

August 29, 2018

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATION
DEPARTMENT OF ADMINISTRATION

DIVISION OF PURCHASES BID NO. 7596589

RHODE ISLAND DEPARTMENT OF TRANSPORTATION

RHODE ISLAND CONTRACT NO.2018-CB-061

FEDERAL-AID PROJECT NO. FAP Nos: BHO-015A(001)

Bridge Group 15A - East Bay

On Bridge Nos. 011401, 012201, 012301, 012401, 012501, 012901, 013301, 013501, 015101, 020001, 028201, 029401, 045101, 059501, 059601, 059701, 094101, 094601, 099401, & 113801 and their approach roadways and roadways below the bridges where applicable.

CITY/TOWN OF Barrington, East Providence, Warren

COUNTY OF BRISTOL, PROVIDENCE

NOTICE TO PROSPECTIVE BIDDERS

ADDENDUM NO. 2 Prospective bidders and all concerned are hereby notified of the following changes in the Plans, Specifications, Proposal and Distribution of Quantities for this contract. These changes shall be incorporated in the Plans, Specifications, Proposal and Distribution of Quantities, and shall become an integral part of the Contract Documents.

A. Other Item Changes

1. 907.0100 - WATER FOR DUST CONTROL
Quantity Updated To "36.00".
2. 824.9903 - TEMPORARY STEEL TRAFFIC PLATE – BRIDGE NO. 059501
Quest Item Added.Quantity Updated To "1.00".
3. 824.9904 - TEMPORARY STEEL TRAFFIC PLATE – BRIDGE NO. 059601
Quest Item Added.Quantity Updated To "1.00".
4. 824.9905 - TEMPORARY STEEL TRAFFIC PLATE – BRIDGE NO. 059701
Quest Item Added.Quantity Updated To "1.00".
5. 932.0200 - FULL-DEPTH SAWCUT OF BITUMINOUS PAVEMENT
Quantity Updated To "1620.00".

B. Specification Change/Addition

1. Pages JS-ii
Delete Page JS-ii in its entirety and replace it with revised Page JS-ii (R-1) attached to this Addendum No. 2. Item codes 824.9903 through 824.9905 has been added to the index.
2. Page JS-4 to JS-7
Delete Pages JS-4 through JS-7 in its entirety and replace it with revised Page JS-4 (R-1) through JS-7 (R-1) attached to this addendum No. 2. The Specification has been revised.
3. Pages JS-21
Delete Page JS-21 in its entirety and replace it with revised Page JS-21 (R-1) attached to this Addendum No. 2. The specification has been revised.
4. Pages JS-31 and JS-32
Delete Page JS-31 & JS- 32 in its entirety and replace it with revised Page JS-31 (R-1) & JS-32 (R-1) attached to this Addendum No. 2. The specification has been revised.
5. Page JS-66
Delete Page JS-66 in its entirety and replace it with revised Page JS-66 (R-1) attached to this addendum No. 2. The Specification has been revised.
6. Pages JS-72 and JS-73
Insert new page JS-72 and JS-73 attached with this Addendum No. 2. New Special provision has been added for Items 824.9903 Temporary steel Traffic Plate – Bridge No. 059501, 824.9904 Temporary steel Traffic Plate – Bridge No. 059601, and 824.9905 Temporary steel Traffic Plate – Bridge No. 059701

C. Distribution of Quantities

1. Index Pages
Delete Pages Index 1 through Index 3 in their entirety and replace them with revised Pages Index 1 (R-1) through Index 3 (R-1) attached to this Addendum No. 2. Items with changes are indicated in bold type and new Items 824.9903 Temporary steel Traffic Plate – Bridge No. 059501, 824.9904 Temporary steel Traffic Plate – Bridge No. 059601, and 824.9905 Temporary steel Traffic Plate – Bridge No. 059701, have been added.
2. Item Code 907.0100 Water for Dust Control
Delete page no. 25 and 26 in its entirety and replace with page 25 (R-1) and 26 (R-1) attached to this Addendum No. 2. The quantity for item code 907.0100 has been revised.
3. Item Code 932.0100 Full Depth Sawcut of Bituminous Pavement
Delete Page No. 32 in its entirety and replace with page 32 (R-1) and 32a attached to this Addendum No. 2. The quantity for item code 932.0100 has been revised.
4. Item Code 824.9903 through 824.9905
Delete page no. 38 in its entirety and replace with page 38 (R-1) and 39 attached to this Addendum No. 2. New Items 824.9903 through 824.9905 have been added.

D. Contract Documents

1. General Provisions - Contract Specific Index

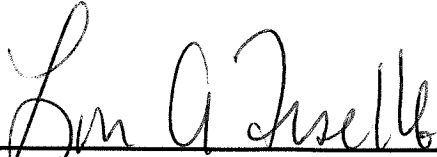
Delete Page CS-ii in its entirety and replace it with revised Page CS-ii (R-1) attached to this Addendum No. 2. Schedule restriction paragraph has been added to the index.

2. General Provisions - Contract Specific Page CS-19

Delete page CS-19 in its entirety and replace with page CS-19 (R - 1) attached to this Addendum No. 2.

3. Compilation of Approved Specifications

Revisions Supplemental Specifications Special Provision Supplement No. 18 and Supplement No. 19 attached to this Addendum No. 2 shall be included with the contract documents.



RI Department of Transportation

Administrator, Division of Project Management

836.9901	Concrete Repair by Surface Application	JS-54
901.9901	Wooden Spacer Block	JS-56
903.9901	Repair Chain Link Fence	JS-57
906.9901	Precast Concrete Curb	JS-58
906.9902	Bituminous Berm	JS-59
907.1000	Dust Control	JS-60
928.9901	Truck Mounted Attenuator (TMA) with Truck Mounted Flashing Arrow Board (TMFAB)	JS-61
937.1000	Maintenance and Movement of Traffic Protective Devices	JS-65
938.1000	Price Adjustments	JS-66
943.0200	On-the-Job-Training	JS-67
L09.9901	Selective Clearing	JS-71
824.9903	Temporary Steel Traffic Plate – Bridge No. 059501	JS-72
824.9904	Temporary Steel Traffic Plate – Bridge No. 059601	JS-72
824.9905	Temporary Steel Traffic Plate – Bridge No. 059701	JS-72

Remove **Subsection 108.03, Prosecution and Progress**, pages 1-56 to 1-69 of the RI Standard Specifications for Road and Bridge Construction its entirety and replace it with the following.

108.03

PROSECUTION AND PROGRESS

108.03 PROSECUTION AND PROGRESS.

a. General Requirements.

1. Project Schedule Program.

The Contractor shall develop and maintain an integrated project management and controls program through Completion of all Projects. The Contractor shall initiate the Schedule Development process upon its receipt of the Post-Qualification notification letter. The Special Provisions of the Contract shall identify the applicable schedule requirements, according to the following levels:

- Schedule Level A. Projects with a high level of complexity, impact to the motoring public or community, and/or larger size Projects.
- Schedule Level B. Projects of average to moderate complexity, moderate impact to the motoring public or community, and/or average size.
- Schedule Level C. Smaller projects with minimal to no complexity, and minimal impact to the community. Examples include Projects such as resurfacing, maintenance, and landscaping.

2. The Contractor's schedule is the primary tool for the Contractor to organize and communicate its plan to timely complete the Project. The Contractor's Schedule shall include all Contract requirements, including Work performed by the State, Contractor, subcontractors, vendors, suppliers, utilities, regulatory agencies, and any other third party. The Contractor's Schedule is used to identify the Critical Path and near-critical activities, assess progress, perform contemporaneous delay analyses, project time and resources required for tasks, and identify opportunities for mitigation, if necessary.

3. If the Contractor fails to provide an acceptable Project Baseline Schedule and Project Schedule Update in accordance with the requirements of the Contract, the Contractor shall be responsible for all delays and resulting costs to the Project.

4. The Department may withhold progress payments if the Contractor fails to submit required Schedule Submissions, including but not limited to Schedule Development, Schedule Updates, Project Meeting Minutes and Recovery Schedule Submissions.

5. Software. The software used to generate the Critical Path Method (CPM) Schedule shall be capable of producing schedules in accordance with the requirements of the Contract Documents

and fully compatible with software utilized by the Engineer, including Primavera Project Planner (P6 Professional Release 8.3) or approved equivalent.

b. Schedule Development.

1. Schedule Development Submittals.

Scheduling and Schedule Submittals shall be based on the defined schedule level. The Schedule Development Process shall commence on the date that the Post-Qualification notification letter is provided to the Contractor, which will be deemed Day 1 for all Schedule Submittals.

2. Meetings will be held as necessary to facilitate the Schedule Development Process. Each Submission shall incorporate the comments from the previous Submission(s). If any Schedule Development Submission does not conform to the Contract, the Contractor shall revise and resubmit prior to proceeding to the next step. Each Submission shall include electronic files in their corresponding format.

The table below details the required Submissions and their corresponding Submission due dates for each schedule level.

STEP	STEP DESCRIPTION*	SCHEDULE LEVEL			ENGINEER REVIEW DEADLINE (After receipt of submission)
		A	B	C	
Step 1	Scheduler's Resume	Day 3		-	3 days
Step 2	Initial Schedule Framework	Day 7	-	-	4 days
Step 3	Complete Schedule Framework	Day 14	Day 14	-	5 days
Step 4	Preliminary Schedule	Day 28	Day 28	Day 28	7 days
Step 5	Baseline Schedule – Activities and Logic	Day 42	Day 42	Day 42	7 days
Step 6	Baseline Schedule – Bid Item Loaded	Day 70**	Day 70**	Day 70**	7 days
Step 7	Baseline Schedule – Resource Loaded Schedule	Day 84	-	-	7 days
Step 8	Project Baseline Schedule	Day 98	Day 98	Day 98	7 days
All days are calendar days					

*Refer to Section 4 for Technical Scheduling Requirements; refer to the Special Provisions for project specific information, including Project Groups, ID Standards, Milestones and Activity Data.

**Required by Day 70 but no earlier than 10 Days after NTP.

The requirements for each Schedule Development Submission are listed below.

Step 1: Scheduler's Resume: The Contractor shall retain a scheduler(s) dedicated full-time to the Project with a minimum of three (3) years' experience on Projects similar in size and scope. The scheduler shall be responsible for developing, updating and maintaining the Schedule. The Contractor shall submit the resume of the proposed scheduler(s) to the Engineer within three days of receipt of the Post Qualification notification letter. The Engineer may impose additional conditions based upon qualifications submitted. The scheduler shall be present at all required meetings, including but not limited to the Schedule Development, Schedule Update, and any other meetings which may affect the project Schedule.

Step 2: Initial Schedule Framework:

- a) Work Breakdown Structure (WBS)
- b) Activity Codes: All Contractor defined activity code values.
- c) Calendars: All Contractor defined calendars
- d) Contractor's Submittal List (including all required Contractor Submittals)
- e) Potential VECP, when not otherwise prohibited in the Contract or alternate sequencing/methods.

Step 3: Complete Schedule Framework:

- a) All requirements of Step 2 with prior comments addressed.
- b) Activity Data for all Milestones, Submittals, Procurement and Work by Others. Data includes:
 - (1) Activity ID;
 - (2) WBS ID;
 - (3) Responsibility (RESP) Code;
 - (4) Activity Type; and
 - (5) Calendar IDs.
- c) Resource Definitions (Level A only): labor resources, work types, and equipment resources detailed by crews, incorporating all Engineer comments to date.

Step 4: Preliminary Schedule:

- a) All requirements of Step 3 with prior comments addressed.
- b) Activity Data, including all logic, for all work required to be performed within the first 120 days after the NTP.
- c) All work after the first 120 days from NTP shall be shown in summary activities (summary activities shall not have durations greater than 60 days).
- d) Narrative explaining the sequence of the work and all critical Submittals and activities.

Step 5: Baseline Schedule – Activities and Logic:

- a) All requirements of Step 4 with prior comments addressed.
- b) Completed Schedule showing all work activities and logic for the complete Contract.
- c) Narrative Report.

Step 6: Baseline Schedule - Bid Item Loaded:

- a) All requirements of Step 5 with prior comments addressed.
- b) Complete Bid Item Loaded Schedule.

- c) Schedule Narrative which shall explain the use of resources and an explanation of all logic changes since the Baseline Schedule Submittal.

Step 7: Baseline Schedule - Resource Loaded Schedule (Level A Only):

- a) All requirements of Step 6 with prior comments addressed.
- b) Resource loading completed for all activities in the Schedule for the entire Project.
- c) Schedule Narrative, which shall explain the use of resources and an explanation of all logic changes made since the Baseline Schedule Submittal.

Step 8: Project Baseline Schedule:

- a) The Contractor shall incorporate and integrate all comments from the previous Steps into the Project Baseline Schedule to conform to the Plans and Specifications.
- b) The Project Baseline Schedule shall be revised and resubmitted until approved by the Engineer. The Contractor shall not change the Project Baseline Schedule after approval by the Engineer.

c. Project Schedule Updates.

Project Update Meetings shall be held every two weeks for Level A and monthly for Levels B and C from the time of Notice to Proceed to the completion of the Project. The Contractor shall be required to attend each meeting with all their update information (data as of the data date) compiled in advance. The Contractor shall furnish meeting minutes from the previous Project Meeting, a complete and accurate report of the current progress, a printed Critical Path report, a report of the days gained or lost relative to the Substantial Completion date and any other completion dates and a depiction of how future Work plans shall meet the Contract completion dates and depiction of how future work plans shall meet the contract completion dates. Failure to attend meetings or submit Schedule Updates may result in withheld Progress Payments. At each meeting, the Contractor shall provide sufficient copies of the updated schedules in the format acceptable by the Engineer.

The Contractor shall submit an electronic copy of the Schedule Update Submittals on the scheduled Project Update Meeting date, or no later than two (2) working days after the Project Schedule Update Meeting. Updates shall be submitted even in the absence of a Project Schedule Update Meeting. The Engineer shall have five (5) working days to review the Schedule Update Submittal. The Schedule Updates shall contain the following components:

- (i) Schedule Update Narrative;
- (ii) Schedule Activity Report – Past Month and Remaining;
- (iii) Schedule Activity Report Longest Path (per completion date);
- (iv) Two week Look Ahead Schedule;
- (iv) Predecessor/Successor Report;
- (v) Schedule Data File;
- (vi) Previous Meeting Minutes, and
- (vii) other reports requested by the Engineer.

Additional Requirements for Schedule Level “A” Projects:

- (i) the Contractor is required to submit a Four-Week Look Ahead Schedule rather than a Two-

Week Look Ahead Schedule, and
(ii) a monthly Resource Utilization Report.

