints formed by a jointing tool or other acceptable means as directed. These dummy joints shall extend into the concrete for at least 1/3 of the depth and shall be approximately 1/8-inch wide. At no time shall the distance between transverse and/or longitudinal dummy joints exceed 5 feet.

Construction joints shall be formed around all appurtenances extending into and through the sidewalk. Premolded expansion joint filler 1/4-inch thick shall be installed in these joints. Expansion joints shall be placed every 20 feet. The forcing of premoulded expansion joint filler into freshly placed concrete will not be allowed.

Expansion joint filler shall be installed between concrete sidewalks and any fixed, smooth structure such as a building or bridge. This expansion joint material shall extend for the full depth of the walk. If the sidewalk abuts an irregular wall, foundation or stationary object, the expansion joint filler shall be placed 4 inches from the irregular surface and concrete placed between the irregular surface and the expansion joint material.

The maximum tolerance for the 4-inch concrete thickness is plus-or-minus 1/2-inch.

h. Curing. Concrete shall be cured for at least 72 hours. Curing shall be by means of moist burlap mats or by other approved methods as set forth in **Subsection 601.03.8; Curing**, of these Specifications. During the curing period all traffic, both pedestrian and vehicular, shall be excluded. Vehicular traffic shall be excluded for such additional time as the Engineer may direct.

i. Cutting and Matching Existing Concrete Sidewalks or Driveways. Where a newly constructed sidewalk and/or driveway abuts an existing sidewalk or driveway, the existing sidewalk or driveway shall be cut with a concrete saw only. The concrete saw shall conform to **Subsection 501.03.2; Para. c** of these Specifications.

After installation of the concrete driveway, the contractor shall match bituminous pavement adjacent to parking areas, walkways, and driveways within 14 days.

905.03.4 Bituminous Sidewalks and Driveways.

a. Excavation and Forms. Excavation and forms shall meet the requirements of **Subsections 905.03.3; Paras. a and c**, respectively. The limits of excavation will be as shown on the Plans, or as directed by the Engineer. All material within the limits of excavation must be removed and replaced with gravel borrow subbase.

b. Gravel Borrow Subbase. Gravel material shall be placed in layers not exceeding 6 inches in depth and each layer shall be compacted as specified in **Subsection 301.03.2** of these Specifications.

c. Placing Bituminous Sidewalk and Driveway Material. Bituminous sidewalk and driveway material shall be placed on the compacted base in one or more courses as indicated to give the required depth when rolled. Compaction shall be accomplished by means of a power roller of a type and weight acceptable to the Engineer. In areas inaccessible to the roller, hand tamping or hand roller will be permitted. In any case, the bituminous material shall be uniformly compacted.

The Contractor shall simultaneously extend the binder and Type I-1 surface course from the project roadway into all driveways which are not constructed with Portland cement concrete for a length of 3 feet, thereby eliminating cold joints at the gutter line.

905.04 METHOD OF MEASUREMENT.

905.04.1 Portland Cement Sidewalks and Driveways. "Portland Cement Concrete Sidewalks and Driveways" will be measured by the number of cubic yards of pavement actually placed in accordance with the Plans and/or as directed by the Engineer.

905.04.2 Bituminous Concrete Sidewalks and Driveways. "Bituminous Concrete Sidewalks and Driveways" will be measured by the number of tons of pavement material actually placed in accordance with the Plans and/or as directed by the Engineer.

905.05 BASIS OF PAYMENT.

905.05.1 Portland Cement Concrete Sidewalks and Driveways. The accepted quantities of "Portland Cement Concrete Sidewalks and Driveways" will be paid for at the contract unit price per cubic yard as listed in the Proposal. A maximum 5 percent overrun of the calculated quantities based on the required thickness as shown on the Plans is permissible. The price so stated constitutes full and complete compensation for all labor, materials and equipment, including expansion joint material, reinforcement, and all other incidentals required to finish the work, complete and accepted by the Engineer. Excavation and gravel borrow subbase will be paid for separately under appropriate work items.

905.05.2 Bituminous Concrete Sidewalks and Driveways. The accepted quantities of "Bituminous Concrete Sidewalks and Driveways" will be paid for at the contract unit price per ton as listed in the Proposal. A maximum 10 percent overrun of the calculated quantities based on the required thickness as shown on the Plans is permissible in accordance with the provisions of **Subsection 401.04.1(b)** of these Specifications. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, and all other incidentals required to finish the work, complete and accepted by the Engineer.

Excavation and gravel borrow subbase will be paid for separately under appropriate work items.

CODE 905.1000

SIDEWALKS

(Job Specific)

DESCRIPTION: Subsection 905.03.1(a) - Failure to Comply, In the event the Engineer determines that new sidewalks have not been constructed within the seven consecutive calendar days required by **Subsection 905.03.1(a)** of these Specifications, a daily charge will be deducted from monies due the Contractor.

The charge for this Contract will be \$_____ per day, for each day that the Contractor is not in compliance with **Subsection 905.03.1(a)** of these Specifications.

Revise **Section 906; Curbing for Roadways**, pages 9-12 through 9-17 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 906

CURBING FOR ROADWAYS

- **Replace Subsection 906.02.2(b) with the following.**

b. Tolerances. Precast concrete curbing, apron stones, inlets and related concrete curb products shall conform to the dimensions shown on the Plans. Said dimensions shall fall within the following tolerances:

Dimension	Tolerance ±
Width	1/4"
Height	1/2"
Length	3/4"
Surface Profile	1/8"

Details and dimensions shall be true and square. The tolerance allowance on each precast element shall not relieve the Contractor from obtaining a suitable configuration of the various installed products.

- **Replace Subsection 906.03.1 in its entirety with the following.**

906.03.1 Granite Curbing.

a. Excavation. Excavation shall be made to the dimensions shown on the Plans or as directed by the Engineer to a sufficient width and depth to allow for the proper trimming and fine grading and compaction of a gravel subbase course. The gravel subbase upon which the curbing is to be set shall be compacted to a firm, even surface. All soft and unsuitable material shall be removed and replaced with gravel borrow material. Gravel borrow shall be placed in layers not exceeding 6 inches in depth before compaction. Each layer shall be compacted to 95 percent of maximum density (AASHTO T-180) by means of a vibratory compactor of size and type approved by the Engineer.

b. Installation. The curbing shall be set such that the front top arris line conforms to the required line and grade.

c. Joints. Curbing units shall be placed end-to-end as close as possible. No more than ½-inch opening shall show for the full width of the top and the top 8 inches of the vertical joint.

d. Backfilling. After the curbing has been set, any remaining excavated areas shall be backfilled with approved material and thoroughly compacted back and front to grade. Methods of compaction shall preserve the line and grade of the curbing.

- **Replace Subsection 906.03.2 with the following.**

906.03.2 Precast Concrete Curbing. The construction of precast concrete curbing shall conform to the requirements of **Subsection 906.03.1**, above.

- **Replace the last paragraph of Subsection 906.03.4 with the following.**

The berm shall be founded entirely on the base course. Any adjacent surface course shall be saw cut as required to form a true and even edge. The portion of the base course on which the berm is to be placed as well as any vertical saw cut edge shall be cleaned to the satisfaction of the Engineer and covered with an approved bituminous tack coat. The berm shall be placed in one layer and shall be compacted by a smooth steel wheel roller of a type and weight acceptable to the Engineer. After the berm is placed, the joint between the berm and the existing pavement shall be sealed with an approved highway joint sealant.

- **Replace Subsection 906.03.5 in its entirety with the following.**

906.03.5 Remove, Handle, Haul, Trim, and Reset Curbing and Edging, Straight and/or Circular, All Types. The existing curbing or edging shall be carefully removed to minimize damage to said units and adjacent pavement or sidewalks. The curbing or edging will then be handled, hauled and stockpiled as required. The individual units shall be trimmed and cut as necessary so that the ends are squared, the joints of the installed curbing or edging are tightly butted and no more than a ½-inch opening shall show at the full width of the top and the top 8-inches of the vertical joint. All curbing or edging shall be thoroughly cleaned prior to resetting.

The construction of reset curbing and edging, straight and/or circular, shall conform to the requirements of **Subsection 906.03.1** above.

The Contractor shall replace with new material any existing curbing or edging that is to be reset which is lost, damaged, or destroyed as a result of either its construction operations or failure to properly store and protect said units, all at no additional cost to the State.

- **Replace Subsection 906.04 in its entirety with the following.**

906.04 METHOD OF MEASUREMENT.

906.04.1 Granite Curbing. "Granite Curb-Straight" and "Granite Curb-Circular" will be measured (along the front face of the section at the finished grade elevation) by the number of linear feet of such curbing actually installed in accordance with the Plans and/or as directed by the Engineer.

"Granite Curb Corners," "Granite Curb Transitions," "Granite Curb Apron Stones," "Granite Curb Inlet Stones," "Granite Curb Wheelchair Ramp Transition" and "Granite Ramp Stones" will be measured by the number of each such units actually installed in accordance with the Plans and/or as directed by the Engineer.

906.04.2 Precast Concrete Curbing. "Precast Concrete Curb-Straight" and "Precast Concrete Curb-Circular" will be measured (along the front face of the section at the finished grade elevation) by the

number of linear feet of such curbing actually installed in accordance with the Plans and/or as directed by the Engineer.

"Precast Concrete Curb Corners," and "Precast Concrete Curb Transitions," "Precast Concrete Curb Apron Stones," "Precast Concrete Curb Inlet Stones," "Precast Concrete Curb Wheelchair Ramp Transition, Stones" and "Precast Concrete Ramp Stones" will be measured by the number of each such units actually installed in accordance with the Plans and/or as directed by the Engineer.

906.04.3 Bituminous Curbing. "Bituminous Curbing" will be measured (along the front face of the section at the finished grade elevation) by the number of linear feet of such curbing actually installed in accordance with the Plans and/or as directed by the Engineer. Deduction in length will be made for the presence of drainage structures installed along the curblines such as catch basins, drop inlets, etc.

906.04.4 Bituminous Berm. "Bituminous Berm" will be measured by the number of linear feet actually installed in accordance with the Plans and/or as directed by the Engineer.

906.04.5 Remove, Handle, Haul, Trim, and Reset Curbing and Edging, Straight and/or Circular, All Types. "Remove, Handle, Haul, Trim and Reset Curbing and Edging, Straight and/or Circular, All Types" will be measured (along the front face of the section at the finished grade elevation) by the number of linear feet of such curbing reset in accordance with the Plans and/or as directed by the Engineer.

"Curb Corners," "Curb Transitions," "Apron Stones," "Inlet Stones," "Curb Wheelchair Ramp Transition Stones" and "Ramp Stones" will be measured (along the front face of the section at the finished grade elevation) by the number of linear feet of such curbing reset in accordance with the Plans and/or as directed by the Engineer.. Deductions in length will be made for the presence of new drainage structures installed along the curblines such as catch basins, drop inlets, etc.

- **Replace Subsection 906.05 in its entirety with the following.**

906.05 BASIS OF PAYMENT.

906.05.1 Granite Curbing. The accepted quantities of "Granite Curb-Straight" and "Granite Curb-Circular" will be paid for at their respective contract unit prices per linear foot as listed in the Proposal.

The accepted quantities of "Granite Curb Corners," "Granite Curb Transitions," "Granite Curb Apron Stones," "Granite Curb Inlet Stones," "Granite Curb Wheelchair Ramp Transition-Stones" and "Granite Ramp Stones" will be paid for at their respective contract unit prices per each as listed in the Proposal.

The prices so-stated constitute full and complete compensation for all labor, materials and equipment, including excavation, joints, gravel borrow subbase course including compaction and trimming and fine grading unless otherwise noted, backfilling, compacting, and all other incidentals required to finish the work, complete and accepted by the Engineer.

The following work will be paid for separately under appropriate work items: sawcutting, the removal and disposal of existing pavements, both rigid and flexible, and sidewalks.

906.05.2 Precast Concrete Curbing. The accepted quantities of "Precast Concrete Curb-Straight" and "Precast Concrete Curb-Circular" will be paid for at their respective contract unit prices per linear foot as listed in the Proposal.

The accepted quantities of "Precast Concrete Curb Corners," "Precast Concrete Curb Transitions," "Precast Concrete Curb Apron Stones," "Precast Concrete Curb Inlet Stones," "Precast Concrete Curb Wheelchair Ramp Transition Stones" and "Precast Concrete Ramp Stones" will be paid for at their respective contract unit prices per each as listed in the Proposal.

The prices so-stated constitute full and complete compensation for all labor, materials and equipment, including excavation, joints, gravel borrow subbase course including compaction and trimming and fine grading unless otherwise noted, backfilling, compacting, and all other incidentals required to finish the work, complete and accepted by the Engineer.

The following work will be paid for separately under appropriate work items: sawcutting, the removal and disposal of existing pavements, both rigid and flexible, and sidewalks.

906.05.3 Bituminous Curbing. The accepted quantity of "Bituminous Curbing" will be paid for at the contract unit price per linear foot as listed in the Proposal.

The prices so-stated constitute full and complete compensation for all labor, materials and equipment, including excavation, joints, gravel borrow subbase course including compaction and trimming and fine grading unless otherwise noted, backfilling, compacting, and all other incidentals required to finish the work, complete and accepted by the Engineer.

The following work will be paid for separately under appropriate work items: saw cutting, the removal and disposal of existing pavements, both rigid and flexible, and sidewalks.

906.05.4 Bituminous Berm. The accepted quantity of "Bituminous Berm" will be paid for at the contract unit price per linear foot as listed in the Proposal. However, the quantity of bituminous material used in the berm is not included in this contract unit price, but rather is included in the unit price listed for Class I-1, Bituminous Concrete Pavement. The unit price for Bituminous Berm includes all preparatory items required for proper placement of the berm, including saw cutting; brooming and cleaning; bituminous tack coat; placement and compaction of the berm; sealing of the joints; and all other incidentals necessary to finish the work, complete and accepted by the Engineer.

906.05.5 Remove, Handle, Haul, Trim and Reset Curbing and Edging, Straight and/or Circular, All Types. The accepted quantities of "Remove, Handle, Haul, Trim and Reset Curbing and Edging, Straight and/or Circular, All Types," for each kind and type specified, will be paid for at the respective contract unit prices per linear foot as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials, and equipment, including removal and disposal of existing pavement structure, excavation for removal and setting unless otherwise noted that resetting excavation is to be paid for separately, all handling, hauling and stockpiling, cleaning all sections to be reset, cutting and trimming as necessary to provide the maximum ½-inch opening across the top and down the front of the curbing, gravel borrow subbase course including compaction and trimming and fine grading unless otherwise noted, the resetting of the curbing or edging to line and grade, backfilling, compacting, and all other incidentals required to finish the work, complete in place and accepted by the Engineer.

Saw cutting, replacement concrete base, and any concrete required between the reset curbing or edging and the existing pavement structure will be paid for separately under appropriate work items.

Remove **Subsections 913.02 and 913.04, Trafficpersons – Qualifications and Method of Measurement**, pages 9-30 and 9-31 of the RI Standard Specifications for Road and Bridge Construction and replace them with the following.

SECTION 913

TRAFFICPERSONS

913.02 QUALIFICATIONS. Police officers shall wear regulation uniforms and should be regular, reserve or special officers of the communities in which they serve.

High-visibility safety apparel should be worn by all police officers providing traffic control. The apparel background (outer) material color shall be either fluorescent orange-red or fluorescent yellow-green, and the retroreflective material shall be either orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors, and shall be visible at a minimum distance of 1000 feet. The retroreflective safety apparel shall be designed to clearly identify the wearer as a person.

913.04 METHOD OF MEASUREMENT. Services of “Trafficpersons” will be measured for payment by the number of hours for each person rendering services in accordance with directions of the Engineer. This is to include, however, only such trafficpersons as are employed within either the limits of the construction right-of-way for the project, upon detours stipulated in the Contract; or upon detours ordered by the Engineer. Trafficpersons furnished by the Contractor for continued use of a detour, bypass or temporary traffic control beyond the period for which the Engineer deems such trafficpersons necessary to the proper completion of the project, or at locations where traffic is unnecessarily restricted by the Contractor’s method of operation will not be measured for payment.

Remove **Subsection 914.02, Flagpersons – Qualifications**, page 9-31 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace with the following:

SECTION 914

FLAGPERSONS

914.02 QUALIFICATIONS. Flagpersons must be trained in safe traffic control practices and public contact techniques, be thoroughly familiar with the most recent publication of the “Flagging Handbook,” published by the Federal Highway Administration and must possess a certificate of satisfactory completion from a training course approved by the Department. All flagpersons should be able to demonstrate the following abilities:

- a. Receive and communicate specific instructions clearly, firmly and courteously;
- b. Move and maneuver quickly in order to avoid danger from errant vehicles;
- c. Control signaling devices (such as STOP/SLOW paddles, flags and lights) in order to provide clear and positive guidance, in frequently changing situations, to drivers approaching a Traffic Control zone;
- d. Understand and apply safe traffic control procedures, sometimes in stressful or emergency situations; and
- e. Recognize dangerous or potentially dangerous traffic situations and alert workers to the situation.

Flagpersons must wear attire appropriate for construction site work, and high-visibility safety apparel shall be worn by all flagpersons actively engaged in providing traffic control. The apparel background (outer) material color shall be either fluorescent orange-red or fluorescent yellow-green, and the retroreflective material shall be either orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors, and shall be visible at a minimum distance of 1000 feet. The retroreflective safety apparel shall be designed to clearly identify the wearer as a person.

Flagpersons unqualified or unable to meet the above requirements or who are, for any reason, unable to provide proper and effective traffic control may be removed at the discretion of the Engineer. In such instances, the Contractor shall provide qualified replacement flagpersons and shall maintain the required traffic control measures for the work site at all times.

Replace **Section 918, Rural Mailboxes Postmaster Approved**, page 9-35 of the RI Standard Specifications for Road and Bridge Construction in its entirety with the following.

SECTION 918

RURAL MAIL BOXES POSTMASTER APPROVED

918.01 DESCRIPTION. This work consists of replacing existing rural mail boxes with new 2-door mail boxes when the existing mail boxes do not conform to the specifications of the U.S. Postal Service and/or local requirements, all in accordance with these Specifications.

918.02 MATERIALS. New rural mail boxes shall conform to the standards established by the U.S. Postal Service for materials, coatings, and paint. The doors of the new mail boxes must have embossed thereon the following inscriptions: "U.S. MAIL," and "APPROVED BY THE POSTMASTER GENERAL." Identification in the form of a house, apartment or box number, clearly visible to the mail carrier's approach and consistent with USPS Standards, shall be provided.

918.03 CONSTRUCTION METHODS. Mounting of new rural mail boxes on posts shall conform to the requirements of **Subsection 917.03.2, Para. c; Mounting of Mail Boxes**, of these Specifications.

918.04 METHOD OF MEASUREMENT. "Rural Mail Boxes" of the various types indicated on the Plans will be measured by the number of such boxes actually installed in accordance with the Plans and/or as directed by the Engineer.

918.05 BASIS OF PAYMENT. The accepted quantities of "Rural Mail Boxes" of the various types indicated on the Plans will be paid for at their respective contract unit prices per each such box as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials and equipment, including removal of existing rural mail boxes, hardware and incidentals required to finish the work, complete and accepted by the Engineer.

Remove **Section 926, Precast Concrete Median Barrier for Temporary Traffic Control**, pages 9-47 and 9-48 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 926

ANCHORED AND UNANCHORED PRECAST CONCRETE BARRIER FOR TEMPORARY TRAFFIC CONTROL

926.01 DESCRIPTION. This work consists of providing anchored or unanchored precast concrete barrier for temporary traffic control at the locations shown on the Plans or as directed by the Engineer, all in accordance with these Specifications.

Anchored barrier on bridge decks will be double-face type barrier except when single-face type units are specified on the Plans.

926.02 MATERIALS.

926.02.1 Anchored and Unanchored Barrier Units. Portland cement concrete and reinforcing shall conform to the requirements of **Subsection 909.02.1** of these Specifications.

926.02.2 Delineators. Delineators shall have a minimum of 9 square inches of reflective surface area. The unit shall be capable of being mounted on the side of barrier by use of an adhesive or other method approved by the manufacturer. Such delineators may be one of those products which appear on the Department's Approved Materials List.

926.02.3 High Strength Non-Shrink Grout. High Strength Non-Shrink Grout shall conform to the requirements of **Subsection 819.02.2** of these specifications.

926.02.4 Anchorage System. For new or existing bridge decks, anchors shall be a minimum $\frac{3}{4}$ inch diameter and shall be listed on the Department's approved materials list. Each anchor must be capable of developing a minimum of 6,000 pounds tension and 2500 pounds shear for a 10-foot barrier section, with the number of anchors and spacing as shown on the Plans. Anchors shall be installed per manufacturer's recommendations.

For existing bridge decks, $\frac{3}{4}$ inch minimum diameter through-bolts may be used in lieu of adhesive or expansion anchors.

All anchors, nuts and washers shall conform to ASTM A325 and shall be galvanized according to ASTM A153. All bolts, anchors, nuts, and washers shall conform to the applicable requirements of **Subsection M.05.04.4** of these Specifications except as modified by the Plans.

Other anchorage systems may be used in lieu of above only upon approval of the Engineer.

926.03 CONSTRUCTION METHODS.

926.03.1 Plant Requirements. Plant requirements shall conform to the applicable provisions of **Subsection 909.03.1** of these Specifications.

926.03.2 Delineators. White delineators shall be installed on the right side of the travel way and amber delineators on the left side of the travel way. The delineators shall be installed at 50-foot intervals and they shall be located 3 inches from the top of the concrete barriers.

926.03.3 Placement. Precast concrete barrier used for temporary traffic control shall be placed on the pavement at locations indicated on the Plans or as directed by the Engineer.

Care shall be exercised during transporting, storing, hoisting and handling of the units to prevent cracking or damage. No damaged units or units that have markings painted on them from previous work-sites shall be installed. Units showing defects or damage as a result of the Contractor's operations or negligence shall be removed and replaced or repaired by the Contractor at no additional cost to the State.

Unanchored barrier shall be carefully removed from their initial locations and transported to alternate locations where they shall be placed on the pavement as directed by the Engineer.

Anchored barrier units shall be firmly secured to the bridge deck surface. Traffic shall not be allowed near the barrier until units are firmly anchored and highway approach transitions are in place.

Anchors shall be placed on the traffic side of the barrier and located such that interference with the longitudinal deck reinforcement is minimized. Prior to barrier placement, deck reinforcement shall be located and marked using a pachometer. The position of the barrier shall then be adjusted, at the direction of the Engineer, to minimize interference between the anchors and deck reinforcement,.

The barrier units shall be placed in such a manner as not to leave exposed blunt ends of said units.

926.03.4 Removal. Upon completion of the work the Contractor shall completely remove and legally dispose of said barrier units from the project site. For anchored barrier, the remaining holes in the new deck shall be patched with high strength non-shrink grout.

926.04 METHOD OF MEASUREMENT.

926.04.1 Unanchored Barrier Units. "Unanchored Precast Concrete Barrier for Temporary Traffic Control" will be measured in linear feet of continuous runs of those units actually placed in accordance with the Plans and/or as directed by the Engineer. The measured length includes all 3-inch joints between the units.

926.04.2 Anchored Barrier Units. "Anchored Precast Concrete Barrier for Temporary Traffic Control" and "Anchored Single-Face Precast Concrete Barrier for Temporary Traffic Control" will be measured in linear feet of continuous runs of those units actually placed in accordance with the Plans and/or as directed by the Engineer. The measured length includes all 3-inch joints between the units.

926.04.3 Delineators. "Reflective Delineators" will be measured by the number of said units provided and installed in accordance with the Plans and/or as directed by the Engineer.

926.05 BASIS OF PAYMENT.

926.05.1 Unanchored Barrier Units. The accepted quantity of "Unanchored Precast Concrete Barrier for Temporary Traffic Control" will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, tools, materials, equipment, initial placement of the units in accordance with the Plans, furnishing, hauling, handling, any new parts required to secure the units to the pavement or to adjacent units, subsequent removal of said units and for all other incidentals required to finish the work, complete and accepted by the Engineer.

The Contractor shall not be compensated for any work necessary to realign barrier units if they are disturbed or damaged as a result of the Contractor's operations.

The Contractor shall be paid 90 percent of the contract unit price when the barrier units are in place. The remaining 10 percent of the contract unit price will be paid when the barrier units have been removed from the project.

926.05.2 Anchored Barrier Units. The accepted quantity of "Anchored Precast Concrete Barrier for Temporary Traffic Control" and "Anchored Single-Face Precast Concrete Barrier for Temporary Traffic Control" will be paid for at the contract unit price per linear foot as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, tools, materials, equipment, initial placement of the units in accordance with the Plans, anchoring, furnishing, hauling, handling, any new parts required to secure the units to the bridge deck or to adjacent units, subsequent removal of said units, grouting and for all other incidentals required to finish the work, complete and accepted by the Engineer.

The Contractor shall not be compensated for any work necessary to realign barrier units if they are disturbed or damaged as a result of the Contractor's operations.

The Contractor shall be paid 90 percent of the contract unit price when the barrier units are in place. The remaining 10 percent of the contract unit price will be paid when the barrier units have been removed from the project.

926.05.3 Delineators. The accepted quantity of "Reflective Delineators" for anchored and unanchored barrier units will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials and equipment, including surface preparation and adhesives, and all other incidentals required to finish the work, complete and accepted by the Engineer.

Delete **Section 927, Remove and Relocate Precast Concrete Median Barrier for Temporary Traffic Control**, page 9-49 of the RI Standard Specifications for Road and Bridge Construction in its entirety.

SECTION 927

**REMOVE AND RELOCATE PRECAST CONCRETE MEDIAN
BARRIER FOR TEMPORARY TRAFFIC CONTROL**

[SECTION DELETED]

Revise **SECTION 929, Field Offices and Materials Laboratory**, pages 9-52 through 9-58 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 929

FIELD OFFICES AND MATERIALS LABORATORY

- **Replace Subsection 929.01; DESCRIPTION with the following.**

929.01 DESCRIPTION. This work consists of providing and maintaining an adequate weatherproof and ADA compliant field office or materials laboratory for the exclusive use of the Engineer and his staff during both the contract period and approximately 180 days thereafter, all in accordance with these Specifications.

- **Replace Subsection 929.02.2; Minimum Spatial Requirements with the following.**

929.02.2 Minimum Spatial Requirements. Unless specified otherwise in the Special Provisions of the Contract, the Engineer's field office or materials laboratory each shall contain a minimum of 550 square feet of floor area, at least 3 rooms, and 7 feet minimum of headroom. It shall contain a sufficient number of windows to provide at least 27 square feet of natural light.

Existing building structures meeting the above minimum requirements are considered acceptable.

- **Replace Subsection 929.02.3b; Other Requirements with the following.**

b. The Engineer's field office or materials laboratory shall be fully equipped, operational and ready for occupancy at least two (2) weeks prior to the start of actual construction operations.

- **Add the following new Subsection 929.02.4; ADA Considerations.**

929.02.4 ADA Considerations. The Department is committed to providing equal access and opportunity for all persons in conjunction with Federal Law under Title I of the American's with Disabilities Act (ADA).

The United States Access Board defines a reasonable accommodation as; "a modification or adjustment to a job, an employment practice, or the work environment that makes it possible for a qualified individual with a disability to enjoy an equal employment opportunity."

In keeping with these directives, the Department will ensure that construction field offices will be accessible to anyone with a disability, and will also ensure that reasonable accommodation in a manner consistent with the ADA will be made to allow Department employees to be productive and efficient members of the Department's workforce.

Personnel may contact the Department's Human Resources Office with any reasonable accommodation requests.

- **Replace Subsection 929.03.2; Interior Utility Services with the following.**

929.03.2 Interior Utility Services.

a. Lighting. Lighting fixtures required to provide a minimum illumination of 70 foot-candles in all areas.

b. Electrical receptacles. Duplex electrical receptacles shall be provided as required in the State Building Code and as directed by the Engineer. At least $\frac{1}{3}$ of these receptacles shall be 20-amp capacity.

c. Heating and Air Conditioning. Heating and cooling equipment capable of maintaining a year round temperature between 68°F and 78°F shall be provided.

d. Sanitary Facilities. A water closet, lavatory, slop sink, vent fan, and a hot water heater of a minimum 5-gallon capacity shall be provided.

e. Telephone. Telephone service and instruments for two (2) incoming phone lines shall be provided.

The Contractor shall also provide and install 4 additional phone jacks, required wiring, and phones to be located throughout the field office at the locations specified by the Engineer.

f. Network Internet Service. The Contractor shall provide and install a secure high speed internet service capable of interconnecting and networking a combination of 8 computers, printers, copiers, and scanners, compatible with the equipment specified in **Special Provision 929.1000**.

- **Replace Subsection 929.03.6(c); Concrete Curing Box with the following.**

929.03.6 Special Requirements for Materials Laboratory.

c. Concrete Curing Box. A concrete cylinder curing box shall be provided and shall conform to the following minimum requirements: approximate internal dimensions of 54 inches in length; 18 inches in width; and 17 inches in depth. The box shall be insulated, hinged at the back and with a lock at the front. The box shall be made of a durable, rust proof material with a moisture-proof seal between the lid and the box. The box shall be leak-proof and be able to hold a pool of water at the bottom of the container approximately 4 inches deep. A drainpipe shall be provided through the side of the box for maintenance purposes. Suitable means of support shall be provided to hold the concrete cylinders above the water surface. A thermometer which can be read from the outside shall be installed to measure the internal temperature of the box. A thermostat shall maintain the water at a uniform temperature of 73°F \pm 3°F using heating or cooling cycles throughout an ambient temperature range of -10°F to 100°F.

1. Equal Characteristics. A concrete curing box of a design and manufacture different from that described above, but which possesses equal characteristics may be employed provided that it is approved in writing by the Engineer.

- **Replace Subsection 929.03.8; Project Sign with the following.**

929.03.8 Project Sign. Both the field office and the materials laboratory shall be equipped with a sign for the purpose of identifying the use of the structure and providing notice against trespassing. The Field Office Identification Sign is detailed in the RI Standard Details.

929.1000**FIELD OFFICES AND MATERIALS LABORATORY**

DESCRIPTION. The items of computer equipment and software to be provided for this Contract in accordance with **Para. c. of Subsection 929.03.5, Special Requirements for Field Office**, page 9-55 of the RI Standard Specifications for Road and Bridge Construction (Amended August 2013), consist of the following

1. One (1) InkJet color printer capable of printing standard and custom paper sizes from 3 by 5 inches to 11 by 17 inches. Print quality shall be 1200 by 1200 dpi minimum resolution for black and white printing and 4800 X 1200 optimized dpi for color printing. It shall be capable of printing up to 20 ppm (black and white) and up to 15 ppm (color).
2. One (1) laser printer capable of printing standard and custom paper sizes from 3 by 5 inches to 11 by 17 inches. Print quality shall be 1200 by 1200 dpi minimum resolution and have a minimum of 64 MB RAM.
3. Two (2) new PC laptop computers with an i3-2.1GHz processor (minimum); 250 GB (5400 rpm) hard drive (minimum); 15" LCD screen (minimum); 4 GB of RAM (minimum); 10/100 network interface card; CD-RW/DVD drive; wireless network card, broadband internet access (3Mbps nominal connection speed) and Internet Service Provider, 9 cell primary battery, two AC/DC power adaptors, extra 9 cell battery, and carrying bag. Installed software shall include: Microsoft Windows 7 (32 or 64 bit) with the latest service packs and security updates, Microsoft Office Professional 2010 (2010 version) with latest service packs, Adobe Acrobat Professional 9.0 (or better), AutoCAD 2012 (or better), and Symantec Endpoint Protection 12.1 with subscription support for the life of the project. All installation CDs, licenses, registration codes and user manuals/documentation shall be provided to the Engineer.
4. Two (2) Docking Stations with a minimum of the following: 1 Ethernet RJ-45 port, 4 USB 2.0 ports, VGA, display port, DVI-D, two (2) 101 key enhanced keyboards, two (2) optical mouse with scroll wheel, and two (2) 21" Wide Screen Flat Panel LCD screens (minimum).
5. One (1) 500 GB External Hard Drive.
6. One (1) approved facsimile machine meeting the following minimum standards: desktop transceiver; automatic fax/tel switch with only one phone line needed; 10 page document feeder; 9600 bps modem speed with automatic fallback; answering machine interface; 20 location capacity; one-touch dial with 16 locations; PSTN line connection; monitor speaker; 16 character LCD size; local copy function; status/error indicators; transmit and receive confirmation reports; no more than 15 pounds in weight; 120V-60 HZ power requirement; built-in handset; image control resolution of 200 x 100 ipi at standard, 200 x 200 ipi at fine, and 200 x 400 ipi at super-fine; 16 level gray scale; automatic redial 2 times at 3 minute intervals and 128 KB memory capacity. The Contractor shall provide a separate phone line for the facsimile machine.
7. One (1) desktop copying machine with an automatic document feeder, or a compatible machine approved by the Engineer.
8. Two (2) 10.0 megapixel digital cameras with wide-angle 5X internal optical zoom and 2.5 inch

Compilation of Approved Specifications

Date: 04/22/2016

LCD screen. The camera shall be dustproof, waterproof to 13 feet (4 meters), and coldproof to 14°F.

9. The computer equipment and software, cameras and hard drive shall become property of the State after the Contract Completion.
10. Dust shields and a security cabinet capable of physically containing all hardware, software, and accessories.
11. Surge Protectors for all the above equipment.
12. The Contractor shall provide maintenance and supplies for the life of the project. Supplies for both new and existing field office equipment shall include but, are not limited to, 3.5" DSDD floppy disks, CD-R disks with jewel cases, DVD-R disks with jewel cases, CD storage case, toner, inks, all paper, etc. All supplies shall be provided with the original installation of the computer equipment and as required, as soon as possible after notification by the Resident Engineer.
13. On delivery of computer equipment to a field office, the Resident Engineer must contact the **(DoIT)** Service Desk Service@DoIT.ri.gov to arrange for State Inventory. The resident engineer must provide the detail spec. of the computer equipment, location of the field site and the completion date of the project. The Resident Engineer must also contact the service desk Service@DoIT.ri.gov at the end of the project to pull the computer equipment into DOT State inventory or if the computer equipment needs to move from one location to another.

Remove **Section 930, Plant Field Laboratory**, pages 9-58 through 9-62 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 930

PLANT FIELD LABORATORY

930.01 DESCRIPTION. This work consists of furnishing a building at the site of the production plant suitable for the housing and use of equipment required to carry out the various tests and for the recording and processing of the results of said tests, all in accordance with these Specifications.

The building shall be for the exclusive use of the Engineer or his representatives during all production for the purpose of testing and recording the results of said testing.

930.02 GENERAL PLANT FIELD LABORATORY REQUIREMENTS.

930.02.1 Location. The laboratory shall be located within its own building, or if the Engineer permits, it may be part of an existing building. In this case, the laboratory portions of the building shall be entirely partitioned off from the remaining unrelated areas and must meet all other laboratory requirements. The use of a trailer, utility control room such as electric, telephone, water, sewage, etc., as a Department designated laboratory and/or office is not permitted. The laboratory shall be within sight distance of the plant and sampling rack (bituminous only) and an unobstructed line-of-sight shall be maintained at all times.

930.02.2 Construction. The laboratory building shall be a room at least 200 square feet with ceiling height at least 7½-feet. The floor shall be sturdy and level (note that some equipment requires mounting to a concrete foundation). The building shall be watertight. There shall be at least two standard windows equipped with shades and screens and two doors equipped with adequate locks. At least one door and window shall open to the outside external environment when the laboratory is located on an external wall.

930.02.3 Other Requirements.

a. In case of theft or breakdown, all equipment involved shall be repaired or replaced by the Contractor within 48 hours. Production of any material shall be discontinued until the equipment is repaired or replaced. In the event buildings are destroyed or rendered untenable for any reason they shall be replaced within two weeks. In the interim, the Contractor shall provide temporary facilities for laboratory operations.

b. The Contractor shall furnish all water, fuel, and electrical power required to conduct the various tests. Additional laboratory equipment not listed herein may be required to properly facilitate an AASHTO or ASTM test procedure (i.e. water bath thermometers, water bath heater / circulator, timers / stopwatches, etc.) and are considered incidental to this item.

c. When both bituminous and cement concrete mixing plants are located in the same compound and when the Contractor provides one laboratory building for both bituminous and cement concrete testing facilities, duplication of laboratory equipment will not be required with the exception of the chairs, calculator and the computer equipment specified in **Subsection 930.03.4**.

930.02.4 ADA Considerations. The Rhode Island Department of Transportation (RIDOT) is committed to providing equal access and opportunity for all persons in conjunction with Federal Law under Title I of the American's with Disabilities Act (ADA).

The United States Access Board defines a reasonable accommodation as; "a modification or adjustment to a job, an employment practice, or the work environment that makes it possible for a qualified individual with a disability to enjoy an equal employment opportunity."

In keeping with these directives, those private entities that provide field material laboratories utilized by RIDOT staff, especially those with a disability, must ensure that said facilities provide reasonable accommodation to allow Department employees to be efficient and productive in their work. Reasonable accommodations shall be provided in a manner consistent with the ADA.

Private entities that provide such facilities must demonstrate to the Department in advance that reasonable accommodations consistent with ADA have been made available.

Department employees should contact RIDOT Human Resources with any reasonable accommodation requests.

930.03 SPECIFIC PLANT FIELD LABORATORY REQUIREMENTS.

930.03.1 Interior Utilities.

a. Power. The electrical power supply shall be adequate to simultaneously operate all laboratory and office equipment, heating and air conditioning units, lighting and all other utilities.

b. Heating and Air Conditioning. The heating and cooling systems shall be capable of maintaining the laboratory at a year round temperature between 68°F and 78°F, with controls in the laboratory.

c. Sanitary Facilities. Restroom facilities shall include a toilet, lavatory sink, slop sink, vent fan and running hot and cold water, with a minimum 5-gallon capacity water heater tank. The restroom shall be fully equipped and located within the laboratory or existing building and shall be accessible at all times during production.

d. Lighting. Adequate and satisfactory lighting inside the laboratory (10 foot-candles minimum per OSHA Standard 1926.56) shall be provided.

e. Telephone. One handset with an answering machine shall be provided.

930.03.2 Outside Facilities.

a. Parking Area. A parking area (adequate for two vehicles) adjacent to the building shall be provided, such that safe and easy access to the laboratory building is ensured. Parking areas shall be paved or well-compacted crushed gravel with maintained surface characteristics.

b. Lighting. Adequate outside lighting (5 foot-candles minimum per OSHA Standard 1926.56) for bins, stockpiles, sampling racks, laboratory access and parking area shall be provided for all night and early morning work.

c. Security. The laboratory building shall have locking doors and windows.

d. Equipment. Bins for coarse and fine aggregates shall be safe and accessible for sampling.

930.03.3 Furnishings, Equipment and Supplies – new or used in a condition acceptable to the Engineer (minimum quantities shown).

a. One office desk, 30 inches high with minimum 32 inches by 60 inches top dimensions. The desk shall have two or more drawers on each side.

b. One work table or bench.

c. Two swivel desk chairs.

d. One fireproof filing cabinet with lock.

e. A cabinet or closet with lock.

f. One wastebasket.

g. A cooling fan.

h. A hood with an exhaust fan or dust eater for ventilation near the scales.

i. A copy machine with paper and toner.

j. A minimum 4.0 cubic foot refrigerator.

k. A Microwave oven.

l. One water cooler and fresh drinking water or a supply of bottled drinking water (to be restocked as necessary).

m. Clock.

n. Calculator.

o. Electric pencil sharpener.

p. One First-Aid kit, fully stocked.

q. One fire extinguisher.

- r. Cleaning Supplies for lab and lavatory, to be restocked as necessary.
- s. Shop vacuum.
- t. Toilet paper holders, paper towel dispensers, and soap dispensers in the lavatory.
- u. Rugs with non-slip backing for all doors (2' by 3' minimum size or interior door mats).

930.03.4 Computer Equipment. The items of computer equipment and software to be furnished, installed, tested, made operational, and maintained within the Plant Field Laboratory are set forth in **Special Provision Code 930.1000**. If a plant is producing both asphalt and concrete, two complete sets of computer equipment will be required.

930.03.5 Maintenance and Custodial Service. The Contractor shall provide the following maintenance and custodial services:

a. Maintenance. The Contractor shall properly maintain equipment and keep in working condition for all production. The Contractor shall replace supplies as needed to maintain the office, office equipment, and lavatory.

b. Custodial Services.

1. Weekly trash removal.
2. Weekly restroom cleaning.
3. Bi-weekly floor cleaning.
4. Bi-monthly window cleaning.

Although the laboratory is for the exclusive use of the State during all production, other Quality Control testing may be performed at the facility on a temporary or intermittent basis. The laboratory and equipment shall remain clean and functional if such testing occurs prior to commencing production for the State.

930.03.6 Special Plant Field Laboratory Requirements for Bituminous Concrete Mixing Plants.

In addition to the requirements of **Subsections 930.02** and **930.03.1 through 930.03.5** above, the Contractor shall provide the following at the bituminous mixing plant:

a. Access. Access to the laboratory must be provided at least one hour before production begins.

b. Equipment and Supplies. (minimum quantities shown)

1. One automatic Marshall bituminous compactor complete with hammer assembly; 4-inch, 10-pound drop hammer and counter, with automatic shutoff.
2. Four Marshall bituminous compaction molds complete with mold body, base plate and collar (4-inch inside diameter).

3. One Superpave Gyrotory Compactor conforming to AASHTO T 312, complete with two molds and capable of recording and printing height measurements.
4. One Material Handling Chute to properly charge gyrotory molds.
5. One assembly to perform theoretical maximum specific gravity tests in accordance to AASHTO T 209. A metal pycnometer, mechanical agitator and electronic digital vacuum gauge shall be provided.
6. One sample splitter ½-inch chute with width - 16 chutes.
7. One sample splitter 2½-inch chute width - 8 chutes.
8. One asphalt ignition oven capable of automatically determining the corrected asphalt content of a 3,000 gram sample. The oven shall have an integral weighing system and printer capable of providing a hard copy of test results. A suitable work area and adequate ventilation for the oven's exhaust shall be provided. Two pair of high-temperature resistant heavy-duty gloves, two sample trays and a face shield shall be provided and shall meet OSHA requirements as applicable. The internal scale shall conform to **Subsection 930.03.4** of these Specifications. The Contractor shall perform all maintenance of the oven at intervals recommended by the manufacturer.
9. One motor-driven 12-inch sieve shaker, complete with belt driven mechanism to produce combination rocking and tapping action on each sieve, capacity for 6 full-height 12-inch sieves plus pan and cover; all parts mounted on a sturdy base (commonly known as a Mary Ann type shaker).
10. One gravity drying oven of rugged construction with 3/8-inch thick insulated walls, minimum inside dimensions to be 18 inches wide, 14 inches deep and 19 inches high, equipped with two expanded metal shelves, automatic thermostat and other controls, a glass thermometer reading 0^o to 300^oC by 1^o divisions.
11. One set of US Standard 12-inch round intermediate height testing sieves. Sizes shall include 1", 3/4", ½", 3/8", Nos. 4, 8, 16, 30, 50, 100, and two-200s with No. 14 mesh backing, with square openings, two pans and one cover.
12. One 12-inch round No. 200 wet wash sieve with 4" minimum depth.
13. One large utility sink complete with spray hose to perform wet washes in accordance with AASHTO T 30. This sink must be separate from the restroom facilities.
14. Six drying pans approximately 10" x 14" x 2½" for use in the oven.
15. One digital scale - 8,000 grams plus/minus 0.1 grams.
16. Two brass wire briquette brushes.
17. Two sieve or sash brushes.

18. Two approved dial type thermometers - 50^oF to 500^oF.
19. One approved two-burner electric hot plate, UL approved.
20. Two metal mixing bowls, 14 inches or greater diameter.
21. Sample splitting tool.
22. Two putty knives.
23. Five metal sampling buckets.
24. Dust masks.
25. Two pairs of suede work gloves.
26. Four (4) approximately 20 inch x 40 inch towels.
27. An approved cleaning solvent for the equipment must be provided.
28. Two pairs of safety goggles and two pairs of gloves for high heat applications.
29. One Marshall core specific gravity apparatus. To include: 30 gallon tank, overflow and drain valves, stainless steel core hanger, water heater and thermometer (0^oF to +160^oF) accurate to 0.1^oF
30. One Density tank for Marshall core specific gravity.
31. Two sampling spoons.
32. Two spatulas.
33. One long handle spade shovel.
34. A sampling rack with minimum dimensions 4 feet x 4 feet located within sight distance of the plant laboratory to allow sampling of bituminous material from truck haulers.

930.03.7 Special Plant Field Laboratory Requirements for Cement Concrete Mixing Plants. In addition to the requirements above, the Contractor shall provide the following at the concrete mixing plant:

a. Access. Access to the laboratory must be provided at least two hours before production begins.

b. Equipment and Supplies. (minimum quantities shown):

1. One digital platform beam scale, capacity 45 kilograms (100 pounds), sensitivity 5 grams (0.01 pounds).

2. One approved two-burner electric hot plate, UL approved.
3. One gravity drying oven of rugged construction with 3/8-inch thick insulated walls, minimum inside dimensions to be 18 inches wide, 14 inches deep and 19 inches high, equipped with two expanded metal shelves, automatic thermostat and other controls, a glass thermometer reading 0^o to 300^o C. by 1^o divisions.
4. One sieve shaker (samples less than 1 cubic foot) with built in timer or equivalent, consisting of eight changeable screens secured by a hydraulic clamping system; screens to be within US Standard tolerances and have openings as follows: 1", 3/4", 1/2", 3/8", No. 4, No. 8, No. 16, and pan. The unit shall be secured on a one foot concrete pad, enclosed and cover and adequate ventilation shall be provided.
5. One motor-driven portable sieve shaker for operation on 110-volt, 60-cycle single phase current, complete with belt driven mechanism to produce combination rocking and tapping action, capacity for 6 full-height sieves plus pan and cover; all parts mounted on a sturdy base.
6. One set of brass-frame United States Standard testing sieves, all to be full height, 8 inches in diameter and matched for nesting; one each of the following: 3/4", 1/2", 3/8", Nos. 4, 8, 16, 30, 50, two No. 100, and one No. 200 with No. 14 mesh backing, two pans and one cover.
7. Two fine, 2-inch sieve or sash brushes and two brass wire briquette brushes.
8. One set of 8 steel pans for drying soils, approximately 10" x 14" x 2 1/4".
9. One complete air meter test outfit, 1/4 cubic foot, (Ref. AASHTO T152 and ASTM C231).
10. One complete slump test outfit (Ref. AASHTO T23 and T119), to include a steel pan with reinforced rims 24" x 24" x 3".
11. One sample splitter 1/2-inch chute width - 16 chutes.
12. One sample splitter 2 1/2-inch chute width - 8 chutes.
13. One digital scale - 2,000 grams plus/minus 0.1 gram.
14. One small concrete scoop (#1).
15. Two dial thermometers (0^oF to +160^oF).
16. Four plastic buckets, approximately 2.5-gallon capacity.
17. One long handle spade shovel.
18. One steel brush, long handle.
19. Two putty knives.

20. Two pairs of suede work gloves.
21. One square steel trowel (6-inch length center handle).
22. One plastic storage tote (10-gallon capacity, 24" x 16" x 8.75" minimum) or acceptable equivalent.
23. One large concrete scoop (#2).
24. One square shovel.
25. Table or bench to run air test and fabricate cylinders.

Should the Contractor fail to provide any of the supplies or equipment described above, the Engineer may not accept any mixes or products dispatched from subject site.

930.03.8 Scales. All laboratory scales for bituminous and cement concrete mixing plant testing equipment must be calibrated every six months and must conform to the requirements of applicable Specifications.

930.04 METHOD OF MEASUREMENT. Not applicable.

930.05 BASIS OF PAYMENT. Provision of "Plant Field Laboratory" will not be paid for separately, but shall be considered a subsidiary obligation of the Contractor, with the costs thereof distributed among the contract unit prices for other items of work.

CODE 930.1000

PLANT FIELD LABORATORY

DESCRIPTION. The items of computer equipment and software to be provided for in this Contract in accordance with **Subsection 930.03.3, Computer Equipment**, of the RI Standard Specifications for Road and Bridge Construction (Amended August 2013), shall meet the following minimum specifications.

One Windows compatible computer with a 2.66 GHz Core 2 Duo or equivalent; 1066 MHz system bus; 3 MB L2 Cache; 2 GB RAM; 500 GB hard drive; 256 MB graphics adapter; 10/100 Ethernet Network Interface Port; DVD +/-RW; 101 key enhanced keyboard; optical mouse; four USB 2.0 ports (the computer case shall have front and rear USB ports); 19" LCD monitor with 1000:1 contrast ratio; broadband Internet access (3 Mbps nominal connection speed); 450 VA backup power supply with surge protector; USB color laser or inkjet printer (20 ppm in black mode); all cables and cartridges for printer; paper; permanent computer dust shield; permanent keyboard dust shield; blank CD-R's with jewel cases; most recent Professional version of Microsoft Windows; Microsoft Access (latest version); McAfee Total Protection (latest version) with subscription support.

Remove **Section 934, Field Control and Construction Layout**, pages 9-66 through 9-68 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 934

FIELD CONTROL AND CONSTRUCTION LAYOUT

934.01 DESCRIPTION. This work consists of establishing, on the ground, all required Field Control and Construction Layout. Project Field Control and Layout is defined as accurately providing all necessary computations, stakes and marks required to establish lines, slopes, elevations, points, and continuous profile grades in order to perform all the required work for the project in accordance with the Contract requirements. Field Control and Layout is required to enable the Engineer to complete all necessary inspection, checks, verification of quantities and Contract Administration duties. The staking shall include, but not be limited to, clearing and grubbing, grading, drainage, culverts, embankments, borrow, aggregate base course, pavements, bridges, utilities, signs, pavement markings, erosion control, and turf establishment items to complete the project as represented in the plans. The Surveying must be done in a way that is timely, and that is reflective of the continuing and ongoing nature of construction and inspection activities which will generally require frequent, separate project visits by the Contractor's survey crew, to the project to accommodate the various stages of construction and inspection activities that will occur. Field Control shall also include all survey required to accurately generate standard cross sections, measure quantities, layout for utility companies, and generate as-built drawings.