All Schedule data, logic and duration changes, and any modifications to the Schedule shall be addressed and discussed with the Engineer at the Project Schedule Update Meeting. This shall be done prior to the Contractor submitting their final Schedule Updates.

Changes to the accepted Baseline Schedule will be detailed in the Schedule Update Narrative. The acceptance and inclusion of these changes will not be the sole basis of acceptance or entitlement to any time extension(s) or monetary compensation.

Schedule Update Submittals will never be used as the sole basis for any adjustment in the Contract Time(s), regardless of their acceptance by the Engineer. Any acceptance of the Schedule Update Submittal by the Engineer, either expressed or implied, will only apply to the issue of progress.

d. Schedule Requirements. The Department will provide the Contractor with templates during Schedule Development. The Schedules shall be developed and maintained in accordance with the following requirements:

Note: The Contractor shall be aware of the other on-going construction activities within the vicinity of the project locations included in this contract, and shall develop a schedule such that any field work on Bridge Nos. 020001, 028201 and 011401 shall not be initiated until the Fall 2019.

The contractor shall note that activities that alter the existing traffic operations at both bridge locations identified below shall not be performed at the same time:

- **Activities altering existing traffic operations at both Bridge No. 012301 and Bridge No. 012401 shall not be performed at the same time.**
- **Activities altering existing traffic operations at both Bridge No. 011401 and Bridge No. 028201 shall not be performed at the same time.**
- **Activities altering existing traffic operations topside at both Bridge No. 059501 and Bridge No. 059601 shall not be performed at the same time.**

1. Schedule Narrative: A description of the sequence of events summarizing the detailed Milestone Status, Critical Path, and all changes made to the Schedule, including Actual Dates, logic revisions, and Calendar and Duration changes. All Project Schedule Submissions shall include a Schedule Narrative as follows:

(a) Preliminary Schedule Narrative. The Preliminary Schedule Narrative shall:

(1) Identify the data date and schedule file name.

(2) Describe the planned flow of work, including details of all key or driving activities/resources for the first 120 calendar days and summarize Project activities thereafter. Summary activities shall not be greater than 60 calendar days in duration.

- (3) Identify proposed alternative methods and product substitutions.
- (4) Include responses to all Engineer's comments and identify and explain all changes made to the Schedule Submission.
- (5) Identify key constraints and potential problems affecting the Contractor's Work.
- (6) For Schedule Level "A" Projects, the Preliminary Schedule Narrative includes:
 - (i) A detailed summary of planned labor utilization for the Project for the first 120 calendar days, including the average and maximum number of workers by craft designation on site each month, the shifts to be worked and actual and potential labor resource limitations.
 - (ii) A detailed summary of planned operated equipment utilization for the first 120 calendar days, including each type of operated equipment, the quantity each month, the criteria for mobilizing and demobilizing to and from the site and actual and potential resource limitations.
- (b) Baseline Schedule Narrative. The Baseline Schedule Narrative shall:
 - (1) Identify the data date and schedule file name.
 - (2) Describe the planned flow of Work identifying all key or driving resources.
 - (3) Identify proposed alternative methods and product substitutions.
 - (4) Include responses to all Engineer's comments and identify and explain all changes made to the Schedule Submission.
 - (5) Explain treatment of adverse weather in the Baseline Schedule, including all activities that contain contingency days for adverse weather. Lack of preparation for normal adverse weather is non- excusable.
 - (6) Identify key constraints and potential problems affecting the Contractor's Work.
 - (7) For Schedule Level "A" Projects, the Baseline Schedule Narrative shall:
 - (i) Summarize planned labor utilization for the Project, including the average and maximum number of workers by craft designation on site each month, the shifts to be worked and actual and potential labor resource limitations.
 - (ii) Summarize planned operated equipment utilization, including each type of operated equipment, the quantity each month, the criteria for mobilizing and demobilizing to and from the site and actual and potential resource limitations.
 - (iii) Identify resolutions to constraints and potential problems, such as interface with plant operations, coordination with third parties, temporary Contractor facilities or fixed

equipment planned for use.

(c) The Schedule Update Narrative shall:

(1) Identify the Update Period, the data date, and the schedule file name.

(2) Detail the Work accomplished in the past two weeks and Work planned for the next two weeks.

(3) Identify and explain why any planned Work was not accomplished and how it affects the Project.

(4) Describe the activities driving the current critical path to each Milestone or Phase Completion Work.

(5) Identify proposed alternative methods and product substitutions.

(6) Include responses to all Engineer's comments and identify and explain all changes made to the Schedule Submission.

(7) Identify any proposed elective changes, including the activities and logic changed, a description of the scope of the elective change, its effect on the Project, driving resources and key constraints.

2. Additional Requirements for Schedule Level A.

(a) Identification of activities with critical or near critical float (within ten (10) Working Days of the Critical Path) that were planned to occur during the Update Period, but did not occur or occurred later than the scheduled late start or late finish date, and an explanation of these delays. Identification of delays to activities taking place off the Project site, e.g., Submittal preparation, fabrication, and delivery activities.

(b) Provide a listing of all activities which have surpassed their planned duration by more than twenty (20) percent and justification for maintaining original planned durations for future activities of like work.

(c) A summary of changed plans for labor utilization for the Project, identifying the average and maximum number of workers on site each month. Identify actual and potential labor resource limitations. A summary of the actual labor utilization used over the past month.

(d) A summary of changed plans for equipment utilization for the Project, identifying each type of operated equipment to be used on the Work, the planned quantity of each type of operated equipment utilized each month, and all changes to the criteria for mobilizing and demobilizing each piece of equipment to and from the site. Identify actual and potential equipment resource problems. A summary of the actual equipment utilized over the past month.

3. CPM Schedules.

All CPM Schedules shall utilize a Work-Breakdown Structure (WBS) developed by the Contractor. The WBS shall be used as the primary code for displaying and organizing the graphical output schedules utilized for the project, unless otherwise directed by the Engineer. Title case shall be used for WBS and activity descriptions. The following is the basic dictionary for the WBS:

(a) Basic Structure for WBS, where XX are contract specific, alpha-numeric characters that will be defined by the Engineer.

XX.00 Contract Name
XX.10 Milestones
XX.15 Summary Activities
XX.30 Procurement/Shop Drawings
XX.40 Utility/RR & Work by Others
XX.60 Construction

(b) Project Naming Standards:

Preliminary Project Schedule: PS00
Baseline Schedule: BL00
Bi-Weekly Status Schedules: Uxxx
Recovery Schedule: Rxxx

(c) Project Milestones, Interim Completion Dates and Phase Completion Dates. The Contractor shall include Milestones, Interim Completion Dates and/or Phase Completion Dates, if specified in the Contract. Late Finish Constraints shall be assigned to these dates.

(d) Activity Codes. The CPM Schedules shall contain activity code classifications and code values. The Contractor shall propose a coding structure for the Engineer's review and acceptance. The activity code structure combined with the activity identification number shall provide the capability to organize information by location, road or ramp, structure, work type, Subcontractor, discipline, etc., as deemed necessary by the Engineer. The Contractor shall reserve three (3) code classifications (fields) and a minimum of six (6) characters for the Engineer's use.

RESP code will be utilized for identification of responsible party. RESP values shall be discussed at the Schedule Development Meetings.

(e) Activity Descriptions. An activity description shall consist of a work function, construction element and specific location of Work. No two activities will have the same description. Non-specific terminology shall not be used in the activity's description. Any abbreviations used in the activity descriptions shall be defined in the Schedule Narrative Report. The activity description shall be left-justified and in title case.

(f) Activity Durations. The CPM Schedule shall incorporate a minimal number of activities with durations less than two (2) working days and more than twelve (12) working days. The Contractor may request permission from the Engineer to assign durations greater than twelve (12) working days. If

the Engineer accepts the Contractor's request to use a long duration, the reason for the request shall be detailed in the Preliminary and Baseline Schedule Narratives.

(g) Activity Type. The following types of activities are required in the Schedule:

(1) Milestones – The Contractor shall only use this Activity Type for Milestones, Interim Completion Dates and Phased Completion Dates as specified in the Contract.

(2) Summary (Hammock and Level of Effort Activities) Schedule Activities –The Contractor shall maintain a Summary Activity Schedule. These schedule activities shall remain in all of the Schedule Submittals. The predecessor and successor activities of the Summary Activities may be modified to include all those activities that are entered into the Schedule and considered part of the respective Summary Activity's scope of work.

(3) Task Activities - This is the primary activity type. All activities other than Milestone and Summary as defined above shall be task activities.

(h) Activity Dates. Activity Early and Late Start and Finish dates shall be calculated for each activity based upon the schedule data date, actual dates, schedule logic, schedule constraints, calendars, and original duration or remaining duration in accordance with the scheduling parameters defined in this section.

The Contractor shall provide actual start and finish dates to the Engineer for approval. In the event of a disagreement, the Engineer will assign the dates to be used for the activities at issue.

(i) Activity Bid Item Loading. All bid items listed in the proposal pages shall be assigned to its corresponding schedule activity or distributed to a group of activities through the use of Primavera's resources dictionary and resource assignment.

The total value and quantities of the activities allocated to each bid item shall equal the total value and quantities of the corresponding bid item listed in the proposal.

(j) Calendars. The Contractor shall include the below referenced calendars in the Schedule or may request approval from the Engineer to create additional calendars. It is the responsibility of the Contractor to schedule the Work in accordance with the Contract. The Contractor shall not schedule Work during winter shutdown or other contract shutdown periods unless permitted by Contract or as permitted by the Engineer. If work during the winter shutdown period is approved by the Engineer, the Department will not consider delays during this time period eligible for a time extension.

The following calendars are:

Calendar 1 - 5-day workweek (includes Holidays and Winter Shut Down)

Calendar 2 - Procurement

Calendar 3 - 6-day workweek (includes Holidays and Winter Shut Down)

Calendar 4 - 7-day workweek (includes Holidays and Winter Shut Down)

Calendar 5 - 5-day workweek (includes Holidays and No Winter Shut Down)

Calendar 6 - 6-day workweek (includes Holidays and No Winter Shut Down)

Calendar 7 - 7-day workweek (includes Holidays and No Winter Shut Down)
Calendar 8 - Interstate 5-day workweek (includes Holidays & Winter Shut Down)
Calendar 9 - Interstate 6-day workweek (includes Holidays & Winter Shut Down)
Calendar A - Seeding
Calendar B - Wetland Seeding
Calendar C- Plants B&B

(k) Data Date.

The following are the definitions of the data dates for the CPM Schedules:

- (i) Preliminary CPM Schedule –Date of Bid Opening
- (ii) Baseline CPM Schedule –Date of Bid Opening
- (iii) Status Update Schedules –TBD at Schedule Development Meeting

(l) Logic.

(1) The logic in the Schedules shall represent the progression of time and the sequence of work performed within the Contract Time(s). The CPM Schedules shall conform to the following requirements:

(2) Every activity shall have logically assigned predecessors and successors. Unless otherwise specified, “Bid Opening” shall be the only activity without a predecessor, “Substantial Completion” and each Milestone or Phase Completion shall be the only activities without successors.

Activity Constraints are limited to the use of Start-No-Earlier-Than and Finish-No-Later-Than, for access restraints and Completion Milestone(s) or Phase(s). The Contractor shall request permission from the Engineer to use these constraints for other activities prior to the incorporation in the CPM Schedule. The use of “Zero Free Float,” “Start-On,” “Expected Finish,” “Mandatory Start” or “Mandatory Finish” is prohibited.

Activity lag durations shall not have a negative value unless approved by the Engineer. Activity lags shall not be used in lieu of logic relationships.

Redundant ties to preceding activities in a sequential series of activities is not allowed. A tie representing a different constraint will not be considered redundant.

(m) Schedule Layout Requirements. The Engineer will provide the Contractor with the required layouts and templates for the Schedule.

(n) Schedule Calculations. Performing scheduling calculations requires the following settings.

- (1) Turn off automatic scheduling and leveling.
- (2) When scheduling activities, apply retained logic.
- (3) Calculate the start-to-start lag from early start.

- (4) Schedule durations as contiguous.
- (5) Show open ends as non-critical.
- (6) Calculate total float as finish float.
- (7) Summary calculations shall use Calendar No. 1 and the weighting factor for determining percent complete shall be duration.
- (8) Set the auto-inserting option on automatic with a minimum increment of three (3).
- (9) Initially set critical activities using defined critical as total float less than one (1). This option may be changed at the direction of the Engineer.
- (10) Set language for output as U.S. English.

(o) Submittals and Procurement. The Schedule shall include activities for all items within the Contractor's Submittal List (CSL). Each submittal item shall have an activity for submittal preparation, review, fabrication, and delivery. The Contractor is responsible for the accuracy and completeness of its schedule activities, and for any delays resulting from inaccurate or incomplete submissions.

e. Review and Acceptance of Project Schedule Submittals.

The Engineer will review Schedule Submittals for conformance with the requirements of the Contract Documents. The planning, scheduling, and execution of the Work and the accuracy of any Project Schedule is the responsibility of the Contractor. The Contractor remains responsible for errors in any previously accepted Project Schedule, including but not limited to omitted activities, activity durations, relationships between activities, resource allocation, or any float suppression techniques. The Engineer may direct the Contractor to address and adjust schedules that do not accurately reflect the Work at any time, with no additional cost to the State. Acceptance of any Project Schedule does not relieve the Contractor of any responsibility for the completion of the work in conformance with all Contract requirements.

f. Progress Delays.

The Contractor shall identify and promptly report to the Engineer all schedule and progress delays during the prosecution of the work. Whenever the Project Schedule Update indicates late critical path progress by 20% or more in Contract Time, or at the Engineer's request, the Contractor shall develop and submit a Recovery Schedule in the form of a proposed Baseline Schedule Revision.

The Contractor is not relieved from the submission of Project Schedule Updates during the development of a Recovery Schedule.

The Recovery Schedule shall illustrate a clear process and procedure for eliminating or mitigating said delays to the Contract Time(s). The Recovery Schedule shall be submitted within (30) calendar days of the corresponding Project Schedule Update and is subject to approval by the Engineer.

Non-Excusable Delays: The development and submission of the Recovery Schedule shall be at no additional cost to the State.

Excusable Delays: The State may reimburse the Contractor for the costs of the development the Recovery Schedule.

The Engineer may withhold progress payments, either in whole, or in part if the Contractor fails to submit a Recovery Schedule.