934.02 MATERIALS. All survey wedges and survey stakes shall be of seasoned oak and free of knots. Survey wedges used for control staking shall be 1- $\frac{3}{4}$ " x 1- $\frac{3}{4}$ " and 18-inches in length. For slope limits, pavement edges, gutter lines, etc., the use of survey stakes shall be acceptable and shall be 1" x 1" and 4'-0" in length.

934.03 CONSTRUCTION LAYOUT

934.03.1 General Responsibilities. It is the responsibility of the Contractor to establish field control and to lay out the work which is proposed within the Contract. The Engineer will furnish the Contractor with basic field control and survey data for all projects except for resurfacing projects, as basic field control is not necessary to perform the work on these projects.

934.03.02 Department's Responsibility. The Engineer will furnish the Contractor with basic field control and survey data for all projects, except resurfacing projects, upon Contract Award. This shall include confirming and re-establishing control, in the field. The basic field control will include control points, benchmarks, survey data files, survey plan sheets, and other data, which may be required for the Contractor to perform construction staking, layout, and maintenance of the basic field control.

Survey work may be monitored by the Engineer for conformance to standard survey practices. The Engineer shall be notified, by the Contractor, 24 hours prior to any survey work being performed in the field. The Engineer/Surveyor may check the control of the work, as established by the Contractor, at any time as the work progresses.

At the discretion of the Engineer, spot checks may be performed upon the Contractor's surveying calculations, records, field procedures, or actual staking. If the Engineer determines that the work is not being performed in a manner that will assure proper controls and accuracy, the Engineer will direct the Contractor to redo such work to the standards specified in the contract at no additional cost to the State. Also, should the Department sustain costs checking and/or correcting Contractor survey and resultant product caused by Contractor survey errors and/or omissions, the Engineer will deduct those related actual costs incurred by the Department from any payments owed the Contractor.

934.03.3 Contractor's Responsibilities. The Contractor shall be responsible, at a minimum, for the following:

a. Pre-Construction Surveys shall be submitted to the Department five (5) working days prior to the commencement of any clearing and grubbing, or earthwork. These surveys shall accurately record the existing conditions of areas where work is proposed. Pre-Construction Surveys shall be submitted to the Engineer electronically in both CADD and survey data files.

Pre-construction surveys shall accurately record the existing conditions, as identified in the Contract Documents, and areas where work (disturbance) is proposed. This shall include original grades; curb line and grades, sanitary and drainage structures and inverts; easements; visible utility locations; etc.

The Contractor shall notify the Engineer, in writing, of any discrepancies between the Design Plans and their pre-construction survey. The Contractor shall not disturb the areas in question, until the Engineer responds to the Contractor's notification. The Engineer will respond to Contractor within five (5) working days. Furthermore, should the Contractor fail to comply with these requirements, all time, rework and delay costs associated with survey inaccuracies shall be borne solely by the Contractor; no additional payment will be allowed.

b. Construction stakes shall be set for all project construction, and shall be installed as reference points, as needed, for the use of any public utility crews that are staking or accomplishing utility relocations, or construction associated with this contract. References to staking, additional or replacement thereof, which may be required for the construction operations shall be furnished, set and properly referenced by the Contractor. Construction stakes shall be clearly labeled by referencing station, offset, and purpose. The intent of the labeling is so both the Contractor and Engineer may accurately interpret the field control. In particular, the Department's personnel need to be able to orientate themselves in the field based on the staking to confirm construction operations are in conformance with design plans and specifications.

c. Re-staking shall be performed, as needed, due to progressive change in operation including, but not limited to:

1. Identification of Limits
2. Staking for Excavation
3. Staking for Grading
4. Staking for new Drainage and Utilities including center of proposed structures and elevation.
5. Staking for curbing and final pavement

6. Staking of easements

d. Structures and Bridges construction staking which includes setting and reestablishing Working Points and Reference Points by XYZ coordinates to provide line and grade during all stages of work, and at all substructures and segments of Bridge or Structure Construction, as shown below:

1. Establish Working Points or Reference Points, approved by the Engineer, on the ground as shown on the Bridge Layout sheet in the Plans.

2. Transfer of required points from the ground to the top of footing after the completion of concrete footing construction. If the structure is a curved wall or bridge edge of slab, curb, coping, median, or railing, the Contractor's Surveyor shall mark a curved line on the footings, forms, or deck slab, to the proper degree of curvature within 1/8" in ten (10) feet, as needed for construction and inspection activities.

3. Transfer required points to the top of all finished structures.

4. Transfer required points to the superstructure deck forming.

5. Measurements and marks for plumbness are also required.

e. Establish and Protect adequate ties to all control points such that they can be conveniently re-established if disturbed or destroyed. This includes the preservation of all reference points, monuments, horizontal and vertical control points, stakes, and marks that are established by the Department or their representatives, within the project limits. If the Contractor or its surveyor fails to preserve these items and if they must be reestablished it will be the responsibility of the Contractor to do so at no additional cost to the State.

f. A Rhode Island Registered Land Surveyor (RLS) shall be retained by the Contractor to be responsible for all survey work; which shall be performed in accordance with the Department's procedures and the procedures established by the "Procedural and Technical Standards for the Practice of Land Surveying in the State of Rhode Island and Providence Plantations" prepared by the Rhode Island Society of Professional Land Surveyors and adopted by the Rhode Island Board of Registration for Professional Land Surveyors. The Contractor shall submit to the Engineer for approval the RLS who will be responsible for the survey work on the project. The Engineer will review the qualifications of the RLS and respond, in writing, to the Contractor within five days as to the acceptance of the candidate. The Contractor must notify the Engineer prior to any changes to the RLS in charge. While all work must be overseen by an RLS, the survey Party Chief shall also be an RLS.

Any surveying or measurements necessary for the computing of pay quantities shall be performed by the Contractor's RLS in the field. The Contractor shall notify the Engineer at least five (5) working days prior to disturbing any areas where survey will be used to calculate pay quantities. Additionally, the Contractor shall afford the Department five (5) working days for verification, upon receipt, of cross sections stamped by the RLS. Where the Department deems it necessary and appropriate to check the Contractor's quantity-related field survey data, the Contractor shall not perform any operations during the five (5) day period that may render Department's efforts to check the Contractor's survey ineffective.

The final monumentation of the project must be supervised by the Contractor's RLS.

g. Field Records shall be maintained by the Contractor in Department approved field books. Copies of field book pages, survey documentation and calculations shall be submitted to the Engineer, in a form acceptable to the Department, on a daily basis. Upon completion of the construction work, original field books and records shall be submitted to the Department. The copies shall be submitted in both hard copy and electronic files (Adobe PDF format, latest edition on approved DVD media).

The survey documentation shall include:

1. Control station monumentation with reference ties.

2. Field notes that were used to set construction stakes, control the Project, and document monument locations. The Contractor shall use bound, hard cover field books for recording survey data and field notes, and/or store field notes on an electronic medium. If an electronic medium is used, the raw field data files must be made available, and the Contractor shall make all files and data available in the Standard formats used by the Department.

h. As-Built surveys shall be performed and drawings submitted to the Engineer to document all changes to the proposed Contract work. The Contractor shall provide the Engineer with the as-built data in both hard copy reproducible material and electronic files. This data shall be provided to the Engineer as changes/additions occur. The Engineer may request verification of any and all survey data. The Contractor shall be responsible for submitting this data within five (5) working days of the request. The as-built data shall include the following:

1. Construction changes/additions in alignment, profiles, typical sections, structures, drainage, tapers, roadway widths, utilities, and curb types pertaining to location and elevation, on the copy of the appropriate construction Plans.

2. Revised coordinates for any of the above items.

3. Revisions in centerline station and offset.

4. Pile cut-off elevations.

5. Bearing elevations.

i. Miscellaneous.

1. The Engineer's acceptance of all or any part of the Contractor's layouts shall not relieve the Contractor of responsibility to secure proper dimensions for the completed work.

2. The Contractor shall bear all costs, including but not limited to the cost of actual reconstruction of contract work, that may be incurred due to errors in the Contractor's field control and construction layout.

3. No claims for extensions of time or additional costs associated with delays as the result of this work will be allowed.

When required, the Engineer will, in writing, direct the Contractor to make the necessary minor surveying and staking adjustments to suit actual field conditions. In addition, some Plan details may be

dependent upon actual field conditions at the time of construction. It may be necessary to perform some field survey and/or office computations in order to stake these components.

All level runs, traverses, or GPS control surveys, shall start and end from known control. Complete all control surveys in accordance with "Procedural and Technical Standards for the Practice of Land Surveying in the State of Rhode Island and Providence Plantations".

934.04 METHOD OF MEASUREMENT. The field control and construction layout work is deemed incidental to the contract and will not be measured for payment. The incidental survey and survey-related work shall include, but not be limited to, all on-site field work as well as on-site and off-site office work such as calculations, sketches, drawings, tabulations, correspondence, research and any other tasks required to complete the work to the satisfaction of the Engineer. Re-work, including re-staking, performed for any and all reasons, is deemed incidental and will not be measured for payment.

a. Measurement for Extra Work. Survey work performed outside the scope of the original contract at the direction of the Engineer will be deemed Extra Work, and will be documented and paid for on a Force Account basis as set forth in **Subsection 934.05**.

934.05 BASIS OF PAYMENT. The field control and construction layout work will not be paid for separately, but shall be included in the bid for the items of work to which the layout is incidental, including all labor, materials and equipment, transportation of crews, surveying supplies and all incidentals required to finish the work, complete and accepted by the Engineer.

a. Payment for Extra Work. When the Engineer determines that extra construction surveying beyond the scope of the original contract is required, such work will be paid for on a Force Account basis as set forth in **Subsection 109.04, Differing Site Conditions, Changes, Extra Work and Force Account Work**; Para. a(4) of these Specifications.

Remove **Section 935, Removing Bituminous Pavement by Cold Planing**; pages 9-69 and 9-70 of the RI Standard Specifications for Road and Bridge Construction and replace it with the following:

SECTION 935

REMOVING BITUMINOUS PAVEMENT BY MICRO-MILLING

935.01 DESCRIPTION. This work consists of the removal of bituminous material using micro-milling to a depth specified on the Plans or as directed by the Engineer, all in accordance with these Specifications.

935.02 MATERIALS. Not applicable.

935.03 CONSTRUCTION METHODS.

935.03.1 Equipment. The milling equipment for removing the bituminous pavement shall be designed specifically for grinding asphalt surfaces to close tolerances and shall be operated at a rate that will avoid tearing and gouging of the pavement surface. The equipment shall be capable of accurately establishing profile grades and cross slopes, and shall have a positive means for preventing any dust resulting from the operation from escaping into the air. An averaging ski not less than 25 feet in length shall be utilized with the pavement removal equipment on all limited-access highways and on other types of highways when indicated in the Contract Documents.

The equipment furnished by the Contractor shall be in good repair and shall be maintained so as to produce a clean cut to the pavement at all times.

935.03.2 Control Strip. The Contractor shall grind a control strip at least 500 feet long with uniformly textured surface and cross section. The milled pavement surface shall have a transverse pattern 0.3 inches or less between the centers of each strike area. The macrotexture shall be 1/16 inches or less as measured using ASTM E965.

935.03.3 Pavement Grinding. Upon the approval of the Control Strip by the Engineer, all areas designated for micro-milling shall be ground using the identical procedures, settings and speed, and shall conform in all respects to the requirements for the control strip.

No asphalt cuttings shall remain on the project at the end of the workday. Asphalt cuttings shall be removed and legally disposed of by the Contractor.

Care shall be exercised in cold planing adjacent to roadway joints, roadway appurtenances and face of curbing.

935.04 Method of Measurement. “Removing Bituminous Pavement by Micro-Milling” will be measured by the number of square yards of said pavement actually removed in accordance with the Plans and/or as directed by the Engineer.

935.05 Basis of Payment – The accepted quantity of “Removing Bituminous Pavement by Micro-Milling” will be paid for at the contract unit price per square yard as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, equipment, disposal and all other incidentals required to finish the work, complete and accepted by the Engineer.

Remove **Section 936, Mobilization**, pages 9-70 and 9-71 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 936

MOBILIZATION AND DEMOBILIZATION

936.01 DESCRIPTION.

936.01.1 Mobilization consists of those efforts necessary for the movement of the Contractor's personnel and equipment to the project site, the establishment of all the Contractor's field offices, buildings and other facilities required for the performance of the Contract, and all other incurred costs for work or operations required to be performed prior to the actual commencement of work on the Proposal items in the Contract.

936.01.2 Demobilization consists of removal of all materials, equipment, temporary structures and all other facilities of a temporary nature from the project site at the conclusion of the project, and restoration of the project site, including those areas used for storage of equipment, materials or the placement of temporary facilities.

936.02 MATERIALS. Not applicable.

936.03 CONSTRUCTION METHODS. Not applicable.

936.04 METHOD OF MEASUREMENT. This work will be measured for payments as follows:

a. First Payment. The first payment of 40 percent of the lump sum price for Mobilization and Demobilization, or 4 percent of the total contract amount minus the bid amount for Mobilization and Demobilization, whichever is the lesser, will be made on the first progress payment, following notice to proceed and the complete, approved set up of the project field office.

b. Second Payment. The second payment of 20 percent of the lump sum price for Mobilization and Demobilization, or 2 percent of the total contract amount minus the bid amount for Mobilization and Demobilization, whichever is the lesser, will be made when the progress payment estimate of the amount earned, not including that amount earned for Mobilization and Demobilization, is 5 percent of the total contract amount minus the bid amount for Mobilization and Demobilization.

c. Third Payment. The third payment of 15 percent of the lump sum price for Mobilization and Demobilization, or 1.5 percent of the total contract amount minus the bid amount for Mobilization and Demobilization, whichever is the lesser, will be made when the progress payment estimate of the amount earned, not including that amount earned for Mobilization and Demobilization, is 10 percent of the total contract amount minus the bid amount for Mobilization and Demobilization.

d. Final Payment. Upon completion of all the work on the project, including the completion of all Punch List items in accordance with **Subsection 105.17(b) Para. 4** of these Specifications, and

Demobilization of the project site in accordance with **Subsection 936.01.2** above, payment of the remaining balance of the lump sum price for Mobilization and Demobilization will be paid.

936.05 BASIS OF PAYMENT. "Mobilization and Demobilization" will be paid for at the contract lump sum price as listed in the Proposal, in accordance with the provisions of **Subsection 936.04** above. The price so-stated constitutes full and complete compensation for all labor, materials, equipment and other incidentals required to establish the Contractor's facilities at the site and, at the conclusion of the contract, for the complete removal thereof.

No lump sum breakdown will be required for this item of work.

Revise **Section 937, Maintenance and Movement of Traffic Protective Devices**, pages 9-71 through 9-73 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION 937

MAINTENANCE AND MOVEMENT OF TRAFFIC PROTECTIVE DEVICES

• **Replace Subsection 937.01; Description with the following.**

937.01 DESCRIPTION. This work consists of removing (from original locations), maintaining, storing, covering and uncovering, relocating and re-erecting all temporary construction signs, sign mountings, portable barricades, traffic cones, delineators and other traffic warning devices when so-directed by the Engineer, for conformance with the Plans, or for compliance with the traffic-related work restrictions included in the Transportation Management Plan, all in accordance with this Specification. All such maintenance and movement work on these devices shall take place after their initial installation on the project and prior to their final removal from same.

• **Replace Subsection 937.05.1; Basis of Payment – Payment for Full Compliance with the following.**

937.05.1 Payment for Full Compliance. "Maintenance and Movement of Traffic Protective Devices" will be paid for at the contract lump sum price as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, and equipment, including removing the devices from their initial locations, handling, maintaining, transporting and relocating said devices to storage or to subsequent intermediate locations at which they are to be used for traffic control, and all other incidentals required to finish the work, complete and accepted by the Engineer.

Monthly progress payments under this item will be made at a rate determined by dividing the contract lump sum price by the number of months allocated for completion of the contract. Said number of months shall be equal to the difference between the contract completion date and the date of the Notice to Proceed.

At the discretion of the Engineer, payment for authorized contract time extensions will be made at either the calculated monthly rate as defined above or on a Force Account basis in accordance with **Subsection 109.04; Differing Site Conditions, Changes, Extra Work and Force Account Work**, of these Specifications.

If the contract is completed prior to the authorized completion date, the final monthly payment will consist of the remaining balance of the contract lump sum price.

No payment will be made for unauthorized contract time extensions.

• **Replace Subsection 937.05.2; Basis of Payment - Failure to Comply with the following.**

937.05.2 Failure to Comply.

a. Maintenance. If, in the judgment of the Engineer, the Contractor fails to adequately and safely maintain traffic control devices along any portion of the project, a charge will be assessed as follows:

For each day the Engineer determines that the Contractor has failed to comply with the provisions of this Section, the daily charge set forth in **Special Provision Code 937.1000** will be deducted from monies due the Contractor.

b. Movement. If the Contractor fails to remove and/or relocate traffic control devices for compliance with the traffic-related work restrictions included in the Transportation Management Plan or to otherwise meet changes in traffic conditions, construction operations, or other conditions affecting the safety and/or mobility of the traveling public, a charge(s) will be assessed as follows:

When the Engineer determines that the Contractor has failed to comply with the provisions of this Section, the appropriate charge(s) set forth in **Special Provision Code 937.1000** will be deducted from monies due the Contractor.

Remove **Subsection 938.03, Price Adjustment**, page 9-73 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace with the following.

938.03

PRICE ADJUSTMENT

938.03 PRICE ADJUSTMENT. Price adjustment will be determined by the difference between the Period Price and the Base Price. Price adjustments will be made at the end of each month during which a); work was accomplished on the project and b); prices varied.

Price adjustments for work performed after the contract completion date, as may be modified by approved time extension(s), will be the lesser amount calculated from the following two algorithms (a & b); whereas credit due the Department will be greater of the two calculations.

a. The price adjustment calculated using the actual monthly Period Prices in effect at the time of the construction.

b. The price adjustment calculated using the monthly Period Prices in effect during a period determined by setting the last day of relevant work to the contract completion date as may have been modified by approved time extensions.

Price adjustments due the contractor will be made in accordance with an approved Contract Addendum. Credit due the Department will be processed by deducting monies from progress payments or by other means if there are insufficient progress payments remaining.

Remove **Section 942, Detectable Warning Systems**, pages 9-78 and 9-79 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 942

DETECTABLE WARNING PANEL

942.01 DESCRIPTION. This work consists of providing and installing a panel with truncated domes in an arrayed pattern that is compliant with Americans with Disabilities Act (ADA) warning and directional systems for the visually impaired at locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

942.02 MATERIALS. The detectable warning panel shall be of dimension and color contrast within ADA standards and the discretion of the Engineer. The panels shall be gray cast iron conforming to AASHTO M105 and AASHTO M306. The panels shall have integrally cast domes and shall be manufactured with integral embedment lugs for the express installation into fresh unset Portland cement concrete.

942.03 CONSTRUCTION METHODS. Panels shall be set flush into fresh unset concrete at the required line and grade to match the running grade and cross slope of the ADA accessible ramp or blended transition that warranted the installed panel. The contractor shall ensure that the alignment of the panel will match line and grade of the ramp such that the panel is flush with the ramp, and there is no physical conflict with other castings, fittings, structures, foundations or appurtenance thereof.

942.04 METHOD OF MEASUREMENT. “Detectable Warning Panel” will be measured by the number of square feet of panel actually installed in accordance with the Plans and/or as directed by the Engineer.

942.05 BASIS OF PAYMENT. The accepted quantities of “Detectable Warning Panel” will be paid for at the contract unit price per square foot as listed in the Proposal. The price so-stated shall constitute full and complete compensation for all labor, materials, equipment, and other incidentals required to finish the work, complete and accepted by the Engineer.

CODE 943.0200

ON-THE-JOB TRAINING

(Job-Specific)

This On-the-Job Training Specification conforms to the requirements of 23 U.S.C. 140(a).

As part of the contractor's equal employment opportunity and affirmative action programs, training shall be provided as follows:

A. The contractor shall provide on-the-job training aimed at developing full journey worker status in the type of trade or job classification involved.

B. The number of training hours assigned to this contract per this specification will be xxx hours. The specific number of trainees shall be determined by the Contractor during the post qualification process.

C. In the event that a contractor subcontracts a portion of the contract work, he shall determine how many, if any, of the trainees are to be trained by the subcontractor, provided, however, that the contractor shall retain the primary responsibility for meeting the training requirements of this specification. The contractor shall also insure that this specification is made applicable to such subcontract. Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training.

D. The number of trainees shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journey workers in the various classifications within a reasonable area of recruitment. Prior to commencing construction, the contractor shall submit to RIDOT for approval the number of trainees to be trained in each selected classification and training program to be used. Furthermore, the contractor shall specify the starting time for training in each of the classifications. The contractor will be credited for each trainee employed by him on the contract work that is currently enrolled or becomes enrolled in an approved program, and will be reimbursed for such trainees as provided hereinafter.

GOOD FAITH EFFORTS

Training and upgrading of minorities and women toward journey worker status is a primary objective of this Specification. Accordingly, the contractor shall make every effort to enroll minority trainees and women (e.g., by conducting systematic and direct recruitment through public and private sources likely to yield minority and women trainees) to the extent that such persons are available within a reasonable area of recruitment. The contractor will be responsible for demonstrating the steps that he has taken in pursuance thereof, prior to a determination as to whether the contractor is in compliance with this Specification. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

No employee shall be employed as a trainee in any classification in which he has successfully completed a training course leading to journey worker status, or in which he/she has been employed as a

journey worker. The contractor may satisfy this requirement by including appropriate questions in the employee application, or by other suitable means. Regardless of the method used, the contractor's records shall document the findings in each case.

ACCEPTABLE TRAINING

The minimum length and type of training for each classification shall be as established in the training program selected by the contractor and approved by RIDOT and the Federal Highway Administration. RIDOT and the Federal Highway Administration will approve a program if it is reasonably calculated to meet the equal employment opportunity obligations of the contractor and to qualify the trainee(s) for journey worker status in the classification concerned by the end of the training period. Furthermore, apprenticeship programs registered with the U.S. Department of Labor, Bureau of Apprenticeship and Training, or with the Rhode Island apprenticeship agency recognized by the Bureau, and training programs approved but not necessarily sponsored by the U.S. Department of Labor, Manpower Administration, and Bureau of Apprenticeship are acceptable for the purposes of this specification.

Training will be considered acceptable provided it is being administered in a manner consistent with the equal employment obligations of Federal-aid highway construction contracts. Approval or acceptance of a training program shall be obtained from RIDOT prior to commencing work on the classification covered by the program. It is the intention of this specification that training is to be provided in the construction crafts rather than clerk-typists or secretarial-type positions. Training is permissible in lower level management positions such as office engineers, estimators, timekeepers, etc., where the training is oriented toward construction applications. Training in the laborer classification will be permitted provided that significant and meaningful training is provided and is approved by the division office of the FHWA. Some offsite training is permissible as long as the training is an integral part of an approved training program and does not comprise a significant part of the overall training.

REIMBURSEMENT

Except as otherwise noted below, the contractor will be reimbursed at a rate of \$6.00 per hour of training provided to each trainee in accordance with an approved training program. This reimbursement will be made even if the contractor receives additional training program funds from other sources, provided such other does not specifically prohibit the contractor from receiving other reimbursement.

Reimbursement for offsite training will not be made to the contractor. However credit for offsite training will be granted if the contractor; contributes to the cost of the training, provides the instruction to the trainee or pays the trainee's wages during the offsite training period, or the trainees are concurrently employed on another Federal-aid project.

No payment will be made to the contractor if either the failure to provide the required training, or the failure to hire the trainee as a journey worker, is caused by the contractor and evidences a lack of good faith on the part of the contractor in meeting the requirements of this Specification. It is normally expected that a trainee will begin training on the project as soon as feasible after start of work, utilizing the skill(s) involved, and remain on the project as long as training opportunities exist in the work classification or until the trainee has completed the training program. It is not required that all trainees be employed as such for the entire length of the contract. A contractor will have fulfilled his responsibilities under this Specification if he has provided acceptable training to the number of trainees specified. The

number trained shall be determined on the basis of the total number enrolled on the contract for a significant period.

Trainees will be paid the appropriate rates approved by the Departments of Labor or Transportation.

Trainees will be paid at least 60 percent of the appropriate minimum journeyman's rate specified in the contract for the first half of the training period, 75 percent for the third quarter of the training period, and 90 percent for the last quarter of the training period, unless apprentices or trainees in an approved existing program are enrolled as trainees on this project. In that case, the appropriate rates approved by the Departments of Labor or Transportation in connection with the existing program shall apply to all trainees being trained for the same classification covered by this Specification.

The contractor shall furnish the trainee a copy of the program he will follow in providing the training. The contractor shall provide each trainee with a certification showing the type and length of training satisfactorily completed.

The contractor will provide for the maintenance of records and furnish periodic reports documenting his performance under this Specification.

CONTRACTORS' PROCEDURES

Pre-award:

A. Before beginning any federal aid project, the Contractor must have his or her Affirmative Action Plan in place and on file with the Department of Administration/EEO Office.

B. Prior to any award, the Contractor must submit to the Office of Business and Community Resources' (OBCR) OJT Compliance Officer for review and approval, a specific plan that includes the following: the RIDOT OJT ANNUAL Training PLAN, which includes a listing of all current projects (FAP and Non-FAP), Trainee Registration Form and the OJT Acknowledgment and Statement of Intent.

C. The Contractor must either use a US or RI DOL approved program or an approved training program of a recognized labor organization or trades council.

Post-award:

A. Proposed On-the-Job trainees are to be listed on the Trainee Registration enrollment form for each trainee to be employed and submitted to OBCR's OJT Compliance Officer for approval. Trainees may not begin training until the Trainee Plan is approved by RIDOT.

B. The Contractor orients the training foreman, superintendent and the On-the-Job Training trainee(s) to their respective responsibilities in the program and provides copies of the training guidelines for the training job classification being used.

C. The Contractor shall provide a certified payroll weekly to the Resident Engineer. This payroll should distinguish clearly the trainee's training hours from regular hours worked for each On-the-Job trainee.

D. The Contractor will monitor and submit monthly reports (called Monthly Report) for all trainees in the program, for progress, any problems or training issues to the OJT Compliance Officer.

E. The Contractor must notify the Resident Engineer and the OJT Compliance Officer verbally within 5 working days of any trainee termination or trainee resignations. The Contractor must also submit termination forms/documentation to the Resident Engineer and the OJT Compliance Officer within 10 working days after the termination. Subsequent to any trainee's termination or resignation, the OJT Compliance Officer will make a good faith effort determination (regarding the contractor's best efforts to replace the trainee as to whether this training position needs to be filled.

F. Contractors who assign training position(s) to subcontractors must be sure the subcontractor has an approved On-The-Job Training Plan on file with the OBCR. The Prime Contractor shall retain the responsibility for full compliance with OJT training requirements of the project.

G. The contractor shall furnish the trainee a copy of the program he will follow in providing the training. The contractor shall provide each trainee with a certification showing the type and length of training satisfactorily completed.

H. The contractor will provide for the maintenance of record and furnish periodic reports documenting his performance under this Specification.

Add the following new **Section 944, Diesel Emissions Reduction Program** to the RI Standard Specifications for Road and Bridge Construction.

SECTION 944

DIESEL EMISSIONS REDUCTION PROGRAM

944.01 DESCRIPTION. The work under this item requires that the Contractor, subcontractor, and lower tier subcontractor(s) hired by such subcontractor, to comply with Chapter 31-47.3 of the Rhode Island General Laws entitled, "The Diesel Emissions Reduction Act". It is the Contractor's responsibility to both coordinate and ensure the compliance of all subcontractors and to retain an emissions technology installer to retrofit certain emissions devices on the equipment owned by the Contractor, sub-contractor and lower tier subcontractor(s) hired by such subcontractor. Equipment is defined as any heavy duty vehicle or vehicle, on-road or nonroad powered by diesel fuel and having a gross vehicle weight of greater than fourteen thousand (14,000) pounds, or in the case of a nonroad vehicle, powered by diesel fuel and an engine with a rating of at least seventy-five (75) horse power, including, but not limited to non-stationary generators and pumps.

The work also includes program participation and contract-wide coordination by the Contractor and its personnel. All equipment on the project that are used in excess of 30 work days total shall be subject to this reduction of diesel emissions program. The Rhode Island General Law noted above shall take precedent in the case of any discrepancies between these specifications and the above noted Rhode Island General Law.

944.02 APPLICABLE LAWS AND REGULATIONS.

All motor vehicles and construction equipment (both on-road and non-road) shall comply with all applicable Federal, State and local laws and regulations relative to exhaust controls and safety including, Chapter 31-47.3 of the Rhode Island General Laws titled "The Diesel Emissions Reduction Act".

944.03 CONSTRUCTION METHODS.

944.03.1 Inventory List.

1. The Contractor shall submit to the Engineer an inventory list of all equipment as defined in this specification that will be used on the project in excess of 30 work days total. Construction shall not proceed until the Contractor submits this equipment list. The inventory list shall include:

- a. Contractor or subcontractor name/address/contact person;
- b. Equipment/Vehicle type, model, serial number;
- c. Engine serial number, make, model, engine family number, year of manufacture, horsepower, average hours, average operating RPM's, muffler model number;
- d. Vehicle ID/VIN number, license plate number, other ID number(e.g. fleet truck number),

average annual miles;

e. Exemptions to this inventory list are equipment that are only used to deliver equipment or material to and from the project site and standby generators and pumps.

2. Submittal of the Contractor's installer from the State Clean Diesel Grant Program – Master Price Agreement vendor list.

944.03.2 Requirements.

1. General.

a. The Contractor shall establish staging zones, provided that such space is available at no extra cost, for diesel equipment away from the general public or sensitive receptors such as, but not limited to, hospitals, schools, and residential neighborhoods, in order to minimize the impact from idling equipment.

b. Idling of diesel engines shall be limited to no more than five (5) minutes, except in cases where engines must idle to perform normal operations, as with a concrete truck.

c. Equipment shall use only ultra-low sulfur diesel fuels.

2. Pre-Retrofit Installation.

a. The "Statement of Intent to Comply", located on page 6 of this specification must be signed and submitted within 5 days after the notification to the apparent low bidder who shall become the Contractor.

b. The Contractor shall submit all necessary lists and documentation for the Program.

c. Equipment meeting the eligibility requirements shall be operated by engines or retrofitted with properly operating and maintained Level 3 controls. However, if the Rhode Island Department of Environmental Management (RIDEM) finds that no Level 3 verified emission control devices have been verified but are otherwise appropriate for use on particular engines, Level 2 verified devices shall be required. If neither Level 3 nor Level 2 devices have been verified but are otherwise appropriate for use on particular engines, Level 1 verified devices shall be required.

3. Installation of Retrofit Device.

a. The Contractor shall retain an approved installer from the State Clean Diesel Grant Program – Master Price Agreement vendor list. The Installer shall retrofit the emission device to the designated equipment.

b. Opacity testing, or other approved means, is required to determine the "disproportionately" polluting equipment, as defined in the above noted General Law.

c. Acceptable Diesel Retrofit technologies/devices for the Contract shall be included either on the US Environmental Protection Agency (EPA) or California Air Resources Board (CARB) Verified Retrofit Technology List. Thorough and adequate testing procedures are required to ensure that the maximum feasible diesel particulate matter emissions reductions are achieved.

4. Post-Retrofit Installation.

a. After the devices have been installed, the Contractor shall document the technology type, EPA/CARB verification number/control Level, manufacturer, make, model, serial number of the retrofit device, and the date the retrofit was installed, which shall be reported monthly to the Engineer in accordance with Section 5, Program Documentation and Logs. This documentation will be used as evidence that the equipment has been retrofitted in order to satisfy the requirements of the Rhode Island General Law noted above. This documentation may also be used as evidence should the equipment be eligible to continue to be used on this project, or any future RIDOT project or other public project.

b. Equipment on the inventory list that are to be used in this Contract that are not already retrofitted or do not have a retrofit device on order shall not be used on the project site until such time that at least one of these two requirements are met. Non-compliant equipment for which a retrofit has been ordered may operate on site for a maximum of thirty (30) work days.

c. Diesel emission reduction systems and engines must be operational, maintained and serviced as recommended by the manufacturer.

d. The Contractor shall submit monthly summary reports to the Engineer, updating the equipment list, including diesel fuel use for the reporting time period for all retrofitted equipment used in the performance of the contract. The addition or deletion of equipment shall be included in the summary and noted in the monthly report.

e. Retrofits installed with funds from this Contract shall remain on the equipment for the useful life of the emission control device. In the event the equipment is sold out of state the retrofit technology may be removed at the Contractor's expense and used on a piece of equipment that performs work within Rhode Island no later than one year from the date it was removed from the original equipment.

5. Program Documentation and Logs. The following are the required Documentation and Logs that must be maintained for all equipment on the inventory list and fuel used. The Contractor shall submit monthly summary reports to the Engineer, updating the equipment inventory list, including diesel fuel use for the reporting time period for all retrofitted equipment used in the performance of the contract. The addition or deletion of any equipment shall be included in the summary and noted in the monthly report.

a. Documentation including technology type, EPA/CARB verification number/control Level, manufacturer, make model, serial number of the retrofit device and date of installation.

b. Documentation and verification of all retrofit devices already installed on equipment.

c. Proof of purchase and expected ship date for retrofits not yet installed.

d. Monthly update logs, which list all of the on-road and non-road diesel equipment details as outlined in above submittal list. Logs shall include the date on site, date off site and fuel usage of all contractor and subcontractor equipment utilized on the project beyond the 30 day minimum.

e. The monthly log shall be submitted in electronic format and hard copy on a monthly basis to the Engineer.

f. Monthly fuel logs shall be submitted to the Engineer with the bar code, equipment make and model, fill date, quantity and quality of fuel.

g. Verify that the fuel type being used meets the 2010 EPA standard for Ultra Low Sulfur Diesel ULSD, for Off Road Use.

h. Fuel inventory data shall be collected. The data shall include total volume of fuel delivered to the construction site each month and proof in the form of a Bill of Laden that the fuel meets the most recent EPA and ASTM fuel standard for ULSD for off-road and on-road construction.

i. Estimated construction equipment activity and anticipated duration that the equipment is to remain on site.

944.04 METHOD OF MEASUREMENT.

This item, Diesel Emission Reduction Program (DERP), will not be measured for payment. This item will be paid for on the Force Account Method. The Department has included in the Bid Proposal a Force Account amount from which payments for completing various units of emission retrofit work will be dispersed. When 90% of the Force Account amount has been dispersed, the Engineer will determine if additional funding is required to complete work on the DERP.

944.04.1 UNIT OF FORCE ACCOUNT WORK

A unit of work is the cost of completing a single emission control retrofit. It includes the actual cost of the retrofit device and the cost of the qualified installer of the device.

a. It shall be understood that the cost of a unit of emission control work as defined above will vary according to the size of the equipment.

944.05 BASIS OF PAYMENT

Upon completion of a number of completed units of emission control retrofit devices the Contractor shall request a disbursement from the Force Account amount. Each such request must include a detailed account for each particular "unit" of completed emission retro-fit work as defined above under **Subsection 944.04.1**. Payment of a disbursement request from the Force Account constitutes full and complete compensation for all labor, materials, equipment, tools and incidentals for completing the stated units of emission control retro-fits as required to finish the work, complete and accepted by the Engineer.

944.05.1 COSTS NOT INCLUDED IN THIS ITEM.

All costs associated with the implementation of the DERP including training costs inventory lists, retaining the qualified retro-fit installer, Statement of Intent to Comply Documentation of Post Retro-fit Installation, Program Documentation and Logs, monthly summary reports to the Engineer, and the addition and removal of equipment used in this work, will not be paid for separately. Costs thereof shall be included in the Contractor's overhead costs for performing the work of the Contract.

Revise **Section T.01, Electrical Work**, pages T-1 to T-5 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION T.01

ELECTRICAL WORK

- **Replace the first paragraph of Subsection T.01.02 with the following.**

T.01.02 MATERIALS. Rigid steel conduit, PVC conduit, fiberglass conduit, handholes, pull boxes, manholes, wire and cable shall conform to the requirements specified in **SECTION M.15; TRAFFIC CONTROL AND HIGHWAY LIGHTING SYSTEMS**, of these Specifications.

- **Replace the second paragraph of Subsection T.01.03.1 with the following.**

All foundations shall rest on firm ground and shall be placed monolithically. Conduits and anchor bolts shall be placed in proper position and shall be held in place by means of a template until the concrete sets. Forms shall not be removed until the concrete has hardened properly and not less than 24 hours after the concrete has been placed. All exposed portions of foundations shall be neatly finished with a wood float. The tops of foundations shall be finished flush with the finished grade or as detailed on the Plans.

- **Replace Subsection T.01.03.2 with the following.**

T.01.03.2 Bonding and Grounding. Traffic signals, highway lighting, illuminated sign circuits, conduits and aboveground equipment shall be effectively bonded and grounded as hereinafter specified and as shown on the Plans for the respective installations. Bonding and grounding shall conform to the requirements of the National Electric Code and the utility company.

Ground wire and grounding rods shall conform to the applicable requirements set forth in **SECTION M.15; TRAFFIC CONTROL AND HIGHWAY LIGHTING SYSTEMS**, of these Specifications.

The Contractor shall be responsible for maintaining 25 ohm to ground resistance in all systems.

- **Replace the second paragraph of Subsection T.01.03.4 with the following.**

With all equipment connected to the wiring system, a functional test shall be performed by the Contractor, in the presence of the Engineer, to demonstrate that the system as a whole, and all parts thereof, function as specified or intended herein. Any defective materials or faulty or improper installation shall be permanently corrected by repairs or replacements to be made by and at the expense of the Contractor, to the satisfaction of the Engineer and the utility company.

- **Replace the second paragraph of Subsection T.01.03.7(a) with the following.**

All complete shop drawings and design computations shall bear the stamp of a Professional Engineer licensed by the State of Rhode Island. Shop drawings shall be approved prior to fabrication, and it shall be expressly understood and agreed upon that said approval does not relieve the Contractor of its responsibility for the design, fabrication and erection of the structure.

- **Replace the second paragraph of Subsection T.01.03.8 with the following.**

Existing systems or portions thereof may be abandoned in place only with written permission of the Engineer.

- **Replace Subsection T.01.03.9 with the following.**

T.01.03.9 Lines and Grades. It shall be the responsibility of the Contractor to arrange for the furnishing of lines and grades as may be necessary to lay out the work correctly, all as specified in **Subsection 105.08** of these Specifications.

Revise **Section T.02, Highway Lighting**, pages T-5 and T-6 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION T.02

HIGHWAY LIGHTING

- **Replace the fourth paragraph of Subsection T.02.01 with the following.**

Reference is made to the following Sections which are relevant to highway lighting:

SECTION T.03, GROUND RODS AND BARE OR INSULATED GROUND WIRE

SECTION T.04, WIRE AND CABLE

SECTION T.05, HANDHOLES, MANHOLES, AND PULL BOXES

SECTION T.06, CONDUIT

SECTION T.07, LUMINAIRES

SECTION T.08, ALUMINUM LIGHT STANDARDS AND FOUNDATIONS

SECTION T.09, SERVICE PEDESTAL

Revise **Section T.03, Ground Rods and Bare Ground Wire**, pages T-6 and T-7 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION T.03

GROUND RODS AND BARE OR INSULATED GROUND WIRE

- **Replace Subsection T.03.01 with the following.**

T.03.01 DESCRIPTION. This work consists of effectively grounding lighting circuits, service pedestals, conduits, lighting and signal poles, illuminated sign circuits and traffic signal controller cabinets as shown on the Plans or as directed by the Engineer, all in accordance with these Specifications and the requirements of the National Electric Code.

- **Replace the first paragraph of Subsection T.03.03 with the following.**

T.03.03 CONSTRUCTION METHODS. Equipment grounding conductors will be provided for all lighting circuits between service pedestals and lighting standards. Conductors will be connected to each ground rod at each handhole and at each lighting standard.

Remove **Section T.04, Wire and Cable**, pages T-7 to T-9 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION T.04

WIRE AND CABLE

T.04.01 DESCRIPTION. This work consists of furnishing and installing wire and cable of the type and at the locations indicated on the Plans, or as directed by the Engineer, all in accordance with these Specifications. This work also includes the use of material and equipment for furnishing and installing splice kits in handholes and manholes, as indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

T.04.02 MATERIALS. Wire, cable and splice kits shall conform to **Subsection M.15.02** of these Specifications.

T.04.03 CONSTRUCTION METHODS. Splices, taps and terminations shall be made using premolded splice kits fabricated of 6061-T aluminum and insulated with EPDM rubber compound rated for 600 volts and capable of accepting copper conductors. This splice has four terminals and can be used for a two-, three-, and four-way splice application. The splice is to be suitable for submersible installations

Note: Taped splices are allowed only as temporary installations, as directed by the Engineer. Taped splices must be “built-up” and rated for 600 volts using self-vulcanized high voltage tape covered with two (2) layers of PVC tape.

Wires and cables shall be handled carefully during storage. All conductors and cables shall be drawn into the conduit system without damage to covering sheath insulation or conductor. Wiring shall not be done until the raceway system has been completed. Only lubricant manufactured specifically to assist cable pulling shall be used.

Wires on poles shall be installed by a licensed electrician and/or a licensed journeyman.

Wiring installed in raceways shall have slack cable left at all pulling points. No wiring shall be installed until conduit systems have been approved by the Engineer.

Installation of splice kits shall be as recommended by the manufacturer and the National Electric Code. All splices shall be in a handhole, manhole or junction box.

The Contractor shall submit for approval the manufacturer's notarized certificates of compliance for all wire and cable.

T.04.04 METHOD OF MEASUREMENT.

T.04.04.1 Wire and Cable. "Wire" and "Cable" will be measured by the linear foot of each type actually installed in accordance with the Plans and/or as directed by the Engineer.

Measurement shall be along the centerline of the conduit. A 5-foot allowance will be made for slacked cables in handholes. A 6-foot allowance will be made for slacked cables in traffic signal controller cabinets.

T.04.04.2 Splice Kits. "Splice Kits" will be measured by the number of units actually installed, regardless of the number of actual splices made each unit, all in accordance with the Plans and/or as directed by the Engineer.

T.04.05 BASIS OF PAYMENT.

T.04.05.1 Wire and Cable. The accepted quantities of "Wire" and "Cable" will be paid for at their respective contract unit prices per linear foot of the various types as listed in the Proposal. The prices so-stated constitute full and complete compensation for all materials, equipment, tools, labor and all other incidentals required to finish the work, complete in place and accepted by the Engineer.

T.04.05.2 Splice Kits. "Splice Kits" will be paid for at the contract unit price per each as listed in the Proposal. This unit price includes the labor cost to install splice kits for two, three and four-way splice applications. The contract unit price constitutes full and complete compensation for furnishing and installing all tools, labor, splice kits, equipment and all other incidentals required to finish the work, complete in place and accepted by the Engineer.

Remove **Section T.05, Handholes and Pull Boxes**, pages T-9 and T-10 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace with the following.

SECTION T.05

HANDHOLES AND PULL BOXES

T.05.01 DESCRIPTION. This work consists of providing Precast Type “A” Handholes, Precast Type “B” Heavy Duty Handholes, and Precast Type “H” Heavy Duty Handholes at the locations indicated on the Plans or as directed by the Engineer. The work also includes the provision of Type “V” and Type “W” Pull Boxes on those structures indicated on the Plans. All such work will be in full accordance with these Specifications.

T.05.02 MATERIALS.

T.05.02.1 Precast Handholes and Pull Boxes. Precast handholes and pull boxes shall conform to **Subsection M.15.03.1** of these Specifications.

T.05.02.2 Metal Pull Boxes. Pull boxes shall conform to **Subsection M.15.03.2** of these Specifications.

T.05.03 CONSTRUCTION METHODS.

T.05.03.1 Plant Requirements for Precast Units.

a. Casting. Precast concrete units shall be cast true and square in accordance with the applicable details as shown on the Plans. Dimensions of units shall be accurate within the following tolerances:

Dimension	Tolerance ±
Greater than 0" to 12"	1/4"
Greater than 12" to 24"	1/2"
Greater than 24" to 72"	3/4"

b. Manufacture. Precast concrete units shall be designed and manufactured in accordance with ASTM C478; “Precast Concrete Manhole Sections,” with the additional stipulation that the concrete mix design shall be Class XX(AE) as set forth in **SECTION 601** of these Specifications.

c. Inspection. All precast concrete units shall be inspected both at the points of manufacture and on the project site. Any units showing defects or damage shall be removed and replaced by the Contractor at no additional cost to the State.

T.05.03.2 Setting. Except as otherwise specified, precast units shall be placed on previously prepared gravel borrow subbase to the lines and grades shown on the Plans.

The grade of the handhole frame and cover shall be even with the surrounding ground or as directed by the Engineer. The maximum allowable adjustment for the frame and cover is 3- inches

All holes for conduit and ground wire shall be drilled. No punched holes will be allowed. All holes drilled in handholes shall be grouted with a material approved by the Engineer. The frame and cover are to be provided with a ground connector and both items shall be bonded to the ground rod using a #6 bare ground wire.

T.05.03.3 Metal Pull Boxes. Pull boxes, when used in cast-in-place bridge parapets or barrier, shall conform to the details indicated on the Plans and shall be adequately anchored in place to prevent displacement during concrete pouring operations. Surface mounted pull boxes shall be anchored with stainless steel mechanical anchors.

T.05.03.4 Excavation. Excavation for precast handholes and pull boxes shall be completed as nearly as practicable to the dimensions shown on the Plans.

T.05.04 METHOD OF MEASUREMENT. "Precast Type "A" Handholes," "Precast Type B Heavy Duty Handholes," "Precast Type "H" Heavy Duty Handholes," and "Type "V" Pull Boxes" and "Type "W" Pull Boxes" will be measured by the number of units of each type actually installed in accordance with the Plans and/or as directed by the Engineer.

T.05.05 BASIS OF PAYMENT. The accepted quantities of "Precast Type "A" Handholes," "Precast Type B Heavy Duty Handholes," "Precast Type "H" Heavy Duty Handholes," "Type "V" Pull Boxes" and "Type "W" Pull Boxes" will be paid for at their respective contract unit prices per each such type as listed in the Proposal. The prices so-stated constitute full and complete compensation for all materials, labor, tools, and equipment including concrete, ground wire, grounding clamps and support grips, ground rods, gravel, cast iron frame and cover, grounding of frame and cover, excavation and backfill, and for all incidentals required to finish the work, complete in place and accepted by the Engineer.

Payment for "Trench Excavation - Rock" will be made under the applicable provisions of **SECTION 205; TRENCH EXCAVATION**, of these Specifications.

Remove **Section T.06, Conduit**, pages T-11 through T-13 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following:

SECTION T.06

CONDUIT

T.06.01 DESCRIPTION. This work consists of furnishing and installing rigid steel conduit, polyvinyl chloride (PVC) plastic conduit, and fiberglass conduit of the size specified, including the necessary fittings, at the locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

T.06.02 MATERIALS. Conduit and fittings shall conform to **Subsection M.15.04** of these Specifications.

T.06.03 CONSTRUCTION METHODS. All work shall be performed strictly in accordance with the requirements of the National Electrical Code, latest Edition.

T.06.03.1 Rigid Steel Conduit. Conduit shall be installed as shown on the Plans or as directed by the Engineer. Bends which are not smooth or which show any evidence of flattening or destruction of the protective coating will not be accepted. All joints requiring rethreading shall be made with a zinc-based, cold galvanized, spray-applied compound as approved by the Engineer, applied to the male threads. Oils shall be removed from the threads prior to applying the galvanizing compound. All threaded couplings shall be tightened until the ends of the conduit are brought together to form a tight connection.

A nylon pulling rope shall be installed in all conduits which do not carry conductors under the contract. Such pull rope shall be for subsequent use to facilitate pulling of cables. There will be no separate payment for the cost of the pull rope.

Conduit bends and elbows made in the field shall have a radius of not less than twelve (12) times the inside diameter of the conduit, and all such bends shall be made without crimping, heating, denting or otherwise damaging the conduit.

Conduit ends at handholes shall be supplied with insulated bonding bushings with threaded ends. All conduits shall be bonded to the ground rod within the handhole using #6 bare ground wire.

a. Conduit Underground. Conduit underground refers to all conduit placed underground in non-paved areas and in paved areas where the pavement will be replaced as part of the project under other contract items. All conduit shall be grounded in accordance with the National Electrical Code, latest Edition. Ends that have bonding clamps shall be filled with sealing compound to prevent the entrance of moisture, except at handholes. All ground lugs shall be copper, bronze or brass. Underground conduit shall be placed at a minimum depth of 24 inches under vehicular travel areas and 18 inches under non-vehicular travel areas.

Conduits shall be placed on a 6-inch sand bed. Conduits within roadways shall be backfilled with Class 1 controlled low-strength material (CLSM) to the bottom of the gravel subbase. Yellow warning tape shall be placed 1 foot below finished grade.

When two or more conduits are placed in the same trench, conduit spacers shall be used. Spacers shall be placed at 6-foot intervals or as directed by the Engineer.

The Contractor shall immediately notify the Engineer of trench-bottom conditions that are suspected to be unsatisfactory. If the condition of the bottom of the trench is in any way unsatisfactory, as determined by the Engineer, the Engineer may require the Contractor to excavate additional material and replace it with clean gravel to provide a firm bearing for the conduit. The backfill shall be compacted in layers not more than 6 inches in thickness before compaction.

After the trench is backfilled, the Contractor shall, in the presence of the Engineer, test the installation by pushing or pulling a mandrel, not less than 1/4-inch less than the inside diameter of the conduit, through the entire length of the conduit. All debris, including stones and dirt, shall be removed. All damaged conduit shall be removed and replaced at the Contractor's expense.

b. Conduit Under Existing Pavement. Conduit under existing pavement refers to all conduit placed under existing paved areas where removal of the pavement is required only for the placement of conduit and the pavement is to be restored as part of this item. Conduit under existing pavement shall be placed in accordance with all applicable requirements of **Para. a** of this Subsection. The pavement shall be replaced in accordance with the Plans regardless of the method of excavation. When conduit is placed in existing paved sidewalks, the sidewalk shall be replaced in accordance with **Subsection T.01.03.11** of these Specifications.

c. Conduit Overhead. All conduit above grade shall be securely attached using clamps and/or hangers at intervals not exceeding 5 feet or as directed. All clamps and hangers shall be galvanized. A weatherhead shall be installed on all risers.

d. Conduit In or On Structure. Conduit to be embedded in concrete structures shall be rigidly supported in the concrete form by methods and materials which will not cause injury to the zinc coating of the conduit.