1. Baseline Schedule Revisions.

Project Baseline Schedule Revisions shall conform to all requirements for approval of the Project Baseline Schedule and associated updates, including but not limited to inclusion of added or deleted activities, changes to logic or relationships, and a distribution of costs for the added Work or changes.

The Engineer shall review and comment on this revision within 14 calendar days of its submission.

The final draft of the proposed Baseline Schedule Revision shall incorporate all approved changes and be submitted for acceptance within 5 calendar days following the Engineer's approval.

The approved Baseline Schedule Revision shall be referred to as "Baseline Schedule of Record – rev #" in subsequent Project Schedule Update submittals.

A Baseline Schedule Revision is required whenever there is a change to the Baseline Schedule of Record or its corresponding Project Schedule Update, and whenever a Progress Delay threshold is triggered.

- 1) The jackets shall be fabricated from pultruded, hand-laid fiberglass-reinforced polymer (GFRP). The strength and thickness of the jacket walls shall be as required to provide adequate strength and rigidity to withstand forces and stresses it may be subjected to during handling, installation and the pumping of marine grout, but shall not be less than 1/4" inch.
- 2) The exterior surface of the jacket shall be translucent to the extent that progression of grout inside the jacket during pumping can be visually monitored from outside the jacket.
- 3) The inside face of the jacket shall be textured and or roughened similar to a sandblasted surface to ensure a mechanical bond with the marine grout and have no bond-inhibiting agents in contact with the marine grout. Note that all marine grout expelled from the ports and top of the jacket during grout pumping shall be captured by the Contractor and shall not be permitted to fall into the channel.
- 4) The jacket shall be equipped with grouting ports of type, size and locations in accordance with the grout manufacturer's recommendations to ensure uniform distribution of grout.
- 5) The jackets shall be provided with non-corrosive standoffs in accordance with manufacturer's recommendation to ensure the jacket in place without unnecessary damage to jacket and pile surface. Standoffs shall be sized and positioned to minimize interface with the flow of grout.
- 6) The jackets shall be equipped at the bottom with a compressible sealing strip that will effectively seal the annular space between the pile and jacket during grouting procedure.
- 7) The jacket material shall conform to the following physical properties and/or tests:
 - a) Water Absorption (ASTM D570): 1% maximum.
 - b) Ultimate Tensile Strength Longitudinal, Transverse and Diagonal (ASTM D638): 15,000 psi minimum.
 - c) Flexural Strength (ASTM D5224): 25,000 psi minimum.
 - d) Flexural modulus of Elasticity (ASTM D790): 700,000 psi minimum.
 - e) Barcol Hardness (ASTM D2583): 45 plus 5.
 - f) IZOD Impact Strength (ASTM D256): 15 feet -1 lbf/inch (Notched Sample)
- 8) All joints/seams in the jacket material and the grouting ports shall have sufficient strength to assure that they will not open or separate when subjected to installation stresses, waves, currents and grout pumping pressures.
- 9) The lower end of each jacket shall be equipped to provide and/or accept a proper bottom seal.
- 10) A means shall be provided to permit air trapped at the top of the pile jacket around its perimeter to be completely displaced by sound marine grout used to fill the jacket annulus.

JOB SPECIFIC

CODE 818.9901 - BRIDGE DECK REPAIR RAPID SET (PARTIAL DEPTH REMOVAL)

CODE 818.9902 - BRIDGE DECK REPAIR RAPID SET (FULL DEPTH REMOVAL)

DESCRIPTION:

This work shall consist of repairing concrete decks using rapid set concrete in accordance with the details and notes on the plans. Work under this item shall conform to the requirements of SECTION 818 of the Rhode Island Standard Specifications for Road and Bridge Construction as amended herein.

Under this Item the Contractor shall provide temporary steel traffic plates to be used where directed by the Engineer for maintenance of traffic over areas where the concrete has been removed but cannot be replaced in time to allow full roadway traffic operations when required.

MATERIALS:

Materials for this work shall include conformance to the following:

1. Cement Concrete: Rapid-setting, low shrinkage, calcium sulfoaluminate based cement that can be used from ½-inch to 6-inches thick when mixed with sand.

Set time per ASTM C191 (Mod.) at 70°F:

Initial set 17 minutes. Final set 20
minutes.

Compressive strength per ASTM C109 (Mod.):

3 hours	3500 psi
1 day	4000 psi
28 days	5000 psi

Fine Aggregates shall conform to the requirements of Subsection M.02.02.

2. Fine and coarse aggregate for full depth repairs shall be in accordance with Section M.02
3. Mechanical couplers shall be hot-dipped galvanized ASTM A767 Class 1 and shall be one of the following suppliers:
 - a. Meadow Burke, Double Zap Screwlock, <http://meadowburke.com>
 - b. Meadow Burke, Zap Screwlock, <http://meadowburke.com>
 - c. Lenton Quick Wedge Mechanical Lap Coupler, <https://www.erico.com/lenton.asp>

Alternate mechanical splice product may be submitted with sufficient time for review and approval.

A submittal with all procedures, equipment, documentation and any other relevant information should be provided and approved prior to the start of work.

CONSTRUCTION METHODS:

Construction methods as indicated in Section 818 for this work shall include conformance to the following:

1. Reinforcing bars that have lost $\frac{1}{4}$ or more of their original diameter shall be supplemented by new bars lapped in place. Where removal limits are not adequate to prove bar laps, the contractor may use mechanical couplers lapped with new bar as an option to develop the full strength of the reinforcing steel as approved by the engineer. New lap bars shall be positioned to provide the same clear cover as the existing bars.
2. Prior to the removal of concrete, the Contractor shall submit detailed working drawings and design calculations for temporary steel traffic plates. These drawings and design calculations shall be stamped by a licensed Professional Engineer registered in the State of Rhode Island. Traffic will not be allowed on any areas where the Contractor has placed and finished concrete until the material has properly cured and has developed the required 3-hour compressive strength of 3,500 psi as determined by strength test, or as determined by the Engineer.
3. Due to the rapid initial set of the concrete material contractor that organize and personnel and equipment prior to mixing the materials.

METHOD OF MEASUREMENT:

“Bridge Deck Repair Rapid Set (Partial Depth Removal)” and “Bridge Deck Repair Rapid Set (Full Depth Removal)” will be measured by the number square foot of such repairs made in accordance with the Plans and/or as directed by the Engineer.

BASIS OF PAYMENT:

The accepted quantities of “Bridge Deck Repair Rapid Set (Partial Depth Removal)” and “Bridge Deck Repair Rapid Set (Full Depth Removal)” will be paid for at the respective contract unit bid prices per square foot as listed in the proposal. The prices so-stated constitute full and complete compensation for all labor, tools, materials, engineering and equipment, and all other incidentals required to finish the work, complete and accepted by the Engineer. Supplemental reinforcing bars and mechanical splicers shall be paid for separately by force account in accordance with the provisions of SUBSECTION 109.04.

Temporary steel traffic plate is anticipated to be used in Bridge No. 028201, Bridge No. 059501, Bridge No. 059601 & Bridge No. 059701. The item of the work and payment for temporary steel traffic plates will be in accordance with item code 824.9902 through 824.9905 respectively.

END OF SECTION

JOB SPECIFIC

CODE 938.1000 – PRICE ADJUSTMENTS

DESCRIPTION:

- a. **Liquid Asphalt Cement.** The Base Price of Liquid Asphalt Cement as required to implement Subsection 938.03.1 of the Standard Specifications is **\$550.00** per ton.

- b. **Diesel Fuel.** The Base Price of Diesel Fuel as required to implement Subsection 938.03.2 of the Standard Specifications is **\$2.2225** per gallon.

- c. **Steel.** The Base Price of Steel as required to implement subsection 938.03.3 of the Standard Specifications is:

Structural Steel	\$ 0.53 per pound;
Reinforcing Steel	\$ 0.36 per pound;
Stainless Steel	\$ 3.03 per pound;

END OF SECTION

JOB SPECIFIC

CODE 824.9903 TEMPORARY STEEL TRAFFIC PLATE – BRIDGE NO. 059501

CODE 824.9904 TEMPORARY STEEL TRAFFIC PLATE – BRIDGE NO. 059601

CODE 824.9905 TEMPORARY STEEL TRAFFIC PLATE – BRIDGE NO. 059701

DESCRIPTION:

These items of work shall consist of furnishing and installing temporary steel traffic plates bolted to the concrete deck as required to perform the various rehabilitation work at the deck, subbase, and backwalls. Temporary traffic plates are to be used to cover the deck opening during the roadway joint, deck edge/backwall/subbase reconstruction at the abutments, and culvert segmental joint repair. This item of work shall also include all blocking, inserts, anchor bolts, movement of the plates as may be necessary and associated maintenance to complete the work in accordance with these Special Provisions and as detailed on the contract drawing.

MATERIALS:

All materials shall conform to the following requirements:

1. The steel plate shall meet the requirements of AASHTO Designation M270 Grade 36. M270 Grade 50 is an acceptable alternative.
2. The concrete inserts shall be capable of developing the full strength of the bolt.

CONSTRUCTION METHODS:

The entire temporary steel traffic plate including inserts shall be furnished and installed in a sequence consistent with the established maintenance and protection of traffic plan.

The temporary steel traffic plates shall be detailed such that removal and placement of the plates before commencement and after completion of the work is performed expeditiously and in such a manner as to not endanger the motoring public.

The Contractor shall at all times maintain the plates (including concrete inserts), as may be required for the duration of the work.

The minimum plate thickness shall be 1.75", the Contractor shall submit shop drawings and supporting calculations detailing the temporary steel traffic plate, including bolt spacing and inserts, consistent with the proposed sequence of construction. The temporary steel traffic plate shall be so detailed such that the head of the bolts are flush with the top of temporary plate. The shop drawings shall also indicate how the roadway crown and breakpoints shall be accommodated. Shop drawings shall be prepared by a registered professional engineer.

The entire temporary steel traffic plate system shall be dismantled after the completion of the work and any bolt holes in the deck repaired using an approved non-shrink grout to the satisfaction of the Engineer. The steel plates shall become the property of the Contractor.

METHOD OF MEASUREMENT:

These items do not require a measurement for payment.

BASIS OF PAYMENT:

Item Codes 824.9903 through 824.9905 will be paid for at its respective contract "Lump Sum" prices as listed in the Proposal. This payment shall constitute full compensation for all labor, tools materials, equipment, and all other incidentals necessary to properly finish the work, complete and accepted by the Engineer.

END OF SECTION

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201.0415	REMOVE AND DISPOSE GUARDRAIL AND POST ALL TYPES	2
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203.0400	STRUCTURAL EXCAVATION UNCLASSIFIED	2
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206.0312	COMPOST FILTER SOCK 12 INCH DIAMETER	3
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212.2000	CLEANING AND MAINTENANCE OF EROSION CONTROLS	4
302.0100	GRAVEL BORROW SUBBASE COURSE	5
303.0100	SPECIAL GRADED AGGREGATE FOR SHAPING AND TRIMMING DRIVEWAYS OR SHOULDERS	5
401.1000	CLASS 19.0 HMA	5
401.2100	MODIFIED CLASS 12.5 HMA	5
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408.0400	CLEANING, ROUTING, AND SEALING CRACKS IN BITUMINOUS PAVEMENT (LESS THAN ONE INCH)	8
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830.0111	ALUMINUM BRIDGE RAIL 1 BAR STRUCTURAL	20
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Item No.	Item Code	Description	UM	Qty.	Pay Code	Seq. No.
079	905.0140	Cont. BRIDGE 059701				
		BRIDGE 059701		105.00	0014	01
Item 905.0140 Total:				105.00		
080	906.0700	REMOVE, HANDLE, HAUL TRIM RESET	LF			
		CURB EDGING, STRAIGHT, CIRCULAR				
		ALL TYPES				
		BRIDGE 011401				
		BRIDGE 011401		35.00	0014	01
		BRIDGE 012901				
		BRIDGE 012901		10.00	0014	01
		BRIDGE 028201				
		BRIDGE 028201		20.00	0014	01
		BRIDGE 059601				
		BRIDGE 059601		10.00	0014	01
		BRIDGE 094101				
		BRIDGE 094101		250.00	0014	01
Item 906.0700 Total:				325.00		
081	906.9901	PRECAST CONCRETE CURB	LF			
		BRIDGE 059701				
		BRIDGE 059701		1,230.00	0014	01
Item 906.9901 Total:				1,230.00		
082	906.9902	BITUMINOUS BERM	LF			
		BRIDGE 015101				
		BRIDGE 015101		215.00	0014	01
Item 906.9902 Total:				215.00		
083	907.0100	WATER FOR DUST CONTROL	MGAL			
		BRIDGE 011401				
		BRIDGE 011401		1.25	0014	01
		BRIDGE 012901				

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083	907.0100	Cont.				
		BRIDGE 012901		2.25	0014	01
		BRIDGE 013501				
		BRIDGE 013501		1.25	0014	01
		BRIDGE 015101				
		BRIDGE 015101		2.00	0014	01
		BRIDGE 028201				
		BRIDGE 028201		1.75	0014	01
		BRIDGE 029401				
		BRIDGE 029401		3.50	0014	01
		BRIDGE 059501				
		BRIDGE 059501		8.50	0014	01
		BRIDGE 059601				
		BRIDGE 059601		1.00	0014	01
		BRIDGE 059701				
		BRIDGE 059701		9.50	0014	01
		BRIDGE 094101				
		BRIDGE 094101		1.75	0014	01
		BRIDGE 099401				
		BRIDGE 099401		1.50	0014	01
		BRIDGE 113801				
		BRIDGE 113801		1.75	0014	01
Item 907.0100 Total:				36.00		

Item No.	Item Code	Description	UM	Qty.	Pay Code	Seq. No.
084	914.5010	FLAGPERSONS	MHRS			
		011401				
		011401		480.00	0014	01
		012201				
		012201		320.00	0014	01
		012301				
		012301		80.00	0014	01
		012401				
		012401		80.00	0014	01
		012501				

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Item No.	Item Code	Description	UM	Qty.	Pay Code	Seq. No.
098	932.0100 Cont.	BRIDGE 059501		180.00	0014	01
		BRIDGE 059601				
		BRIDGE 059601		44.00	0014	01
		BRIDGE 059701				
		BRIDGE 059701		110.00	0014	01
		BRIDGE 094101				
		BRIDGE 094101		100.00	0014	01
		BRIDGE 099401				
		BRIDGE 099401		85.00	0014	01
		BRIDGE 113801				
		BRIDGE 113801		165.00	0014	01
Item 932.0100 Total:				1,363.00		
099	932.0200	FULL-DEPTH SAWCUT OF BITUMINOUS PAVEMENT	LF			
		BRIDGE 011401				
		BRIDGE 011401		40.00	0014	01
		BRIDGE 012901				
		BRIDGE 012901		18.00	0014	01
		BRIDGE 028201				
		BRIDGE 028201		24.00	0014	01
		BRIDGE 059601				
		BRIDGE 059601		18.00	0014	01
		BRIDGE 059701				
		BRIDGE 059701			0014	01
		BRIDGE 059701				
		BRIDGE 059701		1,260.00	0014	01
		BRIDGE 094101				
		BRIDGE 094101		260.00	0014	01
Item 932.0200 Total:				1,620.00		
100	932.0220	FULL DEPTH SAWCUT OF BITUMINOUS SIDEWALK/DRIVEWAY	LF			