Conduit installations on bridges and other structures shall be provided with expansion fittings at all structure expansion joints. The expansion joint fittings shall be installed as shown on the Plans and meet the requirements of **Subsection M.15.04.3** of these Specifications.

T.06.03.2 PVC Plastic Conduit. PVC plastic conduit shall be installed as shown on the Plans and in conformity with the requirements previously specified in **Subsection T.06.03.1** except those referring specifically to rigid steel conduit.

PVC plastic conduit shall be installed with bell ends on the inside of each handhole.

T.06.03.3 Fiberglass Conduit. Fiberglass conduit shall be installed as shown on the Plans and in conformity with the requirements previously specified in **Subsection T.06.03.1** except those referring specifically to rigid steel conduit.

T.06.04 METHOD OF MEASUREMENT. "Rigid Steel Conduit," "PVC Plastic Conduit", and "Fiberglass Conduit" will be measured by the number of linear feet actually installed of the type or types indicated on the Plans and/or as directed by the Engineer, with no deduction for fittings and couplings.

T.06.05 BASIS OF PAYMENT.

T.06.05.1 Conduit Underground. The accepted quantities of "Rigid Steel Conduit -Underground" and "PVC Plastic Conduit - Underground" will be paid for at their respective contract unit prices per linear foot for the type or types as listed in the Proposal. The prices so-stated constitute full and complete compensation for furnishing all materials, equipment, tools, and labor including fittings, couplings, saw cutting pavements, excavation and backfill, Class B bedding, restoration of existing ground surfaces including all materials necessary for such restoration, testing, and all incidentals necessary to satisfactorily finish the work, complete in place and accepted by the Engineer.

T.06.05.2 Conduit Under Existing Pavement. The accepted quantities of "Rigid Steel Conduit - Under Existing Pavement" and "PVC Plastic Conduit - Under Existing Pavement" will be paid for at their respective contract unit prices per linear foot for the type or types as listed in the Proposal. The prices so-stated constitute full and complete compensation for furnishing all materials, equipment, tools, and labor including fittings, couplings, saw cutting, excavation and backfill, Class B bedding, restoration of existing pavements and sidewalks including all materials necessary for such restoration, testing, and all incidentals required to finish the work, complete in place and accepted by the Engineer.

T.06.05.3 Conduit Overhead. The accepted quantities of "Rigid Steel Conduit - Overhead" and "PVC Plastic Conduit - Overhead" will be paid for at their respective contract unit prices per linear foot for the type or types as listed in the Proposal. The prices so-stated constitute full and complete compensation for furnishing all materials, equipment, tools and labor, including fittings, couplings, clamps and hangers, weatherhead, and all incidentals required to finish the work, complete in place and accepted by the Engineer.

T.06.05.4 Rigid Steel or PVC Plastic Conduit In Structure. The accepted quantities of rigid steel or PVC plastic conduit in structure will be paid for at their respective contract unit prices per linear foot for the various types as listed in the Proposal. The prices so-stated constitute full and complete compensation for furnishing all materials, equipment, tools and labor, including fittings, couplings, and all incidentals necessary to satisfactorily finish the work, complete in place and accepted by the Engineer.

T.06.05.5 Fiberglass Conduit On Structure. The accepted quantities of "Fiberglass Conduit On Structure" will be paid for at the contract unit prices per linear foot of conduit as listed in the Proposal. The price so-stated constitutes full and complete compensation for furnishing all materials, equipment, tools and labor, including fittings, hangers and support systems, expansion fittings, and all incidentals necessary to satisfactorily finish the work, complete in place and accepted by the Engineer.

T.06.05.6 Expansion Couplings. The accepted quantities of expansion couplings of various types will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for furnishing all materials, equipment, tools and labor, and all incidentals necessary to satisfactorily finish the work, complete in place and accepted by the Engineer.

Remove **Section T.07, Luminaires**, pages T- 13 and T-14 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace with the following.

SECTION T.07

LUMINAIRES

T.07.01 DESCRIPTION. This work consists of furnishing and installing 250- or 400- watt high pressure sodium cutoff luminaires on appropriate lighting standards, and understructure luminaires, along with their supports and protective screens, at the locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

T.07.02 MATERIALS. Luminaires, understructure luminaires and photo-electric controls shall conform to **Subsection M.15.05**, of these Specifications.

T.07.03 CONSTRUCTION METHODS.

T.07.03.1 High Pressure Sodium Luminaires. The 250- or 400-watt high pressure sodium luminaires shall be installed as shown on the Plans or directed by the Engineer. Luminaires shall be securely attached to ends of arms and shall be accurately plumbed, with the luminaire reflector properly and accurately placed.

Note: Luminaires installed on bridges must be secured with a belt through end of davit arm in addition to the manufacturer's recommendation due to possible vibration of the bridge span.

T.07.03.2 Understructure Luminaire with or without Protective Screen. Angle iron shall be drilled to accept wire mesh. Wire mesh ends shall be crimped at every end into holes in the angle iron. The protective screen shall be of the size indicated on the Plans and shall be secured to the bridge structure with galvanized "C" clamps located in each corner. The furnishing and installing of supports for the understructure luminaires shall include 3/4-inch conduit installed between the luminaire and the junction box. The high pressure understructure luminaire shall be furnished and installed as indicated on the Plans and/or as directed by the Engineer. Tunnel or underpass luminaries without protective screens shall be specified and ordered with tempered rated glass lens.

T.07.04 METHOD OF MEASUREMENT.

T.07.04.1 High Pressure Sodium Luminaires. "250-Watt High Pressure Sodium Luminaires" or "400-Watt High Pressure Sodium Luminaires" will be measured by the number of units of each type actually installed in accordance with the Plans and/or as directed by the Engineer.

T.07.04.2 Understructure Luminaire with Protective Screen. "Understructure Luminaire with or without Protective Screen" will be measured by the number of units actually installed in accordance with the Plans and/or as directed by the Engineer.

T.07.05 BASIS OF PAYMENT.

T.07.05.1 High Pressure Sodium Luminaires. The accepted quantities of "250-Watt High Pressure Sodium Luminaires" or "400-Watt High Pressure Sodium Luminaires" will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for all materials, equipment, tools and labor, including ballast, lamp and photo-electric control, and all other incidentals required to finish the work, complete in place and accepted by the Engineer.

T.07.05.2 Understructure Luminaire with or without Protective Screen. The accepted quantities of "Understructure Luminaires with or without Protective Screens" will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for all materials, including angle, mesh and clamps for the protective screen, luminaire support, luminaire, ballast, photo-electric cell (if needed), lamp and conduit, and all labor, tools, equipment and all other incidentals required to finish the work, complete in place and accepted by the Engineer.

Revise **Section T.08; Aluminum Lighting Standards and Foundations**, pages T-14 to T-17 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION T.08

ALUMINUM LIGHTING STANDARDS AND FOUNDATIONS

- **Replace Subsection T.08.01 with the following.**

T.08.01 DESCRIPTION. This work consists of furnishing and installing aluminum lighting standards, foundations, anchor bolts, in-line fused and unfused kits, and breakaway support couplings of the sizes and at the locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

- **Replace the third paragraph of Subsection T.08.03.2(a) with the following.**

After the concrete foundation has been placed, finished level and cured, forms shall be removed. The area around the concrete base shall be backfilled and compacted in 6-inch uniform layers. Available stones in the area shall be used to chink the backfill to insure the concrete foundation remains in a stable vertical position.

- **Replace Subsection T.08.03.2(c) with the following.**

c. Preparation of Subbase. The subbase shall be furnished and placed in accordance with **Subsections 302.03.1 and 302.03.2** of these Specifications.

- **Add the following new paragraph at the end of Subsection T.08.03.2(d).**

Foundations shall be installed such that no portion of the foundation or any non-breakaway portion of the installation extends more than 4-inches above the finished grade. Measurement shall be made in accordance with Section 12.5.3; Additional Requirements of the AASHTO Standard Specifications for Structural Supports for Highway Signs and Traffic Signals.

- **Replace Subsection T.08.05.1 with the following.**

T.08.05.1 Light Standards. The accepted quantities of "Light Standards" will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for all materials including poles, cast aluminum bases, ground wire, ground lugs, grounding bushings, in-line fused or unfused kits, No. 10 AWG cable between the luminaire and the in-line fused or unfused kits, and for all labor, tools, equipment and incidentals required to finish the work, complete in place and accepted by the Engineer.

Revise **Section T.09; Service Pedestal**, pages T-17 and T-18 of the RI Standard Specifications for Road and Bridge Construction as follows:

SECTION T.09

SERVICE PEDESTAL

- **Replace Subsection T.09.03 with the following.**

T.09.03 CONSTRUCTION METHODS. All work shall be performed in accordance with the National Electric Code and the National Electric Safety Code. The service pedestal shall be installed as shown on the Plans or as directed by the Engineer. The work under this item shall include all conduit contained within the concrete base. The pedestal shall be installed on the concrete mat as indicated on the Plans with the power distribution panel mounted inside. The concrete pad shall be placed on 12 inches of gravel subbase. The enclosure shall be made watertight. A bead of silicon sealer shall be applied to the base of the cabinet, inside and out. All electrical conductors within the cabinet shall be enclosed in PVC conduit. The electrical components shall be mounted with machine screws and wired as shown on the Plans or as directed. All rigid steel conduits in the service cabinet shall be bonded together and grounded to the cabinet with No. 6 AWG bare copper conductors. A ground grid system consisting of four (4) ground rods and #2 bare copper wire shall be installed around the foundation and as shown in the Standard Details. Foundation rebar and pedestal enclosure are to be bonded to the ground grid.

The Contractor shall provide a shop drawing of the service pedestal foundation showing the location of all conduit.

- **Replace Subsection T.09.05 with the following.**

T.09.05 BASIS OF PAYMENT. The accepted quantities of "Service Pedestal" will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for all material, labor and equipment, including furnishing and installing the service pedestal, anchor bolts, concrete foundation, grounding system, crushed stone, excavation and backfill, meter socket, contactor, panelboard, photo control, relays, neoprene gasket, grounding bushings and ground wire, and for all incidentals required to finish the work, complete in place and accepted by the Engineer.

Revise **Section T.13; Detectors and Relays**; pages T-24 to T-27 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION T.13

DETECTORS AND RELAYS

- **Replace Subsection T.13.03.3 with the following.**

T.13.03.3 Pedestrian Detector Installation. Pedestrian pushbuttons shall be installed in accordance with **Subsection T.10.03** of these Specifications. All pushbuttons, regardless of mounting type, shall be mounted at a height of 3 feet 6 inches. The measurement shall be made from the center of the pushbuttons to the finished sidewalk elevation.

All pedestrian pushbutton detector housings shall be “Federal Yellow” in color unless the Contract calls for other signal equipment within the same intersection to be a different color. In the latter case, the color of the pushbutton detector housing shall match that of the other signal equipment.

Each Accessible Pedestrian Detector shall be tested in the field after initial installation in accordance with the manufacturer’s recommendations and with the Engineer present, as well as other representatives when so designated by the Contract. The programming and operation of audible speech messages, percussive tones, locator tones, and confirmation tones, as well as all other vibrotactile and visual features required, shall be tested and checked for conformance with these specifications. If any are not operating properly or to the satisfaction of the Engineer, they shall be corrected and the features re-tested until accepted by the Engineer.

- **Replace Subsection T.13.04.3 with the following.**

T.13.04.3 Pedestrian Detectors. “Pedestrian Detector-Pushbutton with Sign”, “Accessible Pedestrian Detector-Pushbutton with Sign”, and “Accessible Pedestrian Detector-Configuration Device” will be measured by the number of units actually furnished and installed in accordance with the Plans and/or as directed by the Engineer.

- **Replace Subsection T.13.05.3 with the following.**

T.13.05.3 Pedestrian Detectors. The accepted quantity of “Pedestrian Detectors –Pushbutton with Sign”, “Accessible Pedestrian Detector-Pushbutton with Sign”, and “Accessible Pedestrian Detector-Configuration Device” will be paid for at the contract unit price per each as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, tools and equipment, including ADA-compliant pushbuttons and housings, wiring, pedestrian signs, mounting and installation hardware, furnishing and installation of accessible pedestrian detector control units, all programming, configuration, and testing required prior to and after installation of pedestrian detectors in the field, and all incidentals required to finish the work, complete in place and accepted by the Engineer.

Replace **Subsection T.15.03.5, Post Holes**, page T-30 of the RI Standard Specifications for Road and Bridge Construction in its entirety with the following.

T.15.03.5

POST HOLES

T.15.03.5 Post Holes. Post holes shall be excavated to the depth and in the position shown on the Plans, or as indicated by the Engineer. A tolerance of plus or minus 3 inches will be permitted in the depth of the holes for wood posts. The exposed portions of the posts shall be set plumb and true to line and grade, and holes shall be backfilled with sound earth and tamped in 6-inch layers in such a way as not to displace the posts.

Post holes to be excavated through an existing concrete or asphalt surface shall be backfilled with earth as prescribed above to within 4 inches of the original grade. After this is completed, 4 inches of concrete shall be placed in the hole and the surface leveled and finished with the original grade.

When sign posts, except U-channels, are to be installed within areas where new concrete or asphalt pavement is to be placed, the following method shall be used. At the post location, a box form will be installed. The side dimension of the box form shall be 4 inches larger than the greatest dimension of the required post, but no less than 8 inches, and its depth shall be 6 inches. The box form shall be firmly anchored and shall be placed such that the top of the box is at the finished grade of the pavement. The pavement shall be installed around the box form. The required post hole shall then be excavated within the area of the box form, and the post will be installed, with the proper backfilling, as described above. All concrete box forms shall conform to **Subsections 905.03.3(c), (d) and (g)** of these Specifications.

Revise **Section M.01, Borrow and Aggregates**, pages M-1 through M-5 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION M.01

BORROW AND AGGREGATES

- **Replace Subsection M.01.01; Common Borrow in its entirety with the following.**

M.01.01 COMMON BORROW. Common Borrow shall be gravelly in nature and shall conform to the minimum test data as specified below.

1. Boulders (retained on a 3-inch sieve) up to 9 inches in diameter and not exceeding three-quarters of the thickness of horizontal layers placed after compaction, as specified in **Subsection 202.03.2, Para. C**, are included for use in construction. However, these sizes are not included in the analysis for gradation.

2. The material shall contain not more than 17 percent by weight passing the No. 200 sieve.

Common Borrow shall conform to all applicable specification requirements prior to its final placement on the project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

- **Replace Subsection M.01.02; Gravel Borrow in its entirety with the following.**

M.01.02 GRAVEL BORROW. Gravel Borrow shall consist of bank run sand and gravel or plant processed, crushed or uncrushed gravel with fine aggregate added as filler. Alternatively, Gravel Borrow may consist of selected materials which have been reclaimed from within project limits, are proportioned and processed to produce granular material for reuse as Gravel Borrow within the source project limits. Gravel Borrow, whether consisting of bank run or plant processed sand and gravel, or reclaimed and processed granular material, shall consist of sound, durable particles free from loam, clay, organic soil, vegetative matter, soft and elongate particles.

Gravel Borrow shall conform to all applicable specification requirements prior to its final placement on the project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

- **Add the following paragraph to the end of Subsection M.01.02.2.**

M.01.02.2 Reclaimed and Processed Granular Material.

Reclaimed and Processed Granular Material shall conform to all applicable specification requirements prior to its final placement on the project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

- **Replace Subsection M.01.09; Gradation of Aggregates in its entirety with the following.**

M.01.09 GRADATION OF AGGREGATES. Aggregates for use in base and subbase courses and other applications shall conform to the gradation requirements indicated in the following Table I.

Table I							
Gradation - Percent Passing							
Sieve Size	I Gravel Borrow		II Crushed Stone or Crushed Gravel	III Keystone	IV Pervious Fill	V Filter Stone	VI Cover Stone
	Bank Run Proc Sand/ Gravel	Reclaimed Ib Processed Material					
3"	60-100	100			100		
2 1/4"							
2"			100				
1 1/2"		70-100	90-100				
1 1/4"							
1"			30-55	100		100	
3/4"		50-85	0-25	90-100		70-85	100
1/2"	50-85		0-10	20-55		10-40	90-100
3/8"	45-80			0-20		0-20	30-60
#4	40-75	30-55		0-5	30-100	0-5	0-15
#8							0-5
#40	0-45						
#50		8-25					
#100			0-1				
#200	0-10	2-10			0-8		

Delete **Subsection M.02.08, Latex Emulsion Admixture**, page M-10 of the RI Standard Specifications for Road and Bridge Construction in its entirety.

M.02.08

LATEX EMULSION ADMIXTURE

[SUBSECTION DELETED]

Revise **Section M.03.01, Bituminous Concrete Pavement** and **M.03.02, Materials**, pages M-13 through M-15 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION M.03

BITUMINOUS PAVEMENTS

- **Replace the Table in Subsection M.03.01 with the following.**

SIEVE SIZE	BASE COURSE	BINDER COURSE	BRIDGE BINDER	SURFACE COURSES		FRICTION COURSES	
				CLASS I-1	CLASS I-2 or SIDEWALK	DENSE	RAMP
GRADATION: PERCENT PASSING BY WEIGHT							
1-1/4"	100						
1"		100				100	
3/4"	70-100	70-100		100		90-100	100
1/2"			100	80-100	100	70-90	95-100
3/8"	46-74	46-74	70-100	70-90	95-100	45-75	70-100
#4			25-45	50-70	55-75	20-40	25-45
#8	22-52	22-52	20-35	35-50	40-55	8-18	20-35
#30	10-34	10-34		18-29	20-30		8-15
#50	6-26	6-26	8-17	10-20	13-23	4-12	5-12
#200	3-8	3-8	2-6	3-8	3-8	2-6	2-6
Asphalt % By Weight							
	4.0 - 6.5	4.0 - 6.5	5.0 - 7.0	5.5 - 7.0	6.0 - 7.5	4.5 - 5.5	5.0 - 7.0
Marshall Stability Lbs. (min)							
	1600	1600	750	1000	1000	750	750
% Voids VFA							
	3 - 8 60 - 75	3 - 8 60 - 75	3 - 8 -	3 - 5 65 - 85	3 - 5 65 - 85	8 min. -	5 min. -
Flow (0.01 in)							
	8 - 16	8 - 16	8 - 16	8 - 16	8 - 16	-	8 - 16
Mixing Temp °F							
	300	300	260	300	300	260	260
Compaction #blows at Each end							
	75	75	50	50	50	50	50

- **Replace the second paragraph of Subsection M.03.02.1(c) with the following.**

The asphalt cement shall be sampled and tested in accordance with and meet all the requirements of AASHTO M 320 for PG 64-28 binder. A direct tension test shall not be used.

Remove **Subsection M.04.02.1, Ductile Iron Pipe**, page M-20 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION M.04

DRAINAGE

M.04.02.1 Ductile Iron Pipe. All ductile iron pipe, joints, fittings and appurtenances shall be Class 52 and meet the requirements of the latest revisions and addenda of the following standard specifications.

a. American National Standards Institute, ANSI (parenthesis designations are American Water Works Association designations for the standard).

1. A21.51 (C151) Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds, for Water and Other Liquids.
2. A21.11 (C111) Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
3. A21.53 (C153) Ductile Iron Compact Fittings.

b. ASTM A716 – Ductile Iron Culvert Pipe.

Revise **Section M.05, Metals**, pages M-23 through M-30 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION M.05

METALS

- **Replace Subsection M.05.01, Bar Reinforcement in its entirety with the following.**

M.05.01 BAR REINFORCEMENT. All reinforcement shall be furnished as indicated on the Plans. Reinforcing bars shall be deformed and be fabricated from new billet steel and shall conform to AASHTO M31 (ASTM A615) or ASTM A706. The grade shall be 60 unless otherwise shown on the Plans.

- **Replace Subsection M.05.04.6, Shear Connectors in its entirety with the following.**

M.05.04.6 Shear Connectors. Shear connector studs shall conform to the requirements of the Specification for Cold Finished Carbon Steel Bars and Shafting, AASHTO M169 (ASTM A108) cold-drawn bar, Grade 1018 or Grade 1020, either semi- or fully-killed. If flux-retaining caps are used, the steel for the caps shall be of a low carbon grade suitable for welding and shall comply with Cold-Rolled Carbon Steel Strip, ASTM A109.

Tensile properties as determined by tests of bar stock after drawing or of finished studs shall conform to the following requirements:

Tensile Strength (min.)	60,000 psi
Yield Strength* (min.)	50,000 psi
Elongation (min.)	20 percent in 2 inches
Reduction of area (min.)	50 percent

*As determined by a 0.2 percent offset method.

Tensile properties shall be determined in accordance with the applicable sections of ASTM A370, Mechanical Testing of Steel Products. Tensile tests of finished studs shall be made on studs welded to test plates using a test fixture similar to that shown in Figure 7.2 of the current ANSI/AASHTO/AWS D1.5 Bridge Welding Code. If fracture occurs outside of the middle half of the gauge length, the test shall be repeated.

Finished studs shall be of uniform quality and condition, free from injurious laps, fins seams, cracks, twists, bends, or other defects. Finish shall be as produced by cold drawing, cold rolling, or machining.

a. Certification. The manufacturer shall certify that the studs, as delivered, are in accordance with the material requirements of this Section. Certified copies of in-plant quality control test reports shall be furnished to the Engineer upon request.

b. Acceptance_Samples. The Engineer may select at the Contractor's expense, studs of each type and size used under the Contract, as necessary for checking the requirements of this Section.

- **Replace Subsection M.05.05, Epoxy Coating for Bar Reinforcement in its entirety with the following.**

M.05.05 GALVANIZING FOR BAR REINFORCEMENT. The bar reinforcement shall be Class 1 galvanized after bar fabrication, in accordance with ASTM A767, Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement, including Supplemental Requirements S1 and S3.

In accordance with ASTM A767, the average coating thickness, of a minimum of 3 tests, shall be 3.5 oz/sf or 6 mils.

Chromating is not allowed.

Prior to galvanizing, the material shall have all grease, dirt, mortar, mill scale, injurious rust, or any other foreign substance removed.

For the purpose of these specifications, the term "injurious rust" shall be interpreted to mean rust which is not firmly bonded to the steel. Rust which is difficult to remove, even by vigorous scrubbing with a wire brush, shall be considered firmly bonded to the steel.

The galvanized threads of nuts and mechanical connectors used for assembly with galvanized bolts and reinforcement shall be tapped oversize prior to coating and need not be retapped afterwards. The minimum additional diameter for Class-2A threads galvanized to Class C is as follows:

<u>Class-2A Thread Diameter (in.)</u>	<u>Additional Diameter (in.)*</u>
7/16" and smaller:	0.016"
Over 7/16" to 1":	0.021"
Over 1":	0.031"

* applies to both pitch and minor (root) diameters, minimum and maximum limits.

Material galvanized in accordance with these specifications shall be free from any buildup of unadhered wet storage stains (white rust). These corrosion deposits, if present, shall be removed in a manner satisfactory to the Engineer prior to incorporation of the material in the work. After removal of these deposits, the coating shall have a uniform appearance free from uncoated spots, lumps, blisters, gritty areas, acid flux and black spots. Materials with these defects, or not meeting the finish and adherence of coating requirements as defined in the above ASTM specification, will be rejected and shall be immediately removed from the work site. Acceptable material shall be provided to replace rejected material at no additional cost to the State.

Zinc-Rich Paint. Zinc-rich paint used for the field application and repair of galvanized coatings shall meet the following requirements:

- One application of the material shall provide a dry coating thickness of at least 2.0 mils.
- The applied coating shall provide barrier protection and shall be anodic to steel.
- Application of the coating material shall be possible under shop or field conditions.
- The dried film shall have a minimum zinc dust content equal to 94% (by weight).

- E. The brand of material used shall be approved by the galvanizer, and shall be compatible with the galvanizing, and inert in concrete.

Miscellaneous Hardware - Chairs, tie wires, nuts, bolts, washers, other devices, and miscellaneous hardware used to support, position, or fasten the reinforcement shall be made of or coated with, a non-conducting material, or galvanized. The specific hardware that the Contractor proposes to use shall be approved by the Engineer. If the specific hardware is galvanized, the hardware shall be prepared and galvanized in accordance with the requirements of both AASHTO M232 (ASTM A153) and this specification. The deflection of the hardware used to support the reinforcing bar mat shall not exceed ten percent of the specified concrete clear cover.

Mechanical Couplers. Mechanical couplers shall be on the RIDOT Approved Products list or submitted to the Engineer for approval a minimum of 15 working days prior to their use. They shall be sized to fit the reinforcing bar to be spliced and designed such that the splice connection shall meet or exceed 125% of the specified yield strength of the rebar.

- **Replace Subsection M.05.06, Galvanizing in its entirety with the following.**

M.05.06 GALVANIZING. Structural steel shall be galvanized in accordance with the Specifications for Zinc (Hot-dip-Galvanized) Coatings on iron and steel products, AASHTO M111 (ASTM A123). Fasteners and hardware items shall be galvanized in accordance with the specifications for Zinc Coating (Hot-dip) on Iron and Steel Hardware, AASHTO M232 (ASTM A153) except that high strength fasteners shall not be galvanized if hydrogen embrittlement can occur. Corrosion protection for these fasteners shall be per **Subsection 825.03.3(c)**.

- **Replace Subsection M.05.07.2, Metalizing – Blast Abrasive in its entirety with the following.**

M.05.07.2 Blast Abrasive. Material shall be fresh, dry and sharp. The grain size shall be such as to provide a surface profile of 2.0 to 3.0 mils (approximately 30 to 70 mesh). In no case may round, soft sand be used. Samples of the abrasive shall be submitted to and approved by the Engineer prior to the commencement of any work.

The Contractor shall verify that abrasive cleaning materials meet the requirements of SSPC AB2, “Cleanliness of Recycled Ferrous Metallic Abrasives,” or SSPC AB 3, “Newly Manufactured or Remanufactured Steel Abrasive.” The condition and cleanliness of the recycled abrasives shall be in accordance with the fabricators approved quality control program as per SSPC QP3 and/or AISC Special Paint Endorsement.

- **Replace Subsection M.05.07.3, Wire in its entirety with the following.**

M.05.07.3 Wire. The wire used for spraying required herein shall be pure zinc or an alloy consisting of 85 percent zinc and 15 percent aluminum by weight drawn to manufacturer's recommendation for compatibility with equipment being used. The chemical composition shall be in accordance with ASTM B833.

Remove **Section M.06, Paint**, pages M-31 and M-32 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION M.06

PAINT

M.06.01 GENERAL. Obtain certification from the coating manufacturer that all paint materials satisfy composition and testing requirements, are in conformance with the approved qualified products or other applicable requirements, and will not exceed the manufacturer's specified shelf life before use.

Materials will be rejected if the material arrives at the application site in containers other than original, unopened containers; if a container has a break in the lid seal or a puncture; or if the coating materials have started to polymerize, solidify, gel, or deteriorate in any manner.

There shall be no noticeable difference in color between batches of finish paint used on an individual structure, as defined herein: The tri-stimulus color value shall be no greater than a ΔE (color difference) of 2. The Volatile Organic Content (VOC) shall comply with prevailing federal and state regulations.

M.06.01.1 Material Certification.

Test Data: Have the coating manufacturer or an approved laboratory test a sample from each production batch and forward the results to the Resident Engineer. Provide the following test data for each of the coating material components (primer, intermediate and topcoats):

- Infrared spectra (2.5 μm to 15 μm (2.5 to 15 microns))
- Mass per liter (weight per gallon), at 25°C (77F)
- Viscosity in Krebs Units, at 25°C (77F)
- Percent solids by mass (weight)

M.06.01.2 Literature. Product data sheets shall be supplied with each of the products and shall include but not be limited to the following information:

a. Basic Description. Generic type, recommended service environment/use, recommended substrates, recommended surface preparation, recommended compatible coatings and recommended thinners.

b. Physical Characteristics and Performance. Solids by volume of the mixed components, recommended thickness per coat, weathering ability, minimum and maximum recoat interval and cure requirements, per the applicable ASTM standards.

c. Application Instructions. Mixing instructions, pot life for catalyzed materials, temperature and humidity application limitations, instructions for application by spray including equipment recommendations, cleanup recommendations, and storage conditions.

d. Solvent Identification Sheets. Solvent Identification Sheets shall indicate a listing of the volatile portions of vehicle and categorize solvents by type and photochemical reactivity.

e. Product Certification. Certificates of Compliance shall be provided for materials used to meet State Department of Transportation Specifications.

f. Safety Data Sheets. Safety Data Sheets (SDS) shall be provided to the Contractor and Engineer and shall accompany all shipped materials so the person receiving the material is aware of storage requirements and of the hazards presented by the products. Additional copies of the SDS shall be made available upon request.

M.06.01.3 Shipping and Delivery. All paint shall be delivered to the shop or jobsite in their original containers, unopened, and with labels intact.

All coating layers in the Paint system shall be supplied by the same manufacturer.

The Contractor/fabricator shall ensure that sufficient quantities of paint are ordered. All topcoat material shall be supplied from the same lot or batch number.

Unless otherwise specified, all paint furnished shall be delivered in metal containers that are U.S. Standard 5 (five) gallon size or the similar metric equivalent. One gallon containers may be used for small quantities only for touch-up or spot maintenance work.

All containers shall be labeled in accordance with ANSI Z129.1-2000 "Hazardous Industrial Chemicals- Precautionary Labeling"

The following information shall be listed in clear, legible type on the label of each container for each product:

- Manufacturer's name and complete address
- Product name including component type, if applicable
- Color name or number of the particular product or component
- The lot and/or batch number of the product and components
- The date of manufacture of the product and components
- Identification of any toxic substances contained in the product.

M.06.01.4 Sampling. Samples will be randomly selected by the Engineer from the stockpile of material proposed for the work, from each production batch represented by the project stockpile. A production batch is defined as one distinct, identifiable unit of production of material outlined in the manufacturer's quality control plan. The Contractor shall properly mix the contents of each paint component to be sampled by the Engineer, per the manufacturer's recommendations, immediately prior to sampling. The Engineer reserves the right to sample any container of paint material on the job site. No paint shall be applied until the batch sample has been approved by the Engineer. After the samples have been collected, the remainder may be used for the project work, providing the samples pass the testing requirements and are stored prior to use in accordance with the manufacturer's recommendations.

M.06.02 PAINT SYSTEMS. The paint shall be selected from either the NEPCOAT Qualified Products List or as otherwise described in this specification.

M.06.02.1 New or 100% Bare Existing Structural Steel and/or Hardware. Paint systems on the NEPCOAT Qualified Products List are required for new or 100% bare structural steel and any related hardware. Surface preparation shall be per the recommended (not minimum) method as recommended by the manufacturer. Steel that is galvanized or metalized shall omit the specified zinc rich primer. The intermediate and finish coats of NEPCOAT systems shall be used to overcoat galvanizing or metalizing. If the galvanizing or metalizing is damaged, the approved organic zinc-rich primer from the NEPCOAT Qualified Products List for the system shall be applied before applying the intermediate and topcoat.

M.06.02.3 Existing Steel Structures and/or Hardware. This shall apply whenever the surface has been previously coated and/or has rusted, when minimal surface preparation has been specified by the Engineer or requested by the Contractor and approved by the Engineer. The coating system used shall be on the NEPCOAT Qualified Products List, except the zinc rich primer shall be replaced by a surface tolerant product from the same manufacturer and compatible with the coating to be applied over it. The coating system shall be submitted for approval prior to the start of any work. Surface preparation shall be per the manufacturer-recommended (not minimum) method, unless otherwise approved by the Engineer.

M.06.03 CAULKING AND SEALANTS. Supply caulking and sealants that are compatible with the coating system specified for the project. Provide written confirmation from the coating and caulking/sealant manufacturers that the caulking and sealant products are compatible. The color of the caulking or sealants shall be the same as the finish coat color or clear, as approved by the Engineer.

Revise **Subsections M.07.08.2, Concrete** and **M.07.10, Steel Pipe Piles**, page M-35 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION M.07

SHEET PILING AND PILES

- **Replace Subsection M.07.08.2 with the following.**

M.07.08.2 Concrete. Concrete for concrete-filled shell piles shall be Class X(AE) and shall otherwise conform to the applicable requirements of **SECTION 601; PORTLAND CEMENT CONCRETE**, of these Specifications. Reinforcement shall conform to the requirements of **Subsection M.05.01; Bar Reinforcement**, of these Specifications.

- **Replace Subsection M.07.10 with the following.**

M.07.10 STEEL PIPE PILES. This Subsection covers steel piles where the casing is considered a permanent load-carrying member.

M.07.10.1 STEEL PIPE. Steel for pipe piles shall conform to the Standard Specifications for Welded and Seamless Steel Pipe Piles, ASTM A 252, Grade 2.

M.07.10.2 CONCRETE. Concrete for steel pipe piles shall be Class A(AE) and shall otherwise conform to the applicable requirements of **SECTION 601; PORTLAND CEMENT CONCRETE**, of these Specifications.

Remove **Section M.12, Waterproofing, Dampproofing and Sealers**, pages M-45 through M-49 of the RI Standard Specifications for Road and Bridge Construction and replace it with the following.

SECTION M.12

**WATERPROOFING, DAMPPROOFING AND SEALERS
(CONCRETE PROTECTIVE SYSTEMS)**

M.12.01 DAMPPROOFING. Products shall be on the RIDOT Approved Products List

M.12.01.1 Primer shall be as required by the manufacturer,

M.12.01.2 Mop Coats shall conform to ASTM D449.

M.12.02 WATERPROOFING. Products shall be on the RIDOT Approved Products List

M.12.02.1 Hot Applied Liquid Membrane.

a. Surface Conditioner shall be as required by the manufacturer,

b. Waterproof Membrane shall be a single component, hot-applied, rubberized asphalt capable of being applied at a uniform thickness at an application temperature within the range recommended by the manufacturer. After cooling, it shall form a tough, monolithic, flexible membrane, continuously bonded to all concrete surfaces, and meeting the following physical properties.

Test	Method	Required Results
Flash Point	Open Cup	510°F (265°C) min
Water Vapor Transmission	ASTM E96 Vapor transmitted in 24 hrs. gr/hr sq. ft. (g/hr sq. m)	At 77°F (25°C) 0.010 gr.(0.07 g) min At 120°F (49°C) 0.016 gr. (0.11 g) min
Water Vapor Permeability	ASTM E96	0.01 perms max. (0.0066 m perms)
Water Resistance	ASTM D1167 Submerged 96 hours at 120°F (50°C)	No blistering No emulsification No deterioration

Compilation of Approved Specifications

Date: 04/22/2016

Test	Method	Required Results
Water Absorption	Change of mass of coating 3.94x3.94 in. (100x100 mm) applied to glass substrate immersed in water at 120°F (50°C) for 96 hours	Max loss 1.323 gr. (0.189g) Max gain 2.513 gr. (0.359g)
Penetration by Standard Cone	ASTM T187	At 32oF (0oC) less than 35 (1/10 mm) At 77oF (25oC) less than 110 (1/10mm) At 120oF (49oC) less than 200 (1/10mm)
Flow	AASHTO T187 coating bent 75o exposed for 5 hours	At 120oF (49oC) none At 140oF (60oC) 1/8" (3.2 mm) Max.
Low Temperature Flexibility	1/8" (3.2 cm) coating on alum. bent 90 over 1/4" dia. mandrel	No delamination, No cracking At -15oF (-26oC)
Adhesion	1/8" (3.2 cm) coating on alum. bent 90 over 1/4" dia. mandrel	No adhesion failure At -15oF (-26oC)
Heat Aging	Wt. loss in 28 days at 190oF (88oC)	Less than 1%
Elasticity	Reaction to sudden elongation	Min. toughness of 25 in./lbs. (29 cm/kg) 20 in/min (50.8 cm/min)
Toughness (Joules) Ratio of Toughness to Peak Load	AASHTO T187 Ratio of Toughness ft lbs (Joules) to Peak Load pounds (Newtons)	Not less than 4.1 ft lbs (5.5 J) Not less than 0.040
Crack Bridging Capability	3.0+ 0.2mm thick film, tested at -25oC with a crack opening of 3.0+ 0.2mm opening rate of 3.0+ 0.2mm/h for 10 cycles	No cracking No splitting No loss of adhesion

Test	Method	Required Results
Heat Stability	Held for 5 hours at recommended application temperature	Shall meet penetration flow, low temperature flexibility and viscosity requirement
Viscosity	Heated to recommended application temperature	Range 2 to 15 sec

M.12.02.2 Preformed Membranes. The waterproofing membrane shall be provided in rolled sheet form. One face of the membrane shall be adhesive and protected with an easily removable coated backing paper to prevent adhesion of the membrane to itself. The membrane shall be composed of rubberized or polymer modified asphalt, reinforced with a fiberglass or polypropylene mesh or approved equivalent.

a. **Primer** shall be as specified by the membrane manufacturer.

b. **Sheet Membrane** shall conform to the following specifications.

Test	Method	Required Result
Thickness	-	60 mils (\pm 5 mils)
Tensile Strength	Per ASTM D882	50 lbs./in. (88 N/cm) min
Pliability	Per ASTM D146\ At -15°F (-26°C) with 1" (25.4 mm) mandrel	25% elongation, min No cracks or splits
Puncture Resistance	ASTM E154	200 lbs. (890 N) min.
Permeance	ASTM E96	0.1 perms (0.066 m perms), max.

M.12.02.3 Torch-applied Pre-fabricated Membrane. Primer: The primer shall allow the quick application of the prefabricated waterproofing sheet membrane and shall be as specified by the manufacturer of the membrane.

Sheet Membrane: The membrane material shall consist of a prefabricated reinforcement of synthetic nonwoven material, thoroughly impregnated and coated with styrene-butadiene-styrene (SBS) modified bitumen. It shall be provided in rolled sheet form.

Curb bitumen shall be an SBS modified liquid bitumen that conforms to the following tests:

Test	Method	Required Result
Softening Point	ASTM D-2398	Penetration at 77°F

Test	Method	Required Result
Low Temperature Flexibility	Appearance of the membrane lower face after bending at 5°F (-15°C)	No damage
Puncture Resistance	ASTM-E154	315 lbs. (1400 N) min 1 ½ in. (40mm min)
Softening Point	ASTM-D36	≥ 150°C

M.12.02.4 Cold Applied Liquid Membrane.

a. Primer. Primer shall be a 100-percent reactive, monomer or polymer-based, two-component resin.

b. Membrane. The coating system shall be a spray applied, 100% solids, fast cure, high build monomer or polymer system. Primer is required. The membrane system shall pass ASTM C 836 Crack Bridging Test at 80 mils, or the thickness applied shall be at least equal to the thickness used by the manufacturer for the ASTM C 836 Crack Bridging Test. Apply aggregate broadcast into membrane applied at 30 – 40 mils if conditions warrant. A manufacturer-approved tack coat shall be included for overlays on the waterproofing membrane. In addition the membrane shall meet or exceed the following properties, submitted with a Certificate of Compliance, as related to laboratory prepared samples.

Test Method Required Results

Test	Method	Required Results
Initial Cure Time	N/A	30 Minutes, 73°F 50-85% RH
Water Vapor Transmission	ASTM E 96	0.026 gr./ft ² /hr (0.18 g/m ² /hr)
Adhesion to Concrete	ASTM D 4541	>100 psi
Adhesion to Steel	ASTM D 4541	>290 psi
Tensile Strength, Method A, Die C	ASTM D 638	>435 psi
Elongation at Break, Method A, Die C	ASTM D 638	>100%
Low Temperature	¼" (6.35mm) mandrel @ -13°F (-25°C)	Pass
Crack Bridging	ASTM C 836	Pass @ 10 cycles, 0.0625 in, -15°F (1.6mm, -26°C)

M.12.03 CONCRETE PROTECTIVE SEALERS. All material is subject to the approval of the Engineer, shall have been tested and approved by the Engineer prior to the start of application and shall conform to the following requirements.

- a. Shall meet all current Federal and State environmental regulations.
- b. Shall not contain oxidizing ingredients such as marine oils, stearates and vegetable oils.
- c. Shall reduce the chloride intrusion into concrete by 90 percent when tested in accordance with AASHTO T259 "Resistance of Concrete to Chloride Ion Penetration" or by 55 percent when tested in accordance with RIDOT Materials Laboratory Test "Chloride Penetration Resistance of Concrete Sealers" as described in research report FHWA-RI-RD-90-1 "Laboratory Evaluation of Concrete Sealers for Vertical Highway Structures."
- d. Shall reduce the net moisture weight gain of concrete after drying to 30 percent or less as tested in accordance with RIDOT Materials Laboratory Test "Water Absorption and Water Vapor Transmission of Concrete Sealers," as described in RIDOT research report FHWA-RI-RD-90-1 "Laboratory Evaluation of Concrete Sealers for Vertical Highway Structures."
- e. Shall provide effective freeze-thaw protection to the underlying concrete as tested in accordance with ASTM C666; "Resistance of Concrete to Rapid Freezing and Thawing," as modified by RIDOT for coated specimens, as described in RIDOT research report FHWA-RI-RD-90-1 "Laboratory Evaluation of Concrete Sealers for Vertical Highway Structures."
- f. Shall be applied in a minimum of two coats, unless otherwise recommended by the manufacturer.
- g. Shall be used as recommended by the manufacturer. It shall not be diluted or altered in any way.
- h. At least 2 weeks prior to the start of application a one gallon sample of the product and all pertinent information including but not limited to, manufacturer's protective coating test results shall be submitted to the Engineer by the manufacturer.

M.12.03.1 Film Forming Sealers shall form a durable, impermeable surface coat over the concrete substrate, and shall conform to the following.

- a. Shall be a formulation which, when set, is weatherproof, waterproof, resistant to most chemicals, inhibits the intrusion of chloride salts and has exceptionally strong adhesive qualities.
- b. Shall, in the case of two-component coatings, be shipped in new containers identified Part "A" and Part "B," and shall be proportioned in each container to provide the manufacturer's specified mixing ratio.
- c. Shall be applied to concrete median barriers in alternating coats of "light gray" and "white" with the top coat being "white." For structural concrete, the material shall be applied in alternating coats of "white" and "light gray" with the top coat being "light gray." The material shall be applied so that it completely covers the underlying coat.

M.12.03.2 Penetrant Class Sealers shall penetrate the surface of the concrete substrate and leave no visible trace of its presence.

Remove **Section M.15, Traffic Control Systems**, pages M-52 through M-69 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION M.15

TRAFFIC CONTROL AND HIGHWAY LIGHTING SYSTEMS

M.15.01 GROUND RODS. Ground rods shall be a 5/8-inch diameter by 10-foot long rod of copper-clad steel and shall be equipped with a clamp of sufficient size to receive the ground wire.

M.15.02 WIRE AND CABLE.

M.15.02.1 Wire for Highway Lighting.

a. General. Wire and cables shall be single conductor except where otherwise specified or indicated on the Plans. Conductors of sizes No. 10 AWG and larger shall be stranded. Wires of sizes smaller than 10 AWG shall be solid.

The conductors shall be factory identified by printing the size and type of insulation. Each conductor shall be colored in accordance with the National Electric Code. Insulation color shall be constant throughout the length of the conductor and shall not otherwise need to be taped or tagged for identification. The color of the insulation of the neutral conductor shall be white. The remaining conductors shall not be white but shall be of dissimilar colors for identification. The grounding conductor, unless otherwise shown, shall be insulated to 600 volts. The grounding conductor insulation shall be green in color.

b. Conductors. Wire conductors shall be annealed copper conforming to the following specifications as applicable.

American Society for Testing Materials

- ASTM B3 - specification for annealed copper wire.
- ASTM B8 - specification for concentric-lay-standard, copper conductor, hard, medium hard or soft.
- ASTM B33 - specification for tinned soft or annealed copper wire for electrical purposes.

c. Insulation. Insulation shall be indicated and shall conform to the following specifications as applicable.

American Society for Testing Materials

ASTM D1351 - (THW and THWN) specification for polyethylene insulated wire and cable.

ASTM D2655 - XLPE (XHHW-2) specification for crosslink, thermosetting polyethylene insulation for wire and cable 0 to 600 volts.

All wire below finish grade shall be XLPE (XHHW-2). THW or THWN may be used between the handhole and fixture if the percent of wire above ground is greater than the percent below ground.

d. Cable Jacket. Insulation shall be jacketed and have an outer covering as specified in the National Electric Code, Table 310-13, "Conductor Applications and Insulations." When specified by the National Electric Code, the neoprene jacket shall conform to ASTM D752.

e. Insulation and Jacket Thickness. The minimum thickness of insulation and jacket thickness shall be as follows:

Conductor Size	Insulation Thickness in 64ths	Jacket Thickness in Inches
14 thru 10 AWG	3	.015
8 thru 2 AWG	4	.030
1 thru 4/0 AWG	5	.045
250 thru 500 MCM	6	.065
600 thru 1000 MCM	7	.065

M.15.02.2 Ground Wire. Ground wire shall be seven strand, No. 2 AWG or No. 6 AWG, soft drawn copper and shall conform to the requirements of **Para. b** of **Subsection M.15.02.1**.

M.15.02.3 Service Conductors. Service conductors shall be as shown on the Plans, type THHN or TWH and shall meet the requirements of **Para's. a** through **e** of **Subsection M.15.02.1**.

M.15.02.4 Traffic Signal Cable. Traffic signal cable or wire shall conform to IMSA Specification 19-1 or 20-1.

M.15.02.5 Loop Detector Wire. Wire for inductance loop detectors shall consist of No. 14 AWG, meeting the requirements of IMSA Specification 51-5.

A roadway loop embedding sealer approved by the Engineer shall be used to encapsulate traffic signal loop wires embedded in highway materials. The sealer shall be cold applied and may be a one- or two-component system, the viscosity of which shall be sufficient to allow the material to be either poured or placed under pressure and fully encapsulate the loop wires. The sealer shall be curable at temperatures of 40°F and above, and, when bonded to common paving materials, it shall have sufficient strength and resiliency to withstand stresses due to vibrations and differences in expansion and contraction as a result of temperature changes or traffic conditions. The sealer shall be compatible with the sheathing and covering of loop inductance wire, and shall be resistant to most chemicals and solvents, including salts, acids, hydrocarbons, etc.

M.15.02.6 Loop Detector Lead-In Cable. Loop Detector Lead-In Cable shall meet the requirements of IMSA Specification 50-2.

M.15.02.7 In-Line Disconnect Device. Each unfused disconnecting device shall consist of a copper pin and a copper receptacle of at least 90 percent conductivity to be crimped to the cable. The receptacle shall establish contact pressure with the pin through the use of a copper beryllium sleeve spring and shall be equipped with a disposable mounting pin. The receptacle shall be fully annealed. Both the copper pin and receptacle shall have a centrally located recessed locking area adaptor to be complementarily

filled and retained by the rubber housing. The fused disconnecting device shall consist of a spring loaded 90 percent minimum conductivity contact suitable for gripping the specified cartridge fuse. These contacts shall be fully annealed and adapted to be crimped to the cable and shall be adapted to be retained securely in the proper position within the rubber housing. The disconnect device housing shall consist of water resisting synthetic rubber capable of being buried in the ground. Each housing shall provide a section to form a water seal around the cable, have an interior pin or fuse contacts, and a section to provide a water seal between the two housings at the point of disconnection. Each housing shall be permanently marked "load side" or "line side." Fuse for the disconnecting devices shall be rated 600 volts, 100,000 ampere interrupting capacity, and shall be 13/32-inches in diameter.

M.15.02.8 Splice Kits. All material under this item shall consist of a splice made of fabricated 6061-T aluminum and is to be insulated with EPDM rubber compound rated 600 volts to accept copper conductors. Splices shall be approved for submersible installations.

Each splice shall consist of 4 terminals with rubber "boots" suitable to accept recommended conductor sizes. Unused "boots" are to be left intact to keep the watertight integrity of the splice. Splice to be manufactured by HOMAC, RAB 350 Series or approved equal.

M.15.03 HANDHOLES AND PULL BOXES.

M.15.03.1 Precast Handholes and Pull Boxes. Precast Type "A" Handholes, Precast Type "B" Heavy Duty Handholes, and Precast Type "H" Heavy Duty Handholes shall be designed and manufactured in accordance with ASTM C478; "Precast Concrete Manhole Sections," with the additional stipulation that the concrete mix design shall be Class XX (AE) as set forth in **SECTION 601** of these Specifications.

Cast iron frames and covers shall conform to the relevant provision of **Subsection M.04.03.6**, or as indicated on the drawings. Covers on traffic signal handholes shall have the word "Signal" cast into them. Covers on telephone handholes shall have the word "Comm" cast into them. Covers for electric pull boxes shall have the word "Electric" cast into them. Frames and covers shall be provided with ground connectors as shown in the standard drawings for bonding purposes.

Steel reinforcing shall conform to the relevant requirements of **Subsection M.05.01** of these Specifications.

Support grips shall be provided for each cable, including ground wire, in each handhole or pull box. Supporting grips shall be of the closed mesh type for permanent support of the cable; ends shall be made of stainless steel and shall have the capability of supporting 600 pounds complete with supporting hook.

M.15.03.2 Metal Pull Boxes.

a. Type V Pull Box (Within Structure). Type "V" pull boxes shall be galvanized steel, thickness as indicated on the standard drawings. Boxes shall be furnished complete with tapped hubs, galvanized checkered plate covers, and neoprene gaskets. The cover shall be fastened flush to the frame using stainless steel bolts with hex head. A grounding lug is to be provided. Sizes shall be as shown on the Plans.

Pull boxes shall be listed by Underwriters Laboratories and shall be tested for submersible application.

Drainage, including a 1-inch plastic drain pipe, shall be provided as shown on the Plans.

b. Type W Pull Box (Surface Mounted). Type “W” pull boxes shall be galvanized steel, thickness as indicated on the standard drawings. Boxes shall be furnished complete with tapped hubs, galvanized checkered plate covers, and neoprene gaskets. The cover shall be fastened using stainless steel screws. The box can be secured by using mounting lugs (optional) or using stainless steel bolts through back or bottom. Alternate methods of securing this box can be made using unistrut or other means accepted by the Engineer. Sizes shall be as shown on the Plans.