Distribution of Quantities

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Item No.	Item Code	Description	UM	Qty.	Pay Code	Seq. No.
100	932.0220 Cont.	BRIDGE 059701				
		BRIDGE 059701		14.00	0014	01
Item 932.0220 Total:				14.00		
101	932.0230	FULL DEPTH SAWCUT OF PORTLAND CEMENT CONCRETE SIDEWALK/DRIVEWAY	LF			
		BRIDGE 011401				
		BRIDGE 011401		30.00	0014	01
		BRIDGE 012901				
		BRIDGE 012901		25.00	0014	01
		BRIDGE 013501				
		BRIDGE 013501		40.00	0014	01

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116	T20.2014 Cont.	BRIDGE 094101				
		BRIDGE 094101		320.00	0014	01
		BRIDGE 099401				
		BRIDGE 099401		390.00	0014	01
		BRIDGE 113801				
		BRIDGE 113801E		400.00	0014	01
Item T20.2014 Total:				5,035.00		
117	T20.2016	6 INCH EPOXY RESIN PAVEMENT	LF			
		MARKINGS YELLOW				
		BRIDGE 059501				
		BRIDGE 05950		735.00	0014	01
		BRIDGE 059601				
		BRIDGE 059601		175.00	0014	01
Item T20.2016 Total:				910.00		
118	T20.2019	12 INCH EPOXY RESIN PAVEMENT	LF			
		MARKINGS YELLOW				
		BRIDGE 113801				
		BRIDGE 113801		65.00	0014	01
Item T20.2019 Total:				65.00		
119	824.9903	TEMPORARY STEEL TRAFFIC PLATE -	LS			
		BRIDGE NO. 059501				
		BRIDGE NO. 059501				
		BRIDGE NO. 059501		1.00	0014	01
Item 824.9903 Total:				1.00		
120	824.9904	TEMPORARY STEEL TRAFFIC PLATE -	LS			
		BRIDGE NO. 059601				
		BRIDGE NO. 059601				
		BRIDGE NO. 059601		1.00	0014	01
Item 824.9904 Total:				1.00		

Distribution of Quantities

Project Name - Bridge Group 15A - East Bay
 Estimate Name - East Bay Bridge Preservation (Group 15A) - Addendum 2
 R.I. Contract No. - 2018-CB-061
 FAP Nos: BHO-015A(001)

Item No.	Item Code	Description	UM	Qty.	Pay Code	Seq. No.
121	824.9905	TEMPORARY STEEL TRAFFIC PLATE -	LS			
		BRIDGE NO. 059701				
		BRIDGE NO. 059701				
		BRIDGE NO. 059701		1.00	0014	01
Item 824.9905 Total:				1.00		

31	State and Local Police Compensation	CS - 17
32	Inspection Access	CS - 17
33	DBE Requirements	CS - 17
34	Coordination with National Grid Gas During Work on Br. no. 099401 & Br. No. 015101	CS - 17
35	Coordination with G&W Railroad During Work on Br. no. 013501,094101 & Br. No. 094601	CS - 18
36	US Coast Guard Coordination	CS - 18
37	Schedule Restriction	CS - 19
Appendix A:	Transportation Management Plan <ul style="list-style-type: none"> • All Bridges 	
Appendix B:	Environmental Permits <ul style="list-style-type: none"> • Bridge No. 011401, 012901, 015101, 020001, 028201, 094601, 099401, 012201, 012301, 012401, 013301, & 113801 	
Appendix C:	Small-Site Stormwater Pollution Prevention Plan <ul style="list-style-type: none"> • All Bridges 	
Appendix D:	Rhode Island Historical Preservation & Heritage Commission (RIHPHC) PA Form-4-18 <ul style="list-style-type: none"> • All Bridges 	
Appendix E:	National Grid (Gas) Requirement	
Appendix F:	Genesee & Wyoming Railroad Requirements <ul style="list-style-type: none"> • Bridge No. 013501, 094101, & 094601 	
Appendix G:	US Coast Guard Construction Requirements <ul style="list-style-type: none"> • Bridge No.020001 	

to the USCG prior to the start of construction (as indicated in Item 3 of the GCR), as well as any necessary coordination with the USCG during or after construction.

37. SCHEDULE RESTRICTION

The Contractor shall be aware of the other on-going construction activities within the vicinity of the project locations included in this contract, and shall develop a schedule such that any field work on Bridge Nos. 020001, 028201 and 011401 shall not be initiated until the Fall 2019.

COMPILATION OF APPROVED SPECIFICATIONS

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

**REVISIONS
SUPPLEMENTAL SPECIFICATIONS
SPECIAL PROVISIONS**

SUPPLEMENT NO. 18

MARCH 2018

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Remove **Section 206, Perimeter Erosion Controls**, pages AC-12 through AC-16 of the April 2016 Compilation of Approved Specifications in its entirety and replace it 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 five 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 socks 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.

206.01.5 Inlet Sediment Control Device. Inlet Sediment Control Devices shall include the furnishing, installation, maintenance and removal of a reusable fabric sack in drainage structures to prevent silt and sediment from the construction site entering the storm water collection system.

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 fences, 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 (latest revision). Compost filter material shall be in accordance with AASHTO Designation: MP 9-06 (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 inches by 2 inches 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.

206.02.5 Inlet Sediment Control Device. The fabric sack shall be a material suitable for erosion control applications and shall be included on the Department's Approved Materials List or be an approved equivalent. To be approved, proposed equivalents must include the following: a method for securing the device in place, interior handles for use in removing the device for cleaning, and a permanent marking which indicates the level of sediment accumulation at which cleaning is required.

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. Unless otherwise specified, the haybales may be left 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) shall be backfilled, raked, and graded as necessary to match the surrounding grade and then seeded.

206.03.2 Silt Fence.

a. Installation. Silt fences 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 shall 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 includes the removal of the silt fence erosion checks and posts. Silt fences shall not be left to rot in place. A 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 removal, 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 shall 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 includes 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 shall not be left to 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. Prior to removal, 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. Unless otherwise specified, biodegradable filter sock mesh and compost filter material may be left in place. All non-biodegradable mesh material shall be cut open and the mesh removed; the compost filter material may be left in place; however, the material shall be raked out level to surrounding

grades, then seeded. 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**.

206.03.5 Inlet Sediment Control Device.

a. Installation. Inlet Sediment Control Devices shall be installed in catch basins with drop inlets within the project limits and where required by the Engineer.

The device shall be manufactured to fit the opening of the drainage structure under regular flow conditions, and shall be mounted under the grate. The insert sack shall be secured from the surface such that the grate can be removed without the insert discharging into the structure. The sack (filter material) shall be installed, secured, maintained, and removed in accordance with the manufacturer's written instructions and as directed by the Engineer.

Devices shall remain in place until surface borne sediment has been stabilized after completion of final pavement and sidewalk placement, and the adjacent graded areas have become permanently stabilized by vegetative growth, and/or as directed by the Engineer. Devices shall be removed for the period of winter shutdown, provided that the contributing area has been temporarily stabilized to control/prevent alluvial flow. In areas where the devices remain in place during winter shutdown, the contractor is responsible for maintaining them in accordance with this specification, the manufacturer's written instructions, permit requirements, and project specific plan for soil erosion, sediment control and stormwater pollution prevention during the winter shutdown. Following the winter shutdown, the devices shall be reinstalled in accordance with this specification prior to resuming work. Where the devices remain in place during the winter, they shall be removed when the daily temperature is forecast to be at or below freezing.

The Contractor shall inspect the condition of the sacks after each rainstorm of greater than 0.25" as measured by the rain gauge selected for the project in the plan for soil erosion, sediment control and stormwater pollution prevention, or as measured at T.F. Green Airport if the project does not have another gauge selected, and during major rain events. Sacks shall be cleaned periodically, according to manufacturer's written instructions, to remove and legally dispose accumulated material as required. Sacks which become damaged, including damage to the handle(s) required for removing the sack from the basin, during construction operations shall be repaired or replaced immediately at no additional cost or time to the State.

When emptying the sack, the Contractor shall ensure the captured material does not enter the structure. Silt and other debris found in the drainage system at the end of construction shall be removed at the Contractor's expense. The silt and sediment from the sack shall be legally disposed of offsite. Under no condition shall silt and sediment from the insert be deposited on site or used in construction. All curb inlets shall be blocked to prevent stormwater from bypassing the device.

b. Removal. Inlet Sediment Control Devices, including all silt and debris, shall be removed in their entirety at the conclusion of the project in accordance with the applicable provisions of **Section 212** of these Specifications.

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.

206.04.5 Inlet Sediment Control Device. "Inlet Sediment Control Device" will be measured by the number of units per each actually furnished, installed, maintained and removed 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 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 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 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 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 incidentals required to finish the work complete and accepted by the Engineer.

206.05.5 Inlet Sediment Control Device. The accepted quantity of “Inlet Sediment Control 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 materials, labor and equipment, and all incidental costs required to finish the work, complete and accepted by the Engineer.

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

Remove **Section 401; Dense Graded Bituminous Concrete Pavements**, pages AC-23 through AC-46 of the April 2016 Compilation of Approved Specifications 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. No more than 10% of the aggregate in the HMA shall be natural sand with the exception of Class 4.75 HMA which shall include no more than 20%.

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 approval.
- After approval, the three trial aggregate blend gradations shall be blended and submitted in accordance with Section 4.2 of AASHTO R 35.
- 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 312) 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. Samples shall be taken by the Contractor at the direction and in the presence of the Engineer in accordance with AASHTO T 168. The Engineer will take immediate possession of the samples. Samples not provided to the Engineer immediately will not be used for acceptance. Contractor personnel shall be certified by NETTCP (Northeast Transportation Training and Certification Program) as an HMA Plant Technician and subject to RIDOT Independent Assurance Sampling and Testing.

1. Gradation, Binder Content and Air Void Content

Gradations will be performed in accordance with AASHTO T 30. The 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. Acceptance sampling will resume with the subsequent subplot or as determined by the Engineer.

Binder content will be determined in accordance with AASHTO T 308. Air voids will be determined in accordance with AASHTO T 269. 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%

Any combination of gradation, binder content and voids that exceed specifications on two consecutive tests requires the Contractor to shut down the plant. Trial batches shall not be sampled by the Contractor until acceptance testing is complete. 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 120 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 120 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 directed 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. 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:

(d) Name of customer.

(e) Name of project and contract number.

(f) Truck identification and name of driver.

(g) Class of HMA.

(h) 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 ensure 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.

Tri-axle trucks shall be loaded using a minimum of two drops, front and back. Trailers shall be loaded using a minimum of three drops with the center drop always occurring last.

Cleaning of equipment (vehicles, truck beds, etc.) in areas to be paved is prohibited. Any HMA placed in areas where cleaning takes place is subject to rejection by the Engineer.

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 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

Waterman Street/So. Angell Street to Broadway
Access Roadway

401.03.2 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.

Unless otherwise permitted by the Engineer, auger extensions shall be used when the end of the screed extension is more than two feet from the end of the augers.

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.

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.

a. 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. Transverse joints that are constructed to accommodate paving shall be clean, smooth, uniform, vertical, and shall be made using a fixed depth road saw.

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.

Catch basins shall be adequately covered and protected to prevent HMA from entering the basin and to enable the grate to be normally removed after paving. If paving results in HMA entering the catch basin or in bonding the grate to the frame preventing its normal removal, the contractor shall remove all HMA from the catch basin and clean the grate to debond it at no additional cost to the State.

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 taken in accordance with AASHTO R 67. All cores shall be taken by the Contractor under the direction of and witnessed by the Engineer. 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.

Bulk specific gravities will be determined in accordance with AASHTO T 166, regardless of whether the absorption exceeds 2.0%. The cores will be retained by the Engineer for 4 weeks after the results are reported to the Contractor.

For HMA designated as "for Bridge Decks" cores will not be required or allowed.

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

A standard subplot shall be 600 tons. A non-standard subplot shall be the quantity of HMA placed if there is less than 600 tons in the paving session or after the final standard subplot.

Under the direction of 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 standard subplot. One core shall be taken for sublots less than 450 tons. Table 6 will be used to determine the minimum number of cores extracted from the mat. The center of each core used to determine mat density will be at least one foot away from the edge of pavement, transverse or longitudinal joints or drainage structures.

Table 6 – Mat Density Core Quantities

Expected Daily Production Tonnage	Minimum Number of Mat Cores
450 or Less	1
451 - 750	2
751 - 1050	3
1051 – 1350	4
1351 – 1650	5
1651 – 1950	6
1951 - 2250	7
2251 - 2550	8
2551 - 2850	9
2851 - 3150	10

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 7 will be made for in-place mat density:

Table 7 – 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 8 will be made for in-place joint density:

Table 8– 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 that has not been reclaimed.

4. Calculation of Pay Adjustments for In-Place Density

(a) 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.

(b) 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 total length of the joints on the project. 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. If a distribution truck is used the tack coat shall be applied at twice the specified rate. 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 is the difference in elevation between the top of recently placed or milled HMA pavement and the top of adjacent ground (or pavement). Drop-offs on recently placed pavements shall conform to **Section 401.03.7**. Drop-offs on milled surfaces shall conform to the following:

1. For Posted Speeds of 35 mph or Less. Drop-offs greater than 2 inches shall be tapered to not steeper than a 1-to-1 slope to existing ground or pavement. Drop-offs 5 inches or greater shall be tapered to not steeper than a 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 not steeper than 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**.

Longitudinal drop-offs shall occur within one foot of a lane divider or at the edge of pavement.

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 not steeper than 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 not steeper than 5 feet horizontal to 1 inch vertical.

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

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 directed 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 placed on bridge decks, bike paths or sidewalks neither final nor density cores will be required.

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:

1. 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,

2. 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.

c. 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 **Section 601, Portland Cement Concrete**; pages AC-68 to AC-97 of the April 2016 Compilation of Approved Specifications and pages AC17-7 to AC17-13 of the May 2016 Compilation of Approved Specifications 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 Concrete¹		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.

d. 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 a 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 ⁴	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	----
Concrete Prequalification Criteria³						
Rapid Chloride permeability, AASHTO T277, coulomb (max.)						
28-day standard cure	----	----	----	3000	3000	----
56-day standard cure	----	----	----	2000	2000	----
Surface Resistivity, (4x8 cyl.) AASHTO T 358, (k -cm) (min.)						
28-day standard cure	----	----	----	15	15	----
56-day standard cure	----	----	----	21	21	----
Maximum 28-day drying shrinkage ⁶ , AASHTO T 160, %	----	----	----	-0.040	-0.040	----
Aggregate Prequalification Criteria⁷						
Maximum 14-day expansion ASTM C 1567, %	----	0.1	0.1	0.1	0.1	0.1

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. Slump shall not exceed 4 inches for surfaces sloped greater than 4 percent unless otherwise approved by the Engineer. 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. 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.
5. Concrete prequalification testing will not be required for the following concrete items: Flared Ends, Highway Bounds, Fence Post Footings, Guardrail Anchorage, Unreinforced Footings, Paved Waterways, Thrust Blocks, Precast Elements for Collars, Catch Basins, Manholes, Drop Inlets, Sumps, Electrical Handholes, Curbing, Pipe, Headwalls, End-walls, High Capacity Inlets and Temporary Traffic Barriers.
6. Drying shrinkage prequalification is not required for precast/prestressed structures.
7. Aggregate prequalification is required for all concrete classifications.

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 shall 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 proportions of the materials, including aggregate size, shall be made without approval of the Engineer. New materials shall not be used until a revised mixture design and new proportions based on a trial batch and laboratory tests and a minimum 3 cubic yards batch plant trial run is approved by the Engineer. Trial batch laboratory testing shall be conducted by an AASHTO accredited laboratory at the Contractor's expense. Testing requirement criteria are as follows:

1. No testing is required for changes in admixture dose provided the proposed dose does not exceed manufacturer recommendations.

2. Slump, air content, concrete temperature and unit weight is required for all modifications.

3. 28-day compressive strength is required for all modifications.

4. AASHTO T277 testing is required for any change to aggregate source, cementitious material source, cementitious material proportion, or water quantity for concrete classes HP and MC. AASHTO T277 testing is not required for chemical admixture modifications.

5. AASHTO T160 and ASTM C 1567 are required for concrete classes HP and MC for the following changes:

- aggregate source;
- aggregate size;
- single aggregate proportions greater than 300 lb/yd³;
- cementitious material source;
- cementitious material proportions, or
- water content.

AASHTO T160 is not required for chemical admixture-only modifications.

6. 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.

7. 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 Prequalification Requirements. All concrete mixtures shall be proportioned to meet the minimum prequalification requirements listed in Table 2. At his expense, the Concrete Producer shall conduct all prequalification trial batches and prequalification testing using the materials on the submitted mix design. Trial batch and prequalification testing shall be performed by an AASHTO accredited laboratory. The Concrete Producer shall submit complete mixture proportions and

prequalification 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 testing for any of the specified prequalification properties.

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 AASHTO T277 testing.

2. Concrete mixtures shall have an AASHTO T358 surface resistivity greater than or equal to the value listed in Table 2 for the class of concrete. A minimum of two 4" x 8" cylinder specimens shall be reported for the AASHTO T358 testing.

3. 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.

4. Alkali-Aggregate Reactivity.

All combinations of aggregate and cementitious materials used in concrete mixes shall be innocuous to alkali-aggregate reactivity as demonstrated by a mean expansion not greater than or equal to 0.10 percent after 14 days of soaking using the ASTM C 1567 test method. This requirement shall be satisfied for an aggregate if the mean expansion in an AASHTO T303 test after 14 days of soaking is less than or equal to 0.10 percent.

Coarse and fine aggregates shall be tested separately.

A series of tests with the reactive aggregate and different cement replacement levels may be required to determine the minimum cement replacement level necessary to mitigate expansion for a given combination of materials. Determining the minimum replacement level by interpolation between tested levels is not allowed. ASTM C 1567 test results shall be conducted bi-annually and submitted to the Engineer for review.

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 Quality Assurance (QA). QA is defined as all those planned and systematic actions necessary to provide confidence that a material will satisfy given requirements for quality. QA includes Quality Control (QC), Acceptance and Independent Assurance (IA).

QC is the system used by the Contractor to monitor, assess and adjust production and placement processes to ensure that a material will meet the specified quality. QC is the responsibility of the Contractor.

Acceptance is the system used by the Engineer to measure the degree of compliance of the Portland Cement Concrete with the Contract requirements. Acceptance is the responsibility of the Engineer and will be in accordance with the Rhode Island Department of Transportation Project Schedule for Sampling, Testing and Certification of Materials (PMTB) and these Specifications.

IA is an unbiased and independent system used to assess all sampling, testing and inspection procedures used for QA. IA is conducted by the Engineer in accordance with the Rhode Island Department of Transportation Master Schedule for the Preparation of a Project Schedule for Sampling, Testing and Certification of Materials (MST) and these Specifications.

a. Concrete Manufacturing Plant Quality Control (QC).

1. General. The Concrete Producer shall establish, implement and maintain a QC program to control all equipment, materials and processes during concrete production. The Concrete Producer's QC program shall include, but is not limited to, sampling, testing, inspection, monitoring, documentation and corrective action procedures during the handling, blending and mixing operations. A written Quality Control Plan (QCP) shall be developed which details the Concrete Producers QC program and that meets the requirements of these specifications. Concrete shall not be produced for the State without an approved QCP and a QC technician present at the plant for production. QC is not required for optionally tested items listed in the latest edition of the RIDOT Master Schedule of Testing. Failure to comply with the provisions of this Section or the contract special provisions will result in the shutdown of the Concrete Producer's production operation for RIDOT work and rejection by the Engineer of the concrete produced until the Concrete Producer's operations are in compliance with these requirements.

2. Personnel. QC personnel shall not perform concrete production operations when the total quantity of concrete produced for RIDOT on a calendar day exceeds 50 CY. At a minimum, the QC staff shall include the following personnel:

(a) QCP Administrator. The Concrete Producer shall employ a QCP Administrator with five years minimum of Materials QC experience and meeting one or more of the following criteria:

- (1) Professional Engineer licensed in the State of Rhode Island;
- (2) Certification by the National Institute for Certification of Engineering Technologies (NICET) at Level III or above for concrete;
- (3) Certification by the North-East Transportation Training and Certification Program (NETTCP) as a QA Technologist.

Prestress Concrete facilities shall employ a QCP Administrator with five years minimum of prestress concrete production QC experience and meeting one or more of the following criteria:

- (1) Precast/Prestress Concrete Institute (PCI) Level III Certification for prestressed concrete production (PCI Level II for non-prestressed precast);
- (2) Certification by the National Institute for Certification of Engineering Technologies (NICET) at Level III or above for concrete;
- (3) Certification by the North-East Transportation Training and Certification Program (NETTCP) as a QA Technologist.

The QCP Administrator shall have full authority to direct any and all actions necessary for the successful implementation of the QCP, including administering, implementing, monitoring and adjusting processes as necessary to ensure compliance with the Contract Documents.

(b) QC Technicians. The Concrete Producer shall employ QC Technician(s) who test concrete specimens and concrete materials. QC Technicians shall possess current certification as American Concrete Institute (ACI) Concrete Laboratory Testing Technician Level I or NETTCP Concrete Technician.

Precast/Prestressed Concrete facilities shall additionally employ QC technician(s) who sample and test concrete at the point of placement. QC technicians shall possess current certification as ACI Concrete Field Testing Technician Grade I or NETTCP Concrete Technician.

QC technicians shall report directly to the QCP Administrator and shall be responsible for performing required QC activities and preparation of associated QC documentation.

3. QC Testing Facilities and Equipment. The Concrete Producer shall maintain a separate QC Laboratory and associated sampling, testing and measuring equipment necessary to perform the required QC activities. Sampling, testing and measuring devices shall be in accordance with specified standards and shall be properly calibrated and verified. The Concrete Producer shall maintain records of the calibration and maintenance of all sampling, testing and measuring equipment.

Back-up equipment shall be used if a device is found to be defective. Defective equipment shall be clearly tagged and/or removed from the site until repaired and the calibration is verified. If non-standard or alternative sampling methods, testing procedures, or equipment are proposed to be used, they shall be detailed in the QCP and approved by the Engineer prior to use.

4. QC Activities. QC activities shall include monitoring, inspection, sampling and testing. The Concrete Producer's QC activities shall cover all aspects that affect the quality of the concrete, including but not limited to:

- (a) Component Materials
 - (1) Fine and Coarse Aggregates
 - (2) Portland Cement
 - (3) Mineral and Chemical Admixtures
 - (4) Water
- (b) Production and Delivery Equipment
- (c) Mixing and Transportation
- (d) Formwork (Precast/Prestress plants only)
- (e) Prestressing Steel, Reinforcement, Inserts (Precast/Prestress plants only)
- (f) Tensioning Prestressing Steel (Precast/Prestress plants only)
- (g) Plastic and Hardened Concrete Properties (Precast/Prestress plants only)
- (h) Placement and Consolidation (Precast/Prestress plants only)

(i) Finishing and Curing (Precast/Prestress plants only)

(j) Finished Product (Precast/Prestress plants only)

The minimum QC activities and frequencies required are listed in **TABLES 3** and **4** below.

TABLE 3

MINIMUM PRODUCTION EQUIPMENT QC REQUIREMENTS		
Equipment	Control Requirement	Minimum Frequency
1. Plant Central Mixer Blades	Visual Inspection	Annually
2. Plant Scales and Meters	Calibrate	Every 90 days
3. Plant Admixture Dispensers	Calibrate	Every 90 days
4. Mixer Trucks	NRMCA Certification	Annually
5. Truck Water Meters	Calibrate	Annually
6. Tensioning Gauges	Calibrate	Precast/Prestressed Concrete – Every 180 days
7. Hydraulic Jacks	Calibrate	Precast/Prestressed Concrete – Every 180 days

TABLE 4

MINIMUM MATERIALS QC REQUIREMENTS		
Item	Control Requirement	Minimum Frequency
1. Fine and Coarse Aggregates	Gradation	Ready Mix Concrete – Daily/prior to start of production and randomly every 150 cubic yards of concrete.
	Moisture Content	
	Visual Inspection of stockpiles and bins for segregation and contamination	Precast/Prestressed Concrete – Daily/prior to start of production and randomly every 50 cubic yards of concrete.
2. Portland Cement	Mill Test Report – Verify conformance to specifications	Each delivery
3. Mineral Admixtures	Mill Test Report – Verify conformance to specifications	Each delivery
4. Chemical Admixtures	Certificate of Compliance – Verify conformance to specifications	Each delivery
5. Concrete Batching	Verify Mix Proportions and Batch Weights	Each batch
	Compute maximum allowable retempering water and maximum discharge time	
6. Plastic Concrete	Air Content	Precast/Prestressed Concrete – First two loads then randomly every 50 CY for each concrete class delivered and placed on a calendar day from a single supplier.
	Yield (Unit Weight)	
	Slump/Spread	
	Concrete Temperature	
	Air Temperature	
	*Compressive Strength Specimens	Precast/Prestressed Concrete – One set for 1 – 50 CY inclusive and one set for each additional 50 CY or fraction thereof and as necessary for formwork removal, stress transfer, and shipping (Include concrete temperature, air content and slump test results).

*The Concrete Producer shall determine the quantity of cylinders necessary for process control of construction operations.

5. Concrete Producers Quality Control Plan (QCP). The Concrete Producer shall submit a detailed written QCP to the Engineer for approval annually, at least sixty days prior to the first concrete placement. The QCP shall detail the Concrete Producer's plans, policies, procedures and organization deemed necessary to measure and control materials, equipment and concrete production processes.

The QCP shall be maintained to reflect the current status of the operations; proposed changes to the QCP must be submitted to the Engineer in writing. Changes must be approved by the Engineer before implementation.

At a minimum, the QCP shall Detail the following:

(a) Scope of QC Plan – Reference all applicable specifications, including the latest revision of the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction along with all the applicable compilations and supplements.

(b) QC Organization – Include a QC organizational chart identifying all personnel responsible for implementing the QCP and how they integrate and communicate within the Concrete Supplier's management structure and with the Engineer. Include a list of QC personnel and their names, qualifications, responsibilities, levels of authority, certifications, telephone contact number(s) and e-mail addresses.

(c) QC Testing Facilities and Equipment – Include the location and qualifications of QC testing facilities, and a listing of all QC testing equipment with the frequency of calibration and verification.

(d) Materials Control – Include the source(s) for all materials used in the production of Portland Cement Concrete and receiving, storage and handling practices. For fine and coarse aggregates describe stockpile management practices, including stockpile identification, separation, segregation mitigation and loading.

(e) Concrete Production – Provide a description of the concrete plant and concrete batching operation, including but not limited to:

- (1) plant location and layout;
- (2) production equipment;
- (3) method and sequence of batching;
- (4) mixing capacity and minimum mixing time;
- (5) method of monitoring ingredients and recording batches;
- (6) methods of delivery.

(f) QC Activities – Describe QC activities deemed necessary to control all aspects of concrete production. Include the locations, methods, frequency and personnel responsible for conducting QC sampling, testing and inspection. Identify lot/sublot sizes, sample identification system and sample storage/retention procedures. The minimum required QC activities are listed in **TABLES 3 and 4** of this specification.

(g) Pre-Placement (Precast/Prestressed Plants only) – Include source, storage and handling procedures for steel reinforcement, prestressing strand, hardware and inserts. Describe procedures and equipment for tensioning and detensioning of prestressing steel strands.

(h) Concrete Placement (Precast/Prestressed Plants only) – Describe methods, equipment and materials for placement, consolidation, finishing and curing of concrete. Include sequencing of work and maximum discharge times. Include procedures for determination of concrete strength for formwork removal and application of load.

(i) Post Production (Precast/Prestressed Plants only) – Describe procedures for post-production inspection, including product condition assessment, measurement of product geometry and camber (as applicable). Include procedures for handling and storage of finished products.

(j) Documentation – Describe documentation and reporting procedures for all QC activities. Include samples of all QC forms, reports and control charts.