Pull boxes shall be listed by Underwriters Laboratories and shall be tested for submersible application.

M.15.04 CONDUIT AND FITTINGS.

M.15.04.1 Rigid Steel Conduit and Fittings. This conduit shall conform to Federal Specification WW-C-581. The latest revision of the Underwriters' Laboratories, Inc. Publication UL-6-Standard for Rigid Metallic Conduit also forms a part of this Specification. In addition to the above requirements, the exterior surface conduit including fittings shall be zinc-coated and the interior coated with zinc, enamel, or other corrosion resisting coating. The conduit shall be metalized galvanized, hot-dip galvanized or electro-galvanized.

Threads and couplings shall conform to the provisions of Appendix III of ASTM A53; “Basic Threading Data for Pipe.”

M.15.04.2 PVC Plastic Conduit. Plastic conduit and elbows shall conform to the NEMA Standards Publication TC 2. Plastic fittings shall conform to the requirements of the NEMA Standards Publication TC 3. All conduit, elbows and fittings shall be UL listed.

M.15.04.3 Fiberglass Conduit. Fiberglass conduit shall be filament-wound reinforced epoxy resin. All conduit shall be manufactured in accordance with NEMA TC 2 and UL 1684. Fittings shall be manufactured using the same materials and process as the conduit.

Joints shall be watertight and have a minimum pullout strength of 2000 pounds. Watertight joints may be formed by the use of a gasket or epoxy adhesive.

Hanger systems for fiberglass conduit on bridge structures shall be as shown on the Plans. No adhesive anchors will be allowed to support the conduit hanger system.

M.15.04.4 Expansion Couplings. The fittings shall be designed to compensate for expansion in a horizontal line of conduit at expansion joints in a structure and shall be as detailed.

Expansion fittings shall provide for a maximum of 4 inches longitudinal conduit movement, 2 inches in either direction. Expansion fittings shall provide for transverse conduit movement as indicated where required by structural conditions.

Expansion fittings shall be bonded with heavy duty, two bolt, ground fittings. Strap type clamps will not be acceptable.

M.15.05 LUMINAIRES.

M.15.05.1 Luminaires with Integral Ballast and Photo Cell. Luminaires shall be multiple cutoff high pressure sodium type. Each luminaire shall be constructed of a two-piece aluminum die-cast housing. Latching assembly shall be a double action snap safety type. The hinge pin and hinge plate shall be of stainless steel with complete sealed and tilted optical system. The projected surface area of each luminaire shall not exceed 2.25 square feet, excluding the photo electric control when required.

The slip fitter shall be of an adjustable type accommodating 1¼-inch to 2-inch diameter pipe with four stud mounting bolts with two "U" brackets locking a full 7½-inch desirable, 5½-inch minimum of bracket to sustain a 130 mph wind load.

Housing for the luminaries shall be die-cast aluminum with standard grey polyester powder coat finish. The optical assembly shall include a specular Alzak aluminum reflector removable without tools. A flat lens heat resistant glass shall be factory installed. The lamp holder shall be of high grade porcelain, mogul base, enclosed type with both axial and vertical adjustment with visible marking. The luminaries shall be of the horizontal type for IES Type III medium cutoff optics.

The high-pressure sodium lamps shall be mogul base, rated 250 volts and have an initial lumen output of 28,500 lumens for 250-watt fixtures and 50,000 lumens for 400-watt fixtures. Lamps shall have a rated average life of 30,000+ hours, and shall be TCLP compliant with a Prompter end-of-life indicator.

The glass envelope of the lamp shall have a maximum diameter of 1-7/8" and maximum overall length (MOL) of 9-3/4". The light center length (LCL) shall not exceed 5-3/4". The lamp base shall be mogul (E), nickel plated brass with a glass insulation between the outer shell and the center contact.

Luminaires shall be provided with twist lock receptacles for individual photoelectric control. Provisions shall be made to orient the receptacles to the north. Receptacles shall be molded hard rubber, and shall be installed with neoprene gasket and retaining ring.

If circuits are energized via a photocell-controlled contactor at the service pedestal, photo-control shorting caps shall be supplied for each luminaire.

M.15.05.2 Ballast. The luminaire shall contain a high-power-factor reactor type ballast, multi-tap connected for 240 volts plus or minus 10% starting voltage. Ballasts shall be suitable for operation at minus 20°F.

M.15.05.3 Photo-Electric Controls. The controls shall be tubeless type suitable for 240-volt operation with the multiple high pressure sodium luminaires specified above. The photo-electric controls shall be rated 105-285 volts, 50/60 cycles, alternating current, 1,800 volt-amperes, for high pressure sodium loads with peak currents not greater than 120 amperes, and shall be rated with an inrush current rating of 60 amperes complete with single-pole, double-throw 1,000 watt relay. Controls shall have an adjustable turn-on at 1.0 - 2.5 foot-candles. The turn-off value shall be 10 foot-candles maximum. The operating level shall be from 0.5- 10 foot-candles.

The temperature operating range shall be from minus 50°F to plus 150°F.

Each photo-electric control shall consist of a dependable, simple, tubeless circuit, including a hermetically sealed, broad area cadmium sulfide photo-cell capable of controlling a relay without intermediate amplification. The relay shall be de-energized during the night with normally closed contacts in the closed position and the luminaire energized. During the day the relay shall be energized with contacts open and the luminaire de-energized. Fail-safe features shall provide for the lighting load to remain turned on in the event of failure of the electric circuit. Directional design features and a time delay shall be incorporated in the photo-electric controls to prevent false turn-offs to headlights and other transient light sources.

The individual components of each photo-electric control shall be mounted on a Bakelite chassis and protected by a weatherproof acrylic housing. The photo-electric controls shall mount directly on the high pressure sodium luminaires and shall conform to EEI-NEMA standards for locking, sealing and base dimensions.

M.15.05.4 Protective Screen for Understructure Luminaire. Angle iron shall be 1½" x 1¼" x 2.34 pounds per foot. Angles shall be galvanized after welding corners and drilling. Wire mesh shall be galvanized chain link type, #6 gauge, with approximately 1-inch square openings.

M.15.06 LIGHT STANDARDS AND FOUNDATIONS.

M.15.06.1 Light Standards. Poles are to be designed for a basic wind speed of 130 miles per hour with 1.14 gust factor with loading in accordance with the latest revision of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

All non-rounded luminaires and high level lighting structures, as defined in the latest revision of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals on Interstate Highways or limited access type facilities must comply with fatigue Category I requirements, including galloping, vortex shedding (if applicable), natural wind gusts, and truck induced gusts. The truck induced loading shall be based on 65 mph velocity.

All non-rounded luminaires and high level lighting structures on all other roadways must comply with fatigue Category II requirements, including galloping, vortex shedding (if applicable), natural winds gusts, and truck induced gusts. The truck induced loading shall be based on 30 mph velocity.

Lighting structures that have a taper of 0.14 inch per foot or greater are not susceptible to vortex shedding.

Structural components and their connections shall be designed to resist the worst-case fatigue loading, upon evaluation of all applicable cases acting separately.

The design of anchor bolts shall result in a ductile steel failure prior to any sudden brittle failure of the concrete.

The breakaway support couplings shall meet the requirements of the latest revision of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Design and fabrication of aluminum lighting standards for the support of high pressure sodium luminaires shall be similar and compatible in design and appearance with lighting standards installed on various sections of Interstate highways in the State of Rhode Island, except as otherwise noted or indicated on the Plans. The nominal luminaire mounting heights shall be 30 and 40 feet.

Each shaft shall be tempered by a cold working process from a seamless extruded tube of 6063-T6 or 6005-T5 wrought-aluminum alloy. The davit arm shall taper from 6 inches at the base to 4 inches at the tip.

A 2-inch diameter slip fitter, 9 inches long, shall be provided at the end of each davit arm.

All arms shall be curved on an approved radius through an angle within 3 degrees of the horizontal. Twin davit lighting standards shall be provided with approved type field joints. The bottom of the bases shall be coated with bituminous paint after assembly.

The base shall be of 356-T4 permanent mold cast aluminum alloy. The base shall be approximately 12 inches square at the bottom with a height of 3½-inches. Welding shall be performed by the inert gas shielding arc method, and welds shall be free from cracks and porosity. The base shall have slotted anchor bolt holes to allow mounting on 11-inch or 12-inch bolt circles. Bases shall be provided with cast aluminum bolt covers.

The aluminum after fabrication shall have a minimum yield limit of 25,000 pounds per square inch. The shaft shall be capable of withstanding 1,500-pound horizontal load 18 inches down from the top without fracture or apparent permanent deformation after the load has been released. The base shall be capable of withstanding the maximum allowable bending moment of the shaft, but not less than 18,500 foot-pounds.

When the arm is welded to the shaft, the arm shall withstand a vertical load of 100 pounds and a horizontal load of 50 pounds applied at the end of the arm without fracture or permanent deformation after the load has been removed.

M.15.06.2 Light Standard Foundation.

a. Concrete. Light standard foundations may be cast in place or precast units. Cast-in-place units shall be constructed of Class A(AE) cement concrete masonry. Precast units shall be constructed of Class XX(AE) cement concrete masonry.

Cement concrete masonry shall conform to the applicable provisions of **SECTION 601** of these Specifications.

b. Steel Reinforcement. Steel reinforcement shall conform to the requirements of **Subsection M.05.01.**

c. Anchor Bolts. Anchor bolts shall be high strength steel having a minimum yield of 55,000 psi. They shall be 1 inch in diameter by 66 inches long, with a 4-inch L bend on the unthreaded end. Each anchor bolt shall have cut or rolled thread 6 inches long. These threads shall be one inch-8 National Coarse Class 2 fit. A hexagon nut and leveling washers shall be furnished with each bolt. The anchor bolt, washers and the hexagon nut shall be hot dipped galvanized conforming to ASTM A153.

Anchor bolts for roadway lighting are to be provided and set according to templates furnished by the manufacturer.

Anchor bolts for bridge lighting are to be furnished as detailed on structural drawings.

d. Steel Conduit. Steel conduit, elbows, and fittings shall conform to the provisions of **Subsection M.15.04** of this Section.

e. Breakaway Support Couplings. The breakaway support couplings shall be the same as those manufactured by Manitoba Safe-T-Base of Winnipeg, Canada, or an approved equal.

M.15.07 SERVICE PEDESTAL. Service shall be at 120/240, 120/208 or 240/480 volt, single phase, three-wire.

M.15.07.1 Enclosure. Exterior mounted, weatherproof, NEMA 3R, Type 304 stainless steel two-door service enclosure with body stiffeners and mounting shall be provided on a concrete pad and shall conform to the general arrangement and dimensions indicated. The enclosure walls and top shall be cast solid with one opening on the north wall. This opening shall be covered with a lexan, watertight window approximately 5½-inches by 9 inches long. A 10-gauge steel back panel with white baked enamel finish shall be provided for mounting the panelboard, photo control, relay and contactor. The back panel shall be drilled and tapped as required to mount equipment. The enclosure shall be provided with stainless steel, hinged bolted gasketed doors, combination flush access handles, hasp and brass padlock, directory frame and two sets of keys. The enclosure shall be anchored to the concrete base using two (2) 1/2-inch "thunderstuds" stainless steel anchor bolts on each side embedded into the concrete. The service pedestal shall be provided with a 1/4-inch thick by 2-inch wide neoprene gasket continuous around the perimeter of the enclosure base. Joints or splices in gasket shall be vulcanized in an approved manner. The entire installation shall be watertight.

The enclosure shall include space for all materials listed.

The enclosure shall have a watertight air vent in the roof, a 20 amp GFI receptacle, a keyless light with 15-amp single pole switch, and a 500-watt electric utility heater with controlling thermostat mounted inside at the base.

M.15.07.2 Panelboards and Miscellaneous Equipment.

a. 240/480 Volt, Single-Phase, Three-Wire Service. For 240/480 volt services, panelboards and other miscellaneous electrical equipment shall be provided as shown on the Standard Details.

Panelboards and other equipment shall be of dead front safety type with breaker sizes as shown on the Plans, and all conductors enclosed in conduit or other approved enclosed wireways.

The circuit breaker mechanisms shall be quick-make, quick-break on manual as well as automatic and shall be trip-free from the handle so that the contacts cannot be held closed against circuit faults or abnormal overloads.

The main circuit breaker shall be two-pole 200-amp, rated 600 volts in a NEMA 1 enclosure. The main breaker shall have a 200-amp trip setting and have a minimum interrupting rating of 22,000

amps at 480 volts. The breaker shall have dual lug capabilities on the load side or an auxiliary distribution power block shall be provided.

The controlled lighting panelboard shall be a 225-amp, single-phase, 3-wire with 32 circuit positions. All lighting branch circuit breakers shall be single-pole, rated 277 volts, with sizes according to the Plans. Single pole breakers shall have an interrupting rating of not less than 14,000 amps at 277 volts.

A 3.0 Kva dry-type step-down transformer rated 240/480 volts primary to 120/240 volts secondary shall be provided to supply power to the miscellaneous loads distribution panelboard.

Miscellaneous load panelboard shall be rated 100 amps, 120/240 volts, single-phase, three-wire with a 60-amp main breaker and minimum of 12 single-pole positions. Single-pole breakers shall be rated for 120-volt application with an interrupting rating of not less than 10,000 amps at 120 volts.

The mounting panel on which circuit breakers, busses and bolts for making copper connections shall be equipped with lock washers to prevent loosening. Riveter bus connections will not be acceptable. The busses shall be securely fastened to insulating bases and shall have copper based on 1,000 amperes per square inch copper density. Busses shall be drilled and tapped to permit future circuit changes without the necessity for additional machining. Panelboards shall be designed and assembled so any individual breaker may be removed without disturbing adjacent breakers or necessitating the removal or loosening of required insulation. All terminal lugs shall be copper, bronze or brass.

b. 120/240 or 120/208 Volt, Single-Phase, Three-Wire Service. For 120/240 or 120/208 volt services, panelboards and other miscellaneous electrical equipment shall be provided as shown on the Standard Details.

Panelboards and other equipment shall be of dead front safety type with breaker sizes as shown on the Plans, and all conductors enclosed in conduit or other approved enclosed wireways.

The circuit breaker mechanisms shall be quick-make, quick-break on manual as well as automatic and shall be trip-free from the handle so that the contacts cannot be held closed against circuit faults or abnormal overloads.

The main circuit breaker shall be two-pole 200-amp, rated 240 volts in a NEMA 1 enclosure. The main breaker shall have a 200-amp trip setting and have a minimum interrupting rating of 22,000 amps at 240 volts.

Note: For installations where service is at 120/208 volts from a three-phase system, minimum interrupting rating shall be 65,000 amps at 240 volts.

The breaker shall have dual lug capabilities on the load side or an auxiliary distribution power block shall be provided.

Controlled lighting panelboard shall be 225-amp, single-phase, three-wire, with 32 circuit positions for 120/240 volt operation. All lighting branch circuit breakers shall be single-pole, rated 240 volts, with sizes according to the Plans. Single-pole breakers shall have an interrupting rating of not less than 10,000 amps at 120 volts. The mounting panel on which circuit breakers, busses and bolts for making copper connections shall be equipped with lock washers to prevent loosening. Riveter bus connections will not be acceptable. The busses shall be securely fastened to insulating bases and shall

have copper based on 1,000 amperes per square inch copper density. Busses shall be drilled and tapped to permit future circuit changes without the necessity for additional machining. Panelboards shall be designed and assembled so any individual breaker may be removed without disturbing adjacent breakers or necessitating the removal or loosening of required insulation. All terminal lugs shall be copper, bronze or brass.

Miscellaneous load panelboard shall be rated 100 amps, 120/240 volts, single-phase, three-wire with a 60-amp main breaker and minimum of 12 single-pole positions.

M.15.07.3 Service Pedestal Concrete Mat. The service cabinet concrete mat shall be constructed of Class A(AE) concrete in accordance with **SECTION 601; PORTLAND CEMENT CONCRETE**, of these Specifications.

M.15.07.4 Photo-Electric Control. Photo-electric controls shall conform to the requirements of **Subsection M.15.05.3** of this Section, and shall mount inside the service pedestal or as indicated on the Plans.

M.15.07.5 Contactors. Contactors shall be rated for H.I.D. lighting inductive loads, 600 volts, 2-pole, continuous duty ampere as indicated and shall be mechanically held. Contacts shall be silver tungsten. A separate 120- volt circuit shall be provided for coil operation with a hand-off automatic selector switch. Contactor to be ASCO 920 or approved equal.

M.15.07.6 Poles. Poles for temporary work shall conform to U.S.A.S.I. Class 5. Poles shall be southern yellow pine treated in accordance with **Subsection M.11.03; Preservative Treatment**, of these Specifications.

M.15.08 SERVICE UNITS.

a. Disconnect Switch. Disconnect switch shall be of the fusible type, heavy duty, 250 Volt A.C., NEMA 3R rain-tight and shall conform to Federal Specification W-S-865.

b. Fuses. Fuses shall be dual-element and shall be capable of carrying 500 percent of the indicated rating for a minimum of 10 seconds, shall have an interrupting rating of 100,000 RMS amperes and shall have standard National Electrical Code dimensions.

c. Disconnect Switches – Lighting Pedestals. For 240/480 volt and 120/208 volt services, a safety disconnect switch must be installed ahead of the meter socket for cold-sequence operation. The disconnect switch shall be rated 2-pole, 3-wire, 600-volt enclosed in a NEMA 3R enclosure. The switch shall have the capability of being locked with customer or utility padlocks for safety installation and removal of the utility meter.

M.15.09 METER SOCKETS. Meter sockets shall be provided at all service pedestals, traffic signal controllers, intersection control beacons and counter stations. Meter sockets for all of the above applications shall be 5-terminal duncan type and meet all requirements of the local utility company. Meter sockets for traffic signal controllers and service pedestals shall include a manual by-pass.

The line side of the service conductors shall be encased in a watertight PVC conduit within the service enclosure or signal cabinet.

M.15.10 POLE LINE HARDWARE. All miscellaneous pole line hardware required to complete the project as planned shall be standard material manufactured for pole line construction. All metal parts shall be hot-dipped galvanized.

In addition to the above, whenever secondary racks are required they shall be as classified "Heavy Service Secondary Rack" by the EEI-NEMA, and shall have a minimum spacing of 12 inches between the insulators. Each rack shall be secured to the pole by not less than one through bolt and one lag bolt.

All pole hardware, bolts, plate rods, hangers, clips, wire guards and pole bands shall be hot-dipped galvanized in conformance with the requirements of ASTM A153.

M.15.11 METALS. Metals for light standards, poles, bases and hardware shall conform to the same specifications as set forth in **Subsection M.16.04.3** except that design stresses may conform with CE Paper 3341 for 6061-T6 aluminum as it may be modified by subsequent AASHTO publications.

M.15.12 MESSENGER CABLE, FITTINGS. Messenger cable shall be wire steel strand messenger cable conforming to ASTM A475, extra-high-strength grade, Class A galvanized, unless otherwise noted on the Plans.

M.15.13 TRAFFIC SIGNAL CONTROLLER UNITS AND CONTROLLER CABINETS.

M.15.13.1 16-Phase Controller Units.

a. General. Controller units shall be completely digital solid-state capable of a minimum of sixteen phases which, when connected to traffic detectors or other means of actuation or a combination thereof, shall operate the electrical traffic signal system at one or more intersections. The controller unit (CU) shall communicate with the malfunction management unit (MMU) via port 1.

The controller unit shall be a Type A1 configuration conforming to Section 3 of the latest edition of the NEMA Standards Publication TS-2, Traffic Controller Assemblies. The CU shall utilize an input/output interface conforming to Subsection 3.3.1 of the NEMA TS-2 Standards for all input/output functions with the back panel terminals and facilities, the malfunction management unit, traffic detector rack(s) and auxiliary devices.

1. Controller Display. Controller units shall utilize liquid crystal displays and be internally illuminated for night viewing. The display shall consist of a minimum of four lines of text with a minimum of 40 characters per line. As a minimum, the model number and software version level shall be displayed.

2. Controller Security Codes. The controller unit shall provide for a user-specified code entry before allowing any data to be altered. All parameters may, however, be viewed without entering a valid security code. Security code access shall be terminated at a fixed time after access was gained or a keystroke was made. The CU may have the ability via keyboard to disable security code access allowing for constant access to parameter changes.

3. Battery Backup. Controller units shall come with a backup for the real-time clock only. The backup system shall be capable of maintaining the real-time clock for a period of 30 days. All program timings are to be maintained in Electronically Erasable Programmable Read-Only Memory (EEPROM).

b. Functional Requirements. Local intersection controller units shall meet the following functional requirements:

1. Programming shall be accomplished by front-panel menu-driven keyboard entry.
2. Controller units shall provide a user programmable daylight savings time capability.
3. Controller units shall provide data uploading and downloading capability to both a remote central computer station and a direct link to a laptop computer. A minimum 25-foot laptop communications cable configured for the supplied equipment shall be provided in the controller cabinet.
4. Controller units shall have the capability of performing dynamic self-diagnostic testing per NEMA TS-2 Standards, Section 3.9.
5. Controller units and all auxiliary devices shall meet all environmental requirements as set forth in NEMA TS-2 Standards, Section 3.9.

c. Additional Requirements.

1. Controller Coordination and Pre-emption. The controller unit shall be capable of both coordinated operation and pre-emption operation in accordance with the NEMA TS-2 Standards, Section 3.

Given split and cycle timings, the controller unit shall provide a means of automatically calculating coordination yield points, permissive periods and force-offs.

2. Phase Designations. The phase data in the controller unit shall match the numbering scheme shown on the Plans and operate in the same sequence as shown in the Phase Sequence Diagram on the Plans. Changes to the phase numbering or phase sequence shown on the Plans must be approved by the Department's Traffic Design Unit before being implemented.

3. Programmable Field Hardware Documentation. Before the traffic signal is placed in operation, each programmable field hardware component shall be completely programmed by the Contractor to reflect timings or settings shown on the Plans. Programming is defined as user programmable keyboard entries or switch settings. Programmable field devices include, but are not limited to, controller units, closed loop system masters, malfunction management units, detector units, modems, radios, pre-emption devices, etc.

4. Controller Guarantee. The entire controller unit shall be warranted to be free from defects in workmanship and material for one year, or for the greater length of time common to trade practice, from the date of acceptance by the Engineer. Any defective parts are to be replaced free of charge. Manufacturers warranties shall become the property of the State at the time of acceptance.

M.15.13.2 Controller Cabinet.

a. General. Controller cabinets shall conform to Section 7 of the NEMA TS-2 Standards. The minimum size controller cabinet to be supplied shall be a size 6(P) cabinet, unless shown otherwise on the Plans. The cabinet finish shall be unpainted natural aluminum, degreased and free of scratches and blemishes. The traffic signal number shall be stenciled on the inside and outside of the cabinet door on State owned signals in 3-inch block letters.

b. Concrete Work Pad. In unpaved areas, a 48" x 30" x 4" concrete work pad shall be installed in front of the cabinet door. The pad shall be placed on 6 inches of gravel borrow subbase. The concrete shall be Class A concrete conforming to the requirements of **SECTION 601; PORTLAND CEMENT CONCRETE**, of these Specifications.

c. Shelves and Document Tray. Each cabinet shall be furnished with a minimum of two movable shelves suitable for placing the controller, MMU, detector racks, modems, radios or any other required equipment. A slide-out document tray shall be mounted below the bottom shelf. The tray shall be of sufficient size to hold cabinet wiring diagrams and two manuals. The tray shall operate by sliding out on nylon rollers or ball bearings and opening a hinged cover to remove documents. The closed cover shall provide a suitable support for resting documents or a laptop computer. All cables shall be tied away to allow the tray to be opened and closed smoothly without any obstructions.

d. Electrical Outlets. In addition to the requirements of the NEMA TS-2 Standards, Section 5.4.2.6, local controller cabinets shall be furnished with a GFI receptacle on the cabinet door and a duplex outlet within the body of the cabinet. Cabinets which are to contain a closed-loop system master controller, a local controller and auxiliary communications equipment (radios or modems) shall have two duplex outlets in addition to the door mounted GFI receptacle.

e. Interior Lighting. In addition to the requirements for an incandescent fixture in NEMA TS-2 Standards, Section 5.4.2.7, cabinets shall be provided with a "goose neck" lamp having a flexible arm and utilizing a 25 watt R14 bulb (115VAC). The lamp shall be mounted at a location on the side panel approximately level with the load switch/terminal panel for concentrated illumination of this area. The lamp shall have its own on/off switch on the unit.

f. Controller Cabinet Documentation. Two sets of complete cabinet schematics and operating manuals for the controller unit, loop detector units, closed loop system master, modem and any other programmable field hardware supplied shall be included as part of the cabinet documentation.

Three hard copy sets of all programmed data shall be supplied to the Department at the time the controller is installed in the field. Each set shall be bound and covered. One set is to remain in the cabinet, one set is to be delivered to Traffic Design, and one set is to be delivered to Traffic Maintenance.

g. Controller Cabinet Service Switches. All cabinet switches shall be clearly labeled to indicate the switch's function. Toggle switches shall indicate the state of each switch position.

1. Open Door Alarm. A pushbutton switch shall be installed on a bracket in the top right of the controller cabinet door. The output of the switch shall be connected to the alarm No. 1 input as defined by the NEMA TS-2 Standards, and record the opening of the cabinet door as a local alarm.