(k) Non-Conformance and Corrective Action – Establish and maintain an effective and positive system for controlling non-conforming material and products as indicated by inspection and test results. Investigate the cause of any non-conformance to prevent recurrence, and take prompt corrective action to correct conditions that have resulted, or could result, in the incorporation of non-conforming materials and products into the Work. All non-conforming materials and products shall be positively identified to prevent use, shipment, and intermingling with conforming materials and products. Segregated holding areas shall be provided by the Concrete Producer, subject to the approval by the Engineer. Include criteria for identifying non-conforming materials and products, and procedures for isolation, disposition and documentation. Include procedures and personnel responsible for directing corrective action, including suspension of work, disposal and reclaiming or reworking of non-conforming materials and products. Detail how the results of QC inspections and tests will be used to determine corrective actions, define rules to gauge when a process is out of control and associated corrective action to be taken. At a minimum, establish corrective action procedures for each control requirement listed in **TABLES 3** and **4**.

6. Records and Documentation. The Concrete Producer shall maintain complete records of all QC tests and inspections. The QC records shall contain all test and inspection reports, forms and checklists, equipment calibrations, component material certificates of compliance and mill test reports, and non-conformance and corrective action reports. The QC records shall indicate the nature and number of observations made, the number and type of deficiencies found, the quantities conforming and non-conforming, and the nature of corrective action taken, as appropriate. The QC records shall be available to the Engineer at all times, and shall be retained for the life of the contract. The Concrete Producer's documentation procedures will be subject to approval by the Engineer prior to the start of the work, and to compliance checks by the Engineer during the progress of the work.

(a) Forms and Reports – All QC inspection and test results shall be documented on NETTCP forms and reports, or equivalent as approved by the Engineer. Additionally, a non-conformance and corrective action report shall be generated for each instance where test or inspection results indicate a non-conformance. The report shall indicate the nature of the non-conformance and corrective actions taken to resolve it. Forms and reports shall be kept complete, shall be on computer-acceptable medium and shall be submitted to the Engineer as the work progresses (or weekly, at a minimum).

(b) Control Charts. All conforming and non-conforming test results shall be documented on control charts, shall be kept complete, and shall be available to the Engineer at all times during

production. Test data for Portland Cement concrete shall be shown on control charts, including but not limited to critical gradation(s) (i.e. passing no. 4, no. 100, no. 200 sieve); and additionally, air content, unit weight and 28-day compressive for precast/prestressed concrete. Control charts shall indicate lots and sub-lots, target values, control limits, all in chronological order with legend. The Concrete Producer may use other types of control charts as deemed appropriate and as approved by the Engineer. Testing and charting shall be completed within 24 hours after sampling.

(c) Certification. At the conclusion of the project, the Concrete Producer shall certify in writing to the Engineer that all Portland Cement Concrete and Precast/Prestressed products have been produced, inspected and tested in accordance with, and meet the requirements of, the contract specifications.

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

$$PATR = \bar{X} = \frac{X1+X2+X3}{3}$$

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

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

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

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

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)	Pay Factor
$(\bar{X} \text{ or } \bar{X})$	(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.

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. $(1.00-PPF) \times$ 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)**.

Remove **Section 817, Repairs to Structure Concrete Masonry**, pages AC17-22 to AC17-28 of the May 2016 Compilation of Approved Specifications in its entirety and replace it with the following:

SECTION 817

REPAIRS TO STRUCTURE CONCRETE MASONRY

817.01 DESCRIPTION. This work consists of making repairs to structure concrete masonry by removing and disposing deteriorated concrete; furnishing and installing steel reinforcement; preparing bonding surfaces of concrete; preparing and installing bonding agent; replacing the deteriorated concrete with a specified repair material; and finishing and curing to the lines and grades specified at the locations indicated on the Plans, all in accordance with these Specifications and/or as may be directed by the Engineer.

817.02 MATERIALS.

817.02.1 Pneumatically Applied Mortar (Shotcrete). Materials for shotcrete shall conform to the applicable requirements of **SECTION 601, SECTION 602** and **SECTION M.02**, respectively, of these Specifications, except as modified herein.

Shotcrete shall be produced by either the wet mix process or the dry mix process and conform to the following requirements unless otherwise indicated on the Plans:

Material or Property	Value
Compressive Strength at 28 days, f_c' (psi)	As indicated on plans
Maximum Water/Cementitious Ratio	0.45
Minimum Cement Factor (lbs./cy.)	500
Air Content (percent)	5-9
Slump (inches)	1 to 3

a. Mixture Proportions. The Contractor shall determine, recommend and submit a mix proportion for approval, 28-day compressive strength results, water-cement ratio and source of materials. The Contractor shall select mix proportions on the basis of compressive strength tests of specimens continuously moist cured until tested at 28 days or different test age if so specified in accordance with ASTM C1604. Shotcrete core specimens shall be sampled from shotcreted test panels not earlier than 3 days after shotcreting. Sampling and testing of shotcrete cores shall be in accordance with ASTM C1604. Combined aggregate gradation (fine and coarse) shall meet either gradation #1 or #2 of Table 1.1 of ACI 506R, Section 1.5 as indicated on the Plans.

Premixed and prepackaged concrete products specifically manufactured as a shotcrete product may be provided for the dry mix shotcrete process only as approved by the Engineer. The packages shall contain cement and aggregates conforming to the materials requirement of this Specification and the product must be listed on the Department's Approved Materials List.

817.02.2 Patching Mortar. Patching mortar shall conform to the requirements of ASTM C928; "Rapid Hardening or Very Rapid Hardening Mortar" and/or as indicated on the Plans, and be listed on the Department's Approved Materials List. The mortar shall be a non-shrink type and chloride free. Repair mortars not previously approved shall be submitted to and approved by the Engineer before use. All materials shall be used in accordance with the manufacturer's recommendations.

817.02.3 Reinforcement. All reinforcement shall be galvanized and conform to the requirements of **Section M.05**.

817.02.4 Bonding Agent. A bonding agent shall be used when mortar repairs are specified or indicated on the Plans. The bonding agent shall be as specified and/or as indicated on the Plans, and be listed on the Department's Approved Materials List. Bonding agents not previously approved shall be submitted to and approved by the Engineer before use. All materials shall be used in accordance with manufacturer's recommendations.

817.02.5 Form and Cast-in-Place Concrete. Concrete shall be as indicated on the Plans and conform to the applicable provisions of **SECTION 601, Portland Cement Concrete** of these specifications.

817.03 CONSTRUCTION METHODS.

817.03.1 Surface Preparation (All Repair Methods). All deteriorated soft or honeycombed concrete shall be removed from the areas to be repaired by means of suitable power and hand tools to a uniform depth, sufficient to expose a bonding surface of sound material. Power tools that cause or may cause over-breakage of concrete are prohibited. Pneumatic/chipping hammers shall not be heavier than the nominal 30-pound class. Pneumatic/chipping hammers or mechanical chipping tools, to remove concrete within two inches beneath or around reinforcing steel designated to remain, shall not be heavier than the nominal 15-pound class. Tools shall not contact reinforcing steel to remain.

The boundaries of areas to be removed where indicated on the Plans or as directed by the Engineer, shall be saw cut square to a minimum depth of 1 inch, unless otherwise noted on the Plans. Thin, tapered or feathered edges are prohibited.

In areas where reinforcing steel is found to be surrounded by deteriorated concrete or where at least one-half of the rebar surface area is exposed, the depth of concrete removal shall be such as to include all deteriorated concrete but not less than that depth necessary to allow for one-inch minimum annular clearance around the reinforcing bars. All corroded reinforcing bars to remain within the concrete removal boundaries shall be thoroughly cleaned by sandblasting or by other suitable methods approved by the Engineer to remove all rust. Those bars that have lost 1/4 or more of their original diameter shall be supplemented by new bars spliced in place. New bars shall be lapped as indicated on the Plans to develop

the full strength of the bar. Additional concrete removal may be necessary to provide this lap. Dual bars of equivalent or greater cross-sectional area may be used.

All newly exposed concrete repair surfaces shall be free of loose particles and other foreign material. The repair areas shall be thoroughly cleaned and be left roughened by the use of sandblasting, compressed air, air and water blasting, steam, wire brushing, or by other methods approved by the Engineer. The Contractor may use one or any combination of the various means of cleaning the repair areas as approved or as directed by 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 in place. Any damage caused by the Contractor to the existing structure that is designated to remain in place shall be repaired or replaced by the Contractor at its own expense to the satisfaction of the Engineer. Regardless of the method of removal, if in the opinion of the Engineer the removal operation causes excessive damage to portions of the concrete which are to remain, the Contractor shall cease its operations until such time that an alternate removal method has been proposed by the Contractor and approved by the Engineer. Claims for additional time or compensation due to such cessation of operations will not be approved.

The Contractor shall ensure that no debris or any other material falls onto the roadway or waterway below the bridge. Should debris or material fall onto the roadway or waterway, such shall be removed immediately and all work shall stop until such time as a revised procedure of operation has been submitted and approved by the Engineer. All damages or injuries as a result of debris or material falling shall be the responsibility of the Contractor.

All such debris and materials shall be removed and legally disposed of off the project site. Storing or burying of material or debris on site is not allowed.

The surface against which mortar is to be placed shall be kept wet for at least one hour and then allowed to dry to a saturated surface dry (SSD) condition just prior to application of the repair material.

Where bonding agents are specified for use, they shall be applied in accordance with the manufacturer's recommendations. The Contractor shall be aware of the contact time, as per the manufacturer's recommendation after the placement of the bonding agent, and shall perform the necessary coordination between the associated construction activities, primarily the surface preparation, the erection of forms, and the delivery and placement of concrete. The Contractor shall take measures to ensure that the contact time is not exceeded. If the contact time is exceeded, the bonding agent shall be re-applied in accordance with the manufacturer's recommended procedures for reapplication, at no additional cost to the State.

817.03.2 Placement of Reinforcing. Repairs less than 1½-inches depth will not require wire mesh reinforcement unless otherwise directed by the Engineer. In cases where the thickness of the repair mortar exceeds 1½-inches depth and existing bar reinforcement is available, galvanized wire mesh reinforcement shall be attached to the bars with tie wire. If existing rebar is not available, wire mesh reinforcement shall be installed by means of mechanical concrete anchors in accordance with the requirements of Table 1. For areas where the repair exceeds 4 inches depth, a single layer of wire mesh shall be used to reinforce each 2-inch thickness of patch material.

Table 1

Size and Spacing of Anchors

Thickness of Placement (in.)	Overhead Surfaces Dia.(in.) Spacing (in.)	Vertical Surfaces Dia. (in.) Spacing (in.)	Top Horizontal Surfaces Dia. (in.) Spacing (in.)
1½ to 4	1/4 at 24	1/4 at 24	1/4 at 36
4 to 5	1/4 at 20	1/4 at 24	1/4 at 36
5 to 6	3/8 at 17	3/8 at 21	3/8 at 36
over 6	3/8 at 16	3/8 at 20	3/8 at 36

Mechanical concrete anchors shall be galvanized, hooked type expansion bolts to be approved by the Engineer. The exposed end of each anchor shall have at a minimum a right-angle bend for engaging reinforcement. At least three anchors shall be used in each individual patch area.

If any reinforcement is damaged by the Contractor during the repair procedure, it shall be replaced at the Contractor's expense, as directed by the Engineer.

817.03.3 Application of Pneumatically Applied Mortar (Shotcrete).

a. Submittals. Submittal shall include shop drawings, details, material Certificates of Compliance including mill test reports, mix designs, Quality Control (QC) Plan to include but not be limited to staff qualifications, construction procedures, detailed construction sequencing plans, and details of temporary debris shields. Submittals shall be submitted for review and approval by the Engineer a minimum of 45 days prior to the commencement of work.

The Contractors QC Plan shall detail the following:

1. Number and qualifications of personnel involved in shotcrete placement
2. Surface preparation method
3. Equipment and materials for placement, finishing and curing
4. Placement method including application rates, plans for multiple layers where applicable, and methods for achieving required thickness and finish
5. Curing method
6. QC testing and inspection personnel
7. QC testing and inspection methods and frequencies including determinations of thickness and strength of placed shotcrete and checking for hollow areas and surface defects
8. Methods for correcting deficiencies in shotcrete thickness, strength, hollow areas and surface defects

The Contractor shall submit documentation substantiating that project personnel have appropriate qualifications. Inadequate documentation or substantiation of personnel qualifications will be cause for rejection of the QC Plan. Changes to previously approved personnel must be approved in writing. Shotcreting nozzle operators shall have at least one year of experience in the application of shotcrete and

completed at least three projects of comparable nature or work under the immediate supervision of a foreman or instructor with at least two years of such experience. Documentation of nozzle operator's experience shall be submitted with the QC Plan.

Work shall not begin until the Contractor's QC Plan is approved. The Engineer will suspend the work if the Contractor substitutes unqualified personnel for approved personnel during construction or if work is found to be unsatisfactory during placement of shotcrete. Claims for additional time or compensation due to such cessation of operations will not be approved.

b. Batching and Mixing. Aggregate and cement may be batched by weight or by volume. Mixing equipment shall be capable of thoroughly mixing the materials in sufficient quantity to maintain placing continuity. Ready mix shotcrete shall comply with the requirements of **Section 601**.

c. Delivery Equipment. The shotcrete shall be applied by pneumatic equipment that sprays the mix onto the prepared surface at the velocity needed to produce a compacted dense homogeneous mass. The velocity of the material as it leaves the nozzle must be maintained at a uniform rate determined for the given job conditions to minimize rebound.

1. Dry Mix Process. The delivery equipment shall deliver a continuous, smooth uniformly mixed material to the nozzle. The nozzle shall be equipped with a water ring and valve to permit adjustment of the water. The nozzle shall be capable of delivering a conical discharge stream.

2. Wet Mix Process. Only pneumatic-feed type delivery equipment will be allowed.

d. Pre-Construction Testing. Test panels shall be made by each application crew using the equipment, materials, mixture proportions and procedures proposed for the job prior to the commencement of the work. A test panel at least 30" x 30" shall be made for each mixture being considered and for each shooting position to be encountered in the job. The test panels shall be fabricated to the same thickness as in the structure, but not less than 4 inches. Take at least five, 3-inch minimum diameter cores from each panel for testing in accordance with ASTM C1604. Samples for testing shall be obtained by the Contractor in the presence of the Engineer, and tested by the Engineer.

e. Placement of Shotcrete. Shotcrete shall be applied with the same equipment and the same technique as used to construct the approved test panels. The nozzle operator constructing the test panels shall be the same operator used in placing shotcrete in the work. The shotcrete shall be applied as dry as practicable to prevent shrinkage cracking, sagging and sloughing off.

Shooting guide strips or wires shall be employed to ensure square corners, straight lines and a plane surface of mortar, except as otherwise indicated on the Plans or approved by the Engineer. They shall be so placed to minimize trapping of rebound. The re-use of rebounded materials is not allowed. Thickness measuring pins shall be installed on 5-foot centers in each direction. The pins shall be non-corrosive. Other methods to establish if the required minimum thickness of shotcrete is being applied may be approved if the Contractor can satisfactorily demonstrate the reliability of these other methods.

A sufficient number of mortar coats shall be applied to obtain the required thickness. On vertical and overhead surfaces, the thickness of each coat shall not be greater than 1 inch, except as approved by

the Engineer, and shall be so placed that it will neither sag nor decrease the bond of the preceding coat. The time interval between successive layers in sloping, vertical or overhanging work, shall be sufficient to allow initial set but not final set to develop. At the time initial set is developing, the surface shall be cleaned to remove the thin film of laitance in order to provide for a bond with succeeding applications. Rebound or accumulated loose sand shall be removed from the surface by brooming or scraping to be covered prior to placing of the original or succeeding layers of mortar and shall not be embedded in the work. All laitance which has been allowed to take final set shall be removed by sandblasting and thoroughly cleaning the surfaces.

To achieve an SSD condition, care shall be taken to thoroughly wash down all previously hardened concrete with water and compressed air before shooting new material.

The wire fabric reinforcement shall be positioned to minimize vibration while the shotcrete is being applied. Lap mesh one and a half squares in both directions. Tie wires shall be bent flat in the plane of the mesh and not form large knots.

The shotcrete shall be applied from the bottom up to prevent accumulation of rebound on the surface still to be covered.

Horizontal and vertical corners and any area where rebound cannot escape or be blown free shall be filled first. Nozzle shall be held at such distance and angle to place material behind reinforcement before material is allowed to accumulate on its face. Do not place shotcrete through more than one layer of reinforcing steel in one application. Unless suitable means to screen the nozzle is provided, discontinue shotcreting if wind or air currents will cause separation of the stream during placement.

The Contractor shall check in the presence of the Engineer for hollow areas by hammer sounding. Hollow areas, and areas containing any other non-conforming work or defects, are deemed to be deficient areas. An approved repair method including proposed mitigation measures shall be used to correct deficient areas. The repair method shall be submitted by the Contractor for review and approval by the Engineer prior to commencement of any repair work. Deficient areas shall be corrected at the Contractor's expense. At the discretion of the Engineer, deficient areas shall be repaired after initial placement of the shotcrete is completed. All shotcrete defects, including but not limited to, lack of uniformity, segregation, honeycombing, lamination, or which contains any dry patches, slugs, voids, or sand pockets shall be removed and replaced with fresh shotcrete at the Contractor's expense.

f. Acceptance Testing. The Contractor shall prepare a minimum of one test panel for each day of production up to 50 cubic yards, and one test panel for each additional increment up to 50 cubic yards of shotcrete placed, unless otherwise directed by the Engineer. Test panels shall have minimum dimensions of 24" x 24" x 4" gunned in the same position as the work represented. Panels shall be gunned during the course of the work by the previously qualified nozzle operator. Cure the panels and obtain a minimum of three cores as described under "Preconstruction Testing." Cores will be tested by the Engineer in accordance with the requirements listed under "Preconstruction Testing."

g. Limitation of Mixing. Shotcrete shall be placed in accordance with the temperature and weather conditions listed in **Section 601**.

h. Finish. All exposed surfaces shall be finished straight and true, approximating the original contour as close as practicable. The final finish shall be as indicated on the plans.

i. Curing. Shotcrete shall be cured in accordance with **Section 601**.

Curing compounds shall not be used on any surfaces against which additional shotcrete or other cementitious finishing materials are to be bonded.

817.03.4 Application of Patching Mortar. Concrete patching mortar shall be mixed, applied and cured in strict accordance with the manufacturer's recommendations. All exposed surfaces shall be finished straight and true, approximating the original contour as close as practicable. The final finish shall be as indicated on the plans.

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, surfaces shall be prepped in accordance with these specifications or as indicated on the Plans.

c. Use of Self Consolidating Concrete (SCC) in Form and Cast-in-Place Concrete. SCC concrete may be used for form and cast-in-place concrete repairs or as indicated on the plans. Concreting procedures shall be performed by personnel experienced with the placement of SCC mixes. All repair areas shall be adequately formed to contain the proposed SCC material, and all resulting holes from the required formwork fasteners shall be properly filled with an approved cementitious material. Special care shall be taken so that the form is properly sealed against leaks, since SCC is more fluid than standard mixes. If voids are observed when stripping a form, further placements of the SCC shall cease until the mix and/or placement problem is identified and corrected to the satisfaction of the Engineer. Chip out voids using a chisel to create an un-pocketed surface without damaging reinforcing steel or wire mesh. Apply patching mortar into chipped-out voids in accordance with **para. 817.03.4, Application of Patching Mortar** of this section.

d. Final Finish. All exposed surfaces shall be finished straight and true, approximating the original contour as close as practicable. The final finish shall be as indicated on the plans.

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 either the number of "Square Feet" or "Cubic Feet" of new concrete actually placed in accordance with the Contract Documents 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 “Square Feet” or “Cubic Feet” as designated in the Proposal. The price so stated shall constitute full and complete compensation for all labor, materials, equipment, and all incidentals required to finish the work, complete in place and accepted by the Engineer.

Steel reinforcing bars and wire mesh reinforcement will be paid for separately by Force Account in accordance with the provisions of **Subsection 109.04** of these specifications, or when applicable will be paid under the respective pay item for Reinforcing Steel **Section 810**.

Revise **Section 825, Painting Structural Steel**, pages AC-184 to AC-196 of the April 2016 Compilation of Approved Specifications as follows.

SECTION 825

PAINTING STRUCTURAL STEEL

- **Replace Subsection 825.01.5, Contractor Applicator Qualification with the following.**

825.01.5 Contractor Applicator Qualification. When the contract requires surface preparation and painting more than 1,500 square feet of steel surface or beyond the first five feet of a beam end, 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.” For field work involving abrasive blast cleaning and painting, the Contractor must follow the requirements of the SSPC CAS QP1 Implementations Schedule as defined on the SSPC Web site (www.sspc.org). 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.

Remove **Section 926, Precast Concrete Median Barrier for Temporary Traffic Control**, pages AC-219 to AC-221 of the April 2016 Compilation of Approved Specifications in its entirety and replace it with the following.

SECTION 926

ANCHORED AND UNANCHORED BARRIER FOR TEMPORARY TRAFFIC CONTROL

926.01 DESCRIPTION. This work consists of providing anchored or unanchored 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 shall meet or exceed the test level as indicated 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. Barrier units comprising of other materials, such as steel, plastic, etc., may also be used upon approval of the Engineer.

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, the anchorage system shall meet or exceed the specific test level as specified on the Plans. Anchors shall be installed per manufacturer's recommendations.

For new bridge decks and existing bridge decks to remain, only adhesive, embedded or expansion anchors shall be used. For existing bridge decks not to remain, 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.

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 shall be removed and replaced or repaired by the Contractor, and at no additional cost to the State if due to the Contractor's operations or negligence.

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. The Contractor shall be responsible for developing details for transitioning its chosen temporary barrier system to any existing highway or bridge barrier systems.

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 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.

926.03.5 Submittals. For anchored and unanchored barrier on bridge decks, the Contractor shall submit its chosen temporary barrier system, including the FHWA test level approval level and any details for transitional areas to any existing barrier systems, to the Engineer for approval.

926.04 METHOD OF MEASUREMENT.

926.04.1 Unanchored Barrier Units. "Unanchored 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 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 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 incidentals required to finish the work, complete and accepted by the Engineer.

The Contractor will 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 will 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 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 transitioning to adjacent new and existing units, subsequent removal of said units, grouting and for all incidentals required to finish the work, complete and accepted by the Engineer.

The Contractor will 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 will 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 incidentals required to finish the work, complete and accepted by the Engineer.

Remove **Section 928, Truck Mounted Attenuator (TMA) with Truck Mounted Flashing Arrow Board (TMFAB)**, pages 9-50 to 9-52 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION 928

SHADOW OR ADVANCE WARNING VEHICLE WITH IMPACT ATTENUATOR AND FLASHING ARROW BOARD OR CHANGEABLE MESSAGE SIGN

928.01 DESCRIPTION. This work consists of furnishing, operating, moving, and maintaining a shadow or advance warning vehicle that includes a truck- or trailer-mounted energy-absorbing impact attenuator (TMA) and either a truck- or trailer-mounted flashing arrow board (TMFAB) or changeable message sign (TMCMS), all in accordance with these Specifications and applicable state statutes. Shadow vehicles are positioned a short distance upstream of a work space or other temporary hazard in a roadway to protect exposed workers and/or reduce the severity of crashes from errant vehicles. Advance warning vehicles are used for certain types of short duration and mobile work operations to provide advance warning to motorists as they approach the work space.

928.02 MATERIALS.

928.02.1 Shadow or Advance Warning Vehicle. The vehicle shall meet or exceed the requirements and recommendations of the TMA manufacturer and shall weigh a minimum of 10,000 pounds. The vehicle shall accommodate the mounting of the TMA and the TMFAB or TMCMS at the rear of the vehicle such that these devices can and will comply with the requirements set forth in these Specifications.

Each vehicle shall be equipped with a minimum of two functional high-intensity rotating, flashing, oscillating, or strobe lights that are visible to road users approaching from any direction (360°) when operational. Each vehicle shall also include lighting and markings that conform to the latest Federal and RIGL requirements. The Contractor shall ensure that the appropriate number of first-aid kits and fire extinguishers are furnished with each vehicle for conformance to Section 24-8-4.2 of the RIGL.

928.02.2 Truck- or Trailer-Mounted Attenuator (TMA). The TMA shall be approved by the FHWA as a crashworthy device acceptable for use on the National Highway System.

Each type of TMA furnished and used on the Project shall have been crashed-tested and found to conform to the requirements of the AASHTO Manual for Assessing Safety Hardware and/or NCHRP Report 350, whichever is applicable per latest FHWA requirements, at the required test level condition listed below, which varies based on the speed limit of the roadway where the TMA is to be used.

Posted or Statutory Speed Limit (Miles Per Hour)	Required Successful Crash-Testing to Test Level (TL) Condition¹
40 or less	TL-2 or TL-3
45 or greater	TL-3

¹ As stipulated by AASHTO Manual for Assessing Safety Hardware or NCHRP Report 350, whichever is applicable per latest FHWA requirements.

The TMA shall be furnished and installed on the shadow/advance warning vehicle in accordance with the TMA manufacturer's recommendations. The TMA shall include lighting and markings that conform to the latest Federal and RIGL requirements. The entire end panel of the TMA that faces oncoming traffic shall include chevron pattern markings with alternating non-reflective black and retro-reflective yellow stripes, each stripe a minimum of 4-inches wide and slanted at 45 degrees from vertical, in an inverted "V" form with the inverted "V" located at the center of the TMA end panel.

The combination of the TMA and the shadow/advance warning vehicle shall be selected and furnished as a system for conformance to the TMA manufacturer's requirements and recommendations and to ensure conformance with prior FHWA crashworthiness approval. If necessary, the Contractor shall supply the TMA manufacturer with proposed shadow/advance warning vehicle specifications in order to confirm that the furnished system is in compliance with these Specifications.

928.02.3 Truck- or Trailer-Mounted Flashing Arrow Board (TMFAB). The TMFAB shall be a four (4) foot high by eight (8) foot wide electronically-illuminated arrow panel installed at the rear of the shadow/advance warning vehicle, with the bottom of the panel mounted a minimum of seven (7) feet above the roadway when in operating mode.

The TMFAB display shall conform to the latest MUTCD requirements for a Type C Arrow Board. The TMFAB shall contain at least fifteen (15) yellow-color lighted elements and shall provide sufficient light output such that the TMFAB display is legible at a minimum distance of one (1) mile. The TMFAB panel shall be finished with materials that are non-reflective black in color.

The TMFAB shall be capable of displaying a flashing arrow to the left, a flashing arrow to the right, a flashing arrow pointing to both the left and right simultaneously, a flashing 'four corners' caution mode, and other displays if called for on the Plans. The TMFAB shall be capable and programmed to provide automatic dimming of the lighted elements during nighttime operation to eliminate glare to road users.

The TMFAB shall be powered in accordance with the manufacturer's requirements, typically via the shadow/advance warning vehicle's power system or via a dedicated battery system. The TMFAB shall be equipped with a back-up battery system to provide continuous operation when failure of the primary power source occurs.

928.02.4 Truck- or Trailer-Mounted Changeable Message Sign (TMCMS). The TMCMS shall be a four (4) foot high by eight (8) foot wide electronically-illuminated changeable sign panel installed at the rear of the vehicle, with the bottom of the panel mounted a minimum of seven (7) feet above the roadway when in operating mode.

The TMCMS display shall conform to the latest MUTCD requirements for a portable changeable message sign. The TMCMS display shall consist of either a lamp matrix or full-matrix LED array capable of displaying a variety of user-programmed messages. The TMCMS shall provide sufficient light output such that the TMCMS display is visible at a minimum distance of one-half (½) mile and legible at a minimum distance of 850 feet. The brightness of the TMCMS display shall automatically adjust in order to maintain message legibility and to eliminate glare to road users during nighttime operation.

The TMCMS shall be capable of displaying three (3) lines of text with eight characters per line, as well as each of the flashing arrow and flashing caution modes illustrated in the latest MUTCD for a Type C Arrow Board. Each text character displayed by the TMCMS shall be a minimum of 12 inches high, and multiple lines of text shall be equally spaced vertically.

The TMCMS shall be controlled by a solid-state unit housed in a weatherproof enclosure that is lighted for night operation. A keyboard entry system shall be provided to allow the operator to generate unique messages on the TMCMS. The control unit shall include a display screen upon which the operator can review messages before they are displayed on the TMCMS. The display screen shall also allow the operator to see the message that is actively displayed on the TMCMS. The system shall allow the operator to save a minimum of five (5) user-programmed messages in the control unit, and the system shall save these messages in internal memory even when power is turned off or unavailable.

The TMCMS shall be powered in accordance with the manufacturer's requirements, typically via the shadow/advance warning vehicle's power system or via a dedicated battery system. The TMCMS shall be equipped with a back-up battery system to provide continuous operation when failure of the primary power source occurs.

928.03 CONSTRUCTION METHODS.

928.03.1 General. The shadow/advance warning vehicle with TMA and TMFAB or TMCMS shall be available for use throughout the duration of the Project. It shall be positioned and repositioned for conformance to the Plans, these Specifications, and as otherwise directed by the Engineer.