2. Police Door Switches. Police door switches shall have the following:

(a) An Auto/Manual switch that toggles between automatic operation and manual operation. During manual operation, an extendible hand-control pushbutton shall utilize Manual Control Enable and Interval Advance to control the intersection operation. The hand-control pushbutton shall be installed inside the police door. The hand control pushbutton shall be rugged in construction with a weatherproof covering over the cord's pushbutton switch.

The auto/manual switch shall be connected to alarm No. 2 as defined by the NEMA TS-2 Standards. When the switch is placed in the manual position, it shall be recorded as a local alarm.

(b) A Signal/Flash switch that toggles between automatic and flashing operation. To insure the controller exits flash properly, the controller External Start input shall be active in the flash position and inactive in the signal (automatic) position. Activation of the Flash switch shall be recorded as a local alarm.

(c) A Signal/Off switch that toggles power on and off to the controller assembly and signals.

Each switch shall be permanently labeled to identify its function.

3. Main Door Switches. All cabinets shall be provided with the following switches on the main door. These switches shall be accessible only when the main door is open.

(a) Momentary pushbutton switches providing calls to vehicle phases 1 through 8, any concurrent or exclusive pedestrian phases, and calls to intersection pre-empt displays.

(b) A Timer On/Off toggle switch that turns power on/off to the controller only. The MMU and other cabinet equipment shall not be affected by this switch.

(c) A three-position Modem Power switch on all controller assemblies containing modems. This switch shall be labeled "Modem Power" and perform the following functions:

On - When in this switch position, constant power shall be supplied to the modem no matter what the user defined output is set for.

Off - When in this switch position, no power shall be supplied to the modem no matter what the user defined output is set for.

T.O.D. - When in this switch position, power shall be supplied to the modem as a function of the user-defined output controlled by time-of-day programming.

Each switch shall be permanently labeled to identify its function.

h. Controller Cabinet Terminal Strips. All terminal connections shall be marked with a number and, where appropriate, the corresponding NEMA function. All labels shall be silk screened or permanent labels.

i. Lightning Protection.

1. AC Service Protection. The traffic signal control assembly shall be equipped with surge protection installed at the power distribution panel. The surge protector shall be an EDCO ACP 340 filtering surge protector, or approved equal, and shall meet or exceed the following electrical specifications:

- (a) Peak Current; 20,000 amps (8x20 microseconds)
- (b) Clamp Voltage @ 20kA; 250 volts typ.
- (c) Response Time; voltage never exceeds 250 volts during surge
- (d) Operating Temperature; -40 to 85 degrees C.

2. Vehicle Loop Detector Protection. Surge protection shall be installed on each loop detector circuit. The surge protection shall be an EDCO SRA6LCA vehicle loop detection surge protection device, or approved equal. The device shall be configured with the type of mounting which best accommodates the type of loop detector lead-in terminal block supplied. It shall meet or exceed the following specifications:

- (a) Peak Surge Current
 - Differential Mode; 400 amps (8x20 microseconds).
 - Common Mode; 1000 amps (8x20 microseconds).
- (b) Estimated Occurrences; 500 @ 200 amps.
- (c) Response Time; 40 nanoseconds.
- (d) Input Capacitance; 35 picofarads.
- (e) Operating Temperature; -40 to 85 degrees C.
- (f) Clamp Voltage @ 400 amps differential mode; 30 volts max.
- (g) Clamp Voltage @ 1000 amps common mode; 40 volts max.

j. Radio Interference Suppressors. Each cabinet shall be equipped with a radio interference suppressor meeting the requirements of Section 5.4 of the NEMA TS-2 Standards.

k. Cabinet Wiring. As a minimum, cabinets shall be wired in accordance with the NEMA TS-2 Standards, Section 5, Terminals and Facilities, as it applies to Type 1, Configuration 3 cabinets, unless otherwise specified in these Specifications. Any power supplies must be shielded with a non-conductive material to prevent accidental contact. Sealers or compounds that are not non-conductive will not be accepted.

A panel shall be provided suitable for terminating: A minimum of 16 loop lead-ins, Rack Power and Ground, Detector Call Terminations, and Phase 2, 4, 6, and 8 pedestrian pushbuttons.

l. Detector Racks. The cabinet shall provide for a minimum of 16 channels of detection, fully wired for all channels.

Detector channels shall be assigned as shown on the Loop Detector Diagram included on the Plans.

All loop detector units shall be rack mounted. Detector units and racks shall conform to the NEMA TS-2 Standards, Sections 2, 5, and 6. Racks shall be of metal construction, providing top and bottom guides for all slots. Racks shall be bolted to the top shelf of the cabinet using wing nuts to simplify their removal. Where an emergency vehicle priority system is being installed, auxiliary rack positions may be used instead of a separate rack to accommodate the selector modules.

The Contractor shall supply and install on the upper left-hand corner of the back of the cabinet door a laminated intersection graphic and table depicting the traffic detector relay channel assignments. The diagram shall be a graphic of the intersection oriented similar to the Plans showing the locations of each loop detector. The diagram shall, at a minimum, include detector numbers, street names, north arrow (oriented similar to Plans), and controller cabinet location. The assignment information shall be included in a table, which shall include, at a minimum, approach name, detector number, terminal numbers, detector rack slot number, relay number, relay channel number, and the phase associated with each detector.

All detector unit delay and extension timings called for on the Plans shall be programmed in the controller unit, not in the detector unit.

m. Load Switches and Flash Transfer Relays. In addition to the requirements of the NEMA TS-2 Standards, Section 6, Auxiliary Devices, all load switches shall utilize optically isolated, encapsulated modular solid state relays. Discrete components on circuit boards will not be accepted. Load switch indicator lights shall be LED type and wired on the input side of the device.

The field electrical loading for flash operation shall be wired through the transfer relays such that the load on the 2-circuit flasher is as balanced as possible within the limitations of the signal phasing.

Controller cabinets shall be furnished with a full complement of load switches and flash transfer relays. This requires a load switch and a flash transfer relay for each back panel position, even if the position is not used.

n. Malfunction Management Unit (MMU). The MMU shall conform to the requirements of Section 4 of the NEMA TS-2 Standards.

o. Master or Local Modem. Provisions for a telephone connection in the cabinet shall be provided at all master controller locations and at selected local controllers as specified on the Plans. At these locations a shelf mounted modem shall be supplied. The modem shall provide a full duplex operation using a 2-wire, dial-up telephone line, and comply with Part 66, FCC Docket 19528. The modem shall support the communications rate of the system software and synchronous and asynchronous data transfer.

The modem shall be wired such that it is capable of being powered down and powered up via a user-defined controller output to automatically reset the modem. The user-defined output shall utilize an interface relay in controlling power to the modem. The user-defined output shall be initially programmed to be on at all times except for a one-minute interval starting at 1:00 a.m. each day.

Originate Manual or Auto Answer operating modes shall be provided. The modem shall provide an Auto Disconnect function that will disconnect the modem due to lack of carrier after 18 seconds. The front diagnostic L.E.D.s shall display, at a minimum, the operational status of the following:

Modem Ready Terminal Ready Receive Data Send Data

Off Hook Carrier Detect Auto Answer High Speed

The modem reset shall be controlled by a switch on the cabinet door as described in **Subsection M.15.13.2; Para. g.3(c)**.

The modem shall include an easily accessible on/off switch operating with power supplied from a controller cabinet duplex outlet. The modem shall have an operating temperature range of -34°C (-30°F) to +74°C (+165°F). Care should be exercised in the organization and construction of the controller cabinet to insure that the opening and closing of the cabinet door does not interfere with the modem's power cable.

p. Bus Interface Unit (BIU). The BIU furnished shall be of the latest manufacture and meet all requirements of Section 8 of the NEMA TS-2 Standards.

M.15.14 DETECTOR RELAYS - LOOP. All detector units shall be rack mounted and meet the provisions of Subsection 6.5; Inductive Loop Detectors of the NEMA Standard Publication No. TS-2, Traffic Controller Assemblies. All delay and extension settings shall be set in the controller unless otherwise directed on the Plans and/or as directed by the Engineer.

M.15.15 VEHICULAR SIGNAL HEADS. Signal heads shall conform to the requirements of the Equipment Standard of the Institute of Transportation Engineers, latest edition. All vehicular signal heads shall be Light Emitting Diode (L.E.D.) Traffic Signal Modules. They shall be 12 inches (300 mm) in diameter, unless otherwise indicated on the Plans.

The L.E.D. signal module shall conform to the requirements of the Purchase Specifications of the Institute of Transportation Engineers, latest edition, for Light Emitting Diode (L.E.D.) Traffic Signal Modules.

An independent laboratory shall certify that the L.E.D. signal module complies with Section 6; Quality Assurance, of the above referenced ITE L.E.D. Purchase Specification.

All L.E.D. lamps shall have a UV stabilized clear lens.

All L.E.D. signal modules shall be warranted against material defects, workmanship and loss of luminous intensity, for a period of 60 months from the time the units are placed in service.

Lamps shall have a minimum of 144 L.E.D.s (light emitting diodes). The lamps shall be wired with parallel circuits, such that one burned out L.E.D. will not affect more than 5 percent of the total circuit.

A filtered power supply engineered to electrically protect the L.E.D.s and maintain a safe and reliable operation shall be provided. In-Line Fusing with a maximum rating of 2 amps shall be provided in the power lead to minimize the effect and repair cost of an extreme over voltage situation or other failure mode. All signals shall be capable of flash operation with no restrictions or degradation of performance.

Lamps shall be provided with 40-inch pigtails. Wires shall be terminated with a crimp style female quick slide 1/4-inch spade lug (16-14 wire size). Lamps shall have color coded 16 AWG wires for identification of heads as follows:

Red L.E.D.	Red with White neutral
Yellow L.E.D.	Yellow with White neutral
Green L.E.D.	Green with White neutral

All modules supplied to be retrofit into existing signal heads shall include a new gasket.

The L.E.D. signal module shall be a single, self-contained device, not requiring on-site assembly for installation into a signal housing. The module shall have a permanent UP ARROW for correctly orienting the module in the signal housing. The manufacturer's name, trademark, serial number and any other necessary identification shall be permanently marked on the backside of the module.

The maximum wattage for a 12-inch (300 mm) ball shall be 25 watts. The maximum wattage for a 12-inch (300 mm) arrow shall be 14 watts.

Red and green arrows, and green/yellow dual indication arrows shall consist of two rows of L.E.D.s. The lamps shall be in parallel circuits such that one burned-out L.E.D. will not affect more than 5 percent of the total circuit.

M.15.16 PEDESTRIAN SIGNAL HEADS. The signals covered under this subsection consist of L.E.D. modules displaying alternating international "HAND" and "WALKING MAN" symbols contained within a weatherproof housing.

L.E.D. signal module shall be a self-contained devise, not requiring on-site assembly for installation. L.E.D. signal modules shall be manufactured to fit in standard 12-inch signal housings as a retrofit replacement for existing signal lamps. All hardware, including screws, washers, nuts and bolts, shall be stainless steel and all other components shall be corrosion resistant. All components shall be readily accessible when the door is open.

The L.E.D. signal module shall consist of a double message overlay combining the "HAND" and "WALKING MAN" symbols. The symbols shall be formed by arranging the L.E.D.s to form a full overlay of each symbol.

The L.E.D. signal module shall conform to the requirements of the Purchase Specification of the Institute of Transportation Engineers, latest edition, for Light Emitting Diode (L.E.D.) Pedestrian Traffic Signal Modules.

M.15.17 PEDESTRIAN PUSHBUTTON DETECTORS.

a. General. Pedestrian pushbutton detector housings shall consist of a cast aluminum enclosure that is free of voids, pits, dents, excessive foundry grinding marks, and other exterior blemishes, and is water-tight and rated for outdoor use. The housing shall be furnished with a hole in the bottom and back that are tapped to accept a 1/2-inch NPT thread plug. The bottom hole shall be supplied with a threaded plug. The back hole shall be supplied with a non-threaded plastic plug or equivalent.

Pedestrian pushbuttons shall be compliant with the latest edition of the U.S. Access Board's ADA Accessibility Guidelines (ADAAG) that are approved by the U.S. DOT, and shall be pressure-activated requiring no more than three (3) pounds of force to activate. Pushbuttons and solid state switches shall be rated to 20 million actuations minimum.

Pedestrian pushbutton detector assemblies shall include a sign with an arrow indicating the direction of the crossing associated with the pushbutton. The sign shall explain the meaning of each of the pedestrian signal indications that may be visible to a pedestrian standing at the button, and shall conform to the specific design included in the latest MUTCD as called for on the Plans. All pedestrian detectors furnished and installed under one Contract shall be identical models of current production, and untried or prototype units will not be acceptable.

b. Accessible Pedestrian Detector – Pushbutton w/ Sign (APD). In addition to the pedestrian pushbutton, housing, and sign assembly requirements described in Subsection “a” above, APDs shall also include features that provide audible, vibrotactile, and other visual information to pedestrians. APDs shall meet or exceed the requirements for Accessible Pedestrian Signals and Detectors included in the latest MUTCD.

APDs shall include a raised vibrotactile arrow incorporated into the pushbutton to clearly indicate the direction of crossing. The raised vibrotactile arrow shall have high visual contrast (light on dark or dark on light) and be aligned parallel to the direction of pedestrian travel on the crosswalk associated with the pushbutton. The vibrotactile arrow shall vibrate when the WALK signal is on for the crosswalk associated with the pushbutton, and shall be motionless at all other times.

APDs shall include an audible pushbutton locator tone to allow visually disabled pedestrians to locate the pushbutton. The locator tone shall be deactivated or silent when the WALK signal is on for the crosswalk associated with the pushbutton and when the traffic signal is operating in a flashing mode; at all other times the locator tone, having a duration of 0.15 seconds or less and repeating at one (1) second intervals, shall emanate from the APD. The volume of the locator tone shall be automatically adjusted in response to ambient sound level, up to a maximum volume of 100 dBA. The Contractor shall initially program the volume-intensity-responsive locator tone to emanate at a minimum of ambient sound and a maximum of 5 dBA louder than ambient sound. The locator tone shall be audible a distance of six (6) to twelve (12) feet away from the pushbutton or to the nearest edge of the building closest to the pushbutton, whichever is less.

APDs shall emanate an audible indication of the WALK signal upon activation of the WALK signal for the crosswalk associated with the pushbutton. Such audible walk indications shall have the same duration as the pedestrian WALK signal except when the pedestrian signal rests in WALK (in the latter case the duration of the audible indication of the WALK signal shall be no more than seven (7) seconds). The APD-emanated indication of the WALK signal shall be audible from the entrance to the crosswalk associated with the pushbutton that is closest to the APD.

Each APD shall be capable of providing either a percussive tone or a verbal speech message for the audible indication of the WALK signal. Unless otherwise noted on the Plans, where at least ten (10) feet separate the APD from another APD, the audible WALK indication shall be a rapid-tick percussive tone, repeating at eight (8) to ten (10) ticks per second and consisting of multiple frequencies with a dominant component at 880 Hz. Where less than ten (10) feet separate the APD from another APD, the audible WALK indication shall be a verbal speech message that is patterned after the model: “Broadway - Walk sign is on to cross Broadway” for concurrent pedestrian crossings (when some vehicles have a green signal during the pedestrian interval), and “Walk sign is on for all crossings” for exclusive pedestrian

crossings (when all vehicles have a red signal during the pedestrian interval). Verbal speech messages shall be recorded in a clear, moderately pitched voice, with excellent diction and moderate pacing. The volume of the audible WALK indication shall be automatically adjusted in response to ambient sound level, up to a maximum volume of 100 dBA. The Contractor shall initially program the volume-intensity-responsive audible WALK indication to emanate at a minimum of ambient sound and a maximum of 5 dBA louder than ambient sound.

APDs shall include a pushbutton confirmation light that is illuminated upon pushbutton activation. Once illuminated, the confirmation light shall remain on until the WALK signal turns on for the crosswalk associated with the pushbutton, when the confirmation light shall turn off. Each actuation of the confirmation light shall be accompanied by the audible verbal speech message: "Wait." The "Wait." speech message shall comply with the same recording, volume adjustment, and initial programming requirements stipulated above for audible WALK indication verbal speech messages.

All sounds shall emanate from the APD via a weather- and water-proof speaker that is protected by a vandal-resistant screen. Minimum and maximum volumes for each different sound shall be able to be programmed independently.

All audible, vibrotactile, and visual features of the APD shall be non-operational when the traffic signal is in flash mode.

Each APD shall be capable of being customized with speech messages that vary from those described above. Unless otherwise called for on the Plans, a wire connection shall be installed from the APD to a control unit in the traffic signal controller cabinet. The control unit shall enable the technician at the cabinet to reprogram, configure, and communicate with each APD installed at the intersection.

c. Accessible Pedestrian Detector – Configuration Device. The device shall be a handheld battery-powered unit capable of communicating wirelessly with APDs installed in the field. The device shall be capable of modifying all configurable settings of the APD.

M.15.18 PAINT COLORS. "Federal Yellow" shall conform to the color standards approved and contained in the "Manual for Signs and Pavement Marking of the National System of Interstate and Defense Highways," standard Interstate colors.

M.15.19 ITEMS REQUIRING A MATERIALS CERTIFICATE AND A CERTIFICATE OF COMPLIANCE. For the following items a Materials Certificate and a Certificate of Compliance will be required confirming their conformance to the requirements set forth in the Special Provisions and/or Plans.

1. Electrical Conduit
2. Stainless Steel Bolts and Nuts
3. Lamps and Luminaires
4. Ballasts (both multiple and series)
5. Conductors

Remove **Subsection M.17.01, Glass Beads – Dual Gradation**, pages M-89 & M-90 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

M.17.01

GLASS BEADS – DUAL GRADATION

M.17.01 GLASS BEADS - DUAL GRADATION.

M.17.01.1 Scope. This Specification covers the requirements for glass beads which are to be dropped onto white and yellow pavement marking material to produce a highly weather and-wear resistant reflectorized traffic marking.

M.17.01.2 Detailed Requirements.

a. Reflective Glass Spheres. The glass spheres shall be transparent, clean, smooth and spherically shaped, free of milkiness, pits, or excessive air bubbles, manufactured with virgin or recycled glass cullet, meet AASHTO M247, and conform to the following specific requirements:

1. Coatings. The spheres shall be coated to enhance their embedment characteristics to the binder. They shall show no tendency to absorb moisture in storage and shall remain free of clusters and hard lumps.

2. Quality Assurance. The spheres shall be segregated into maximum lots of 2,500 pounds and lot numbers shall be stamped onto each. Each lot shall be tested for gradation, rounds and coating and a Certificate of Compliance stating such will accompany each lot.

3. Gradation. The glass spheres shall meet the following gradation requirements when tested in accordance with ASTM D1214:

Sieve Size Passing	Type I	Percent Passing	Sieve Size	Type II	Percent
10		100	20		95-100
12		95-100	30		80-95
14		80-95	50		9-42
16		10-40	80		0-10
18		0-5	--		----
20		0-2	--		----

4. Roundness. The glass spheres shall have a minimum of 80 percent rounds per screen for the two highest sieve quantities for Types I and II, and no more than 3 percent angular particles per screen for the Type I gradation. The remaining fractions shall typically be no less than 75 percent rounds as tested according to ASTM D1155, Procedure A.

5. Refractive Index. The glass spheres shall have a refractive index of 1.50 to 1.52.

6. Silica Content. The silica content of the glass spheres shall not be less than 60 percent.

7. Packaging. Reflective glass spheres shall be shipped in moisture resistant bags. Each bag shall be marked with the name and address of the manufacturer, the name and net weight of the material, batch or lot number, and shall include a certified test report stating that they meet the above test requirements.

8. Toxicity Characteristics. Glass spheres shall contain no more than 75 ppm of Arsenic, 100 ppm of Lead, and/or 100 ppm of Antimony when determined by EPA Methods 6010B and 3052.

Revise **Subsection M.17.04, Epoxy Resin Pavement Markings**, page M-95 of the RI Standard Specifications for Road and Bridge Construction as follows.

M.17.04

EPOXY RESIN PAVEMENT MARKINGS

- **Replace Subsection M.17.04.1a, paragraph (2) with the following.**

2. Composition. The overall Paint Composition shall be left to the discretion of the manufacturer, but shall meet the following requirements.

White:	Titanium Dioxide	20 ±2 percent, by weight
	ASTM D476 Type II/III	
	Epoxy Resin	80 ±2 percent, by weight
Yellow (lead-free):	Titanium Dioxide	15 ±3 percent, by weight
	ASTM D476 Type II/III	
	Epoxy Resin	73 - 82 percent, by weight
	Organic Yellow	6 – 9 percent, by weight

Revise **Section M.18, Landscaping Materials**, page M-97 to M-107 of the RI Standard Specifications for Road and Bridge Construction as follows.

SECTION M.18

LANDSCAPING MATERIALS

- **Replace Subsection M.18.01; Loam in its entirety with the following.**

M.18.01 LOAM. The material to be furnished shall consist of screened loose, friable, fine sandy loam or sandy loam, as defined by the USDA's Soil Conservation Service in the Soil Survey Manual issued in 1993, free of subsoil, refuse, stumps, roots, rocks, cobbles, stones, brush, noxious weeds, litter and other materials which are larger than ½-inch in any dimension and which will prevent the formation of a suitable seed bed. Organic matter shall constitute not less than 5 percent nor more than 20 percent of the loam as determined by loss-on-ignition of oven dried samples that have been drawn by the Engineer, unless otherwise specified or directed. The loam shall have an acidity range of 5.5 pH to 7.6 pH. The Contractor shall notify the Department of the intended source of loam to be employed at least two weeks prior to the intended time of use to allow time for sampling.

Loam shall conform to all applicable specification requirements prior to its final placement on the project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

- **Replace Subsection M.18.02; Plantable Soil in its entirety with the following.**

M.18.02 PLANTABLE SOIL. The material to be furnished shall consist of loose, friable topsoil free of refuse, brush, stumps, roots, rocks, cobbles, stones, noxious weeds, litter, and other materials which are longer than 1 inch in any dimension and which will prevent the formation of a suitable seed bed. Organic matter shall constitute not less than 4 percent nor more than 20 percent of the Plantable Soil as determined by loss-on-ignition of oven dried samples that have been drawn by the Engineer, unless otherwise specified or directed. The Plantable Soil shall have an acidity range of approximately 5.5 pH to 7.5 pH.

The composition of Plantable Soil can also be arrived at by thoroughly mixing a suitable organic soil with a suitable subsoil. The resulting mix shall be a homogeneous material free from hard lumps, other materials specified above and be capable of supporting plant growth. This soil mixture must meet the above specified requirements for organic matter content and pH. The Contractor shall notify the Department of the intended source of Plantable Soil to be employed at least two weeks prior to the intended time of use to allow for sampling.

Plantable Soil shall conform to all applicable specification requirements prior to its final placement on the project. The practice of culling deleterious or out of specification material after placement and/or grading in-place will not be allowed.

Add the following new **Section M.19, Ant-Graffiti Systems** to the RI Standard Specifications for Road and Bridge Construction.

M.19

ANTI-GRAFFITI SYSTEMS

M.19.01 Approved Products. The anti-graffiti protective coating system shall be one of two types, sacrificial or non-sacrificial, as defined in the contract documents. The system may be applied to any construction material surface, but shall only be applied to substrates for which they are formulated. The system provided shall be on the RIDOT Approved Products List and as approved by the Department for the application.

M.19.02 Non Approved Products Submitted for Approval. Products not on the RIDOT Approved Products List may be considered by the Department, but must be submitted a minimum of 45 days prior to start of any intended application for review and approval.

M.19.02.01 Product Requirements. The system may be clear, showing the original color and texture of the substrate or pigmented opaque, as defined in the contract documents.

There are two types of anti-graffiti coating systems, which are defined as follows:

1. A sacrificial system, where the top layer is removed completely during cleaning and re-applied as soon as practicable to restore protection.
2. A non-sacrificial system, where the top layer is capable of resisting the cleaning process needed to remove the graffiti.

Either type of system may employ a cleaner provided by the manufacturer of the anti-graffiti system to facilitate removal of graffiti, but the system shall not require a cleaner for complete removal. A demonstration of the system's ability to provide effective protection against graffiti shall be conducted by the manufacturer submitting the product. It shall consist of the complete removal of a range of tagging paints provided by the Engineer from the surface treated with the system. No approval for use on RIDOT projects will be granted unless this test is successfully completed to the satisfaction of the Engineer.

a. Product Performance.

1. The system shall have a proven performance history of effectively protecting surfaces, demonstrated by documentation of a minimum of five (5) applications in the last five (5) years.
2. When applied to concrete, the full system shall be formulated not to cause degradation of the concrete in an aggressive freeze/thaw environment.

b. Documentation:

1. Proper surface preparation procedures shall be provided from the manufacturer's specifications for project substrates.

2. Minimum rates of coverage and number of coats for each layer, as applicable, and equipment needed for the application, shall be defined, based on the manufacturer's specifications.

3. A safety data sheet (SDS) shall be provided for each component of the system.

c. Product Delivery and Storage.

1. The product shall be delivered to the job site in manufacturer's containers, with seals unbroken. The containers shall be properly labeled including the batch number and the date of manufacture.

2. The materials shall be protected from the elements and remain in the original unopened containers until the time of immediate use to prevent contamination by foreign materials.