For conformance to Section 24-8-4.2 of the RIGL, the Contractor shall ensure that each shadow/advance warning vehicle with TMA that is deployed in a work zone while work is actively being performed is not left unattended. Contractor personnel who drive, operate, and otherwise attend each shadow/advance warning vehicle with TMA shall not work as laborers or laborer foreman or perform other work whenever such vehicle is deployed in a work zone while work is actively being performed. The driver/operator of each shadow/advance warning vehicle with TMA shall have completed training for and be certified in both first aid and cardiopulmonary resuscitation (CPR). The Contractor shall provide the Engineer with three (3) copies of the first aid and CPR certifications of each vehicle driver/operator, and each driver/operator shall also keep a copy on his/her person.

The Contractor shall maintain the shadow/advance warning vehicle with TMA and TMFAB or TMCMS throughout the Contract period in accordance with the recommendations of the respective equipment manufacturers in order to keep the equipment operating properly.

If there is a failure, malfunction, or damage to the equipment for any reason, the Contractor shall be responsible for expediting the repair or replacement of all equipment necessary in order to ensure that the shadow/advance warning vehicle with TMA and TMFAB or TMCMS is furnished and operated as required by these Specifications. Such repairs or replacement shall be completed as soon as possible but no later than 24 hours after first notification of failure unless another timeframe is approved by the Engineer. Repairs to a TMA shall be accompanied by a written statement from the TMA manufacturer certifying that such repairs were completed in accordance with their requirements and recommendations and that the repaired TMA as furnished conforms to prior FHWA crashworthiness approval. The Engineer reserves the right to stop the work at any time until equipment is so repaired or replaced and furnished to his approval. Work delays due to the failure of the Contractor to furnish and operate properly-functioning equipment for any reason will not constitute justification for an extension of time.

928.03.2 Shadow or Advance Warning Vehicle. The high-intensity rotating, flashing, oscillating, or strobe lights on the shadow/advance warning vehicle shall be turned on and remain operational at all times when the vehicle is actively engaged in controlling or warning road users in a work zone.

Each shadow vehicle shall be positioned to account for roll-ahead distance in the event of an impact. The distance between the shadow vehicle and the work space or other temporary hazard in the roadway shall be selected based on the TMA and/or shadow vehicle manufacturer's recommendations. Such distance selection shall consider the mass of the shadow vehicle, the speed of approaching traffic, and whether the work operation is stationary or mobile, but should be no greater than the minimum distance sufficient to ensure that the shadow vehicle will not roll into the work space or hazard when hit by an errant vehicle. If roll-ahead distance recommendations are not available from the TMA and/or shadow vehicle manufacturer, the example guidelines included in the AASHTO Roadside Design Guide may be used.

When a shadow vehicle is positioned to protect exposed workers and/or to shield a temporary hazard in the roadway, unless otherwise recommended by the TMA or shadow vehicle manufacturer, the vehicle's parking brake shall be set and transmission placed in neutral gear.

928.03.3 Truck- or Trailer-Mounted Flashing Arrow Board (TMFAB). The operation and display of the TMFAB during the work shall conform to the Plans and the latest MUTCD requirements and recommendations for arrow boards. The minimum on-time of the TMFAB lighting elements shall be 50 percent during flashing mode operation. The flashing rate shall be not less than 25 or more than 40 flashes per minute.

928.03.4 Truck- or Trailer-Mounted Changeable Message Sign (TMCMS). The operation and display of the TMCMS during the work shall conform to the Plans and the latest MUTCD requirements and recommendations for portable changeable message signs. TMCMS display messages differing from those called for on the Plans must be approved in advance by the Engineer. No display message requiring more than two phases shall be used at any time. Each phase of the message shall be displayed for at least three (3) seconds, and the display rate per phase shall be adjusted so the entire message can be read at

least twice by passing motorists traveling at the posted or statutory speed limit. The text of messages shall not scroll or travel horizontally or vertically across the face of the TMCMS.

928.04 METHOD OF MEASUREMENT. “Shadow or Advance Warning Vehicle with Impact Attenuator and Flashing Arrow Board” and “Shadow or Advance Warning Vehicle with Impact Attenuator and Changeable Message Sign” will be measured by the number of hours each such assembly is actually employed in the work or as directed by the Engineer.

928.05 BASIS OF PAYMENT. The accepted quantity of “Shadow or Advance Warning Vehicle with Impact Attenuator and Flashing Arrow Board” and “Shadow or Advance Warning Vehicle with Impact Attenuator and Changeable Message Sign” will be paid for at the contract unit price per hour as listed in the Proposal. The price so-stated constitutes full and complete compensation for all labor, materials, equipment, and all incidentals required to finish the work, complete and accepted by the Engineer.

Remove **Provision 929.1000**, pages AC-226 and AC-227 of the April 2016 Compilation of Approved Specifications in its entirety and replace it with the following.

929.1000

FIELD OFFICES REQUIREMENTS

DESCRIPTION. The items of computer equipment and software to be provided for this Contract in accordance with Subsection **929.03.5** Para. C, of the RI Standard Specification for Road and Bridge Construction, latest Edition, consist of the following:

There are three (3) tiers of computer and equipment requirements based upon the contract value.

Tier I: Small Sized Projects (contract value < \$5,000,000)

1. One (1) multifunction all-in-one (printer/copier/scanner/fax) network color laser printer with wireless capability, up to 1200 x 1200 dpi, tray capacity of 250, and accommodates print sizes 3" x 5" through 11" x 17".
2. Two (2) new PC laptop computers with Intel i7 quad core 2.5 GHz processor (minimum) with 4MB cache or RIDOT approved equivalent; 256 GB SSD (minimum); 15" (1920x1080 resolution) widescreen display with webcam and microphone (minimum); Integrated 10/100/1000 Gigabit Ethernet LAN; 12 GB DDR4 SDRAM (minimum); DVD±RW/CD-RW drive; Built-in wireless AC Network Card; Microsoft Windows 10 Pro 64-bit operating system with latest service packs and security updates; Internet access with 50 Mbps minimum download connection speed (wireless AC router if required), two AC/DC power adaptors; two laptop carry bags. All installation CDs, licenses, registration codes and user manuals/documentation shall be provided to the Engineer.
3. Two (2) Microsoft Office Professional Suites 2016 (or newer) with licenses to be supplied upon delivery to field office.
4. Two (2) Adobe Acrobat DC (newest version available) with licenses to be supplied upon delivery to field office.
5. Two (2) Symantec Endpoint Protection 12.1 (or RIDOT Approved equivalent) with subscription for the life of the field office.
6. Two (2) docking stations or port replicators with a minimum of a network (RJ-45) port; DVI interface; at least 2 USB 2.0 interfaces and 1 USB 3.0; and a HDMI port.
7. Two (2) wireless enhanced keyboards.
8. Two (2) wireless mouse with scroll wheel.
9. One (1) USB 3.0 external hard drive with at least 2 TB of storage space.
10. Two (2) 24" (minimum) wide screen flat panel LCD Monitor with 1920 x 1080 (minimum) resolution.
11. Two (2) 12 mega pixel (or greater) digital cameras with wide-angle 5x optical zoom, 2-inch (minimum) LCD screen and be able to capture HD video. The camera shall be dustproof, waterproof to 13 feet (4 meters), cold proof to 14 ° F, and have a 16 GB (or greater) memory card for each camera.
12. All necessary power cords, internet cables, electrical wires, and surge protectors shall be provided by the contractor at the direction of the Engineer.
13. The computer equipment, software, licenses, and cameras will become the property of the State at contract completion.

14. The contractor is responsible for proper maintenance of computers and all office equipment for the life of the project which includes but is not limited to network support, computer support and peripheral support. Supplies for the field office shall be provided by the contractor for both new and existing equipment which includes but is not limited to flash drives, DVDs, toner, binders, folders, phones, paper, dry erase boards, etc. All supplies shall be provided with the delivery and set-up of the office equipment and as required by the Engineer.
15. On delivery of computer equipment to a field office, the Resident Engineer must contact the (DoIT) service desk to arrange for State inventorying. The Resident Engineer must provide the detail spec of the computer equipment, location of the field office and the completion date of the project. The Resident Engineer must also contact the service desk at the end of the project to take the computer equipment into DOT State inventory or the computer equipment needs to move from one location to another.

Tier II: Medium Sized Projects (\$5,000,000 ≤ Contract value ≤ \$20,000,000)
In additional to tier I

1. All items in tier I.
2. One (1) stand-alone copy machine with the following features: fax; automatic document feeder; capable of 25+ PPM; scanning; network compatible; 1200 x 1200 dpi; reduce/enlarge function; paper capacity of at least 500 sheets; 3" x 5" through 11" x 17" paper printing capability; minimum of 8 MB memory. The copier shall be networked by the contractor to be shared by all computers in the field office for scan/fax functions.

Tier III: Large Sized Projects
In additional to tier II (Contract Value > \$20,000,000)

1. All items in tier I & II.
2. (1) NEW desktop PC computers Intel i7 3.5 GHz (minimum) quad core processor with 6mb Cache (minimum) or RIDOT approved equivalent; 512 GB SSD (minimum); 2 terabyte hard drive (7200 rpm); 16 GB DDR4 SDRAM or greater; 4 GB or greater dedicated video graphics card; DVD±RW/CD-RW internal drive; Integrated Gigabit Ethernet LAN (RJ-45 connector); Wireless A/C Network Card (built-in Wi-Fi), USB 3.0 interfaces, Microsoft Windows 10 Pro 64-bit operating system with latest service packs and security updates; All installation CDs, licenses, registration codes and user manuals/documentation shall be provided to the Engineer.
3. One (1) subscription to AutoCAD LT for the life of the project
4. One (1) Microsoft Office Professional Suites 2016 (or newer) with licenses to be supplied upon delivery to field office.
5. One (1) Adobe Acrobat DC (or newer) with licenses to be supplied upon delivery to field office.
6. One (1) Symantec Endpoint Protection 12.1 (or RIDOT approved equivalent) with subscription for the life of the field office.
7. One (1) wireless enhanced keyboards.
8. One (1) wireless mouse with scroll wheel.
9. One (1) USB 3.0 external hard drive with at least 2 TB of storage space.
10. Two (2) 24" (minimum) wide screen flat panel LCD Monitor with 1920 x 1080 (minimum) resolution.

Remove **Section T.13, Detectors and Relays**, pages T-24 to T-27 of the RI Standard Specifications for Road and Bridge Construction and page AC-272 of the April 2016 Compilation of Approved Specifications in its entirety and replace it with the following.

SECTION T.13

DETECTORS AND RELAYS

T.13.01 DESCRIPTION. This work consists of furnishing and installing vehicle detectors, detector relays, pedestrian detectors, and all necessary wiring, associated equipment, and appurtenances at the locations indicated on the Plans or as directed by the Engineer, all in accordance with these Specifications.

T.13.02 MATERIALS. Loop detector wire, loop detector lead-in cable, loop detector relays, and pedestrian detectors shall conform to **Subsections M.15.02.5, M.15.02.6, M.15.14 and M.15.17**, respectively, of these Specifications.

T.13.03 CONSTRUCTION METHODS.

T.13.03.1 Scheduling Detector Installations and Restoration. Whenever a new roadway or driveway is installed and detector installations are called for, the Contractor shall ensure such detection is installed and properly operational prior to opening such roadway or driveway to traffic, unless otherwise authorized in writing by the Engineer.

When the Contractor mills and overlays or otherwise resurfaces an existing roadway that will be open to traffic, and such operations damage existing detection thereby rendering it non-functional, the Contractor shall restore properly operating detection within seven (7) calendar days. When existing detection is rendered non-functional by the Contractor's operations for any other reason, the Contractor shall restore properly operating detection within 72 hours, unless otherwise authorized in writing by the Engineer.

T.13.03.2 Inductance Loop Detector Installation. Inductance loops shall be installed in accordance with the details specified on the Plans, or as directed by the Engineer. Loop dimensions shall be as specified on the Plans. Handholes, conduits and curb cuts shall be completed before beginning the loop installation. The loop shall be outlined on the pavement to conform to the specified configuration.

A power saw shall be used to cut a slot in the pavement. The cut shall be of sufficient width (min. 3/8") to allow easy placement of loop wire (single or twisted pair) into the saw cut and have a depth which will place the last loop turn from 1½-inches to 2½-inches below the final surface unless specified otherwise on the Plans. The corners shall be saw cut, cored, drilled or chipped out as indicated on the Plans. Sharp edges in the corners shall be smoothed. The intersection of saw cuts shall overlap so that the slots have full depth and a smooth bottom.

Immediately after sawing, the slot and pavement shall be flushed with high pressure clean water to remove the saw slurry. Filtered compressed air shall be used to remove all dust and moisture from the slot. The installation shall not proceed until the slot is dry. Hot air may be used to dry the saw slot.

To protect the loop wire at the edge of the pavement or curb, 1-inch minimum diameter flexible PVC or vinyl conduit(s) shall be installed between the pavement and handhole, in accordance with the details indicated on the Plans.

The loop wire shall be installed starting at the roadside handhole, around the loop for the specified number of turns, and back to the handhole. Splices shall not be permitted outside the handhole. The wire shall be depressed in the slot without the use of sharp objects which might damage the wire insulation. The loop shall be held in place every 2 feet with 2-inch (approximate) strips of open-celled polyurethane backer rod as approved by the Engineer. These hold down strips shall be left in place when the slot is filled with roadway loop embedding sealer. Where the loop wire crosses pavement joints and cracks, the loop wires shall be further protected using the method specified on the Plans.

The ends of the vinyl or PVC tubing encasing the wire shall be given a waterproof seal immediately after placing the wire to prevent moisture from entering the tube. The tubing shall be of a continuous length from the curb to the handhole.

The pair of loop wires between the edge of the loop and the splice to the shielded lead-in cable in the handhole shall be twisted together 3 to 5 turns per foot.

The splice between the loop wires (twisted pair) and the shielded lead-in cable shall be moisture proof and shall have a dielectric strength at least equal to that of the original insulation.

Moisture shall be excluded from the splice during the operation and the work shall be done in dry weather or under shelter. All parts of the splice and tools involved shall be clean and dry. Individual splices in each wire shall be staggered in a manner so as to minimize the outside diameter of the finished splice. The bared conductor ends shall be twisted and soldered and reinsulated using an electrical grade fast drying sealant and plastic polyvinyl chloride tape. The reinsulation shall extend approximately one inch onto the adjacent insulation at each end. Sufficient layers of tape shall be applied such that the thickness is one and one-half times that of the original insulation.

Reinsulation of the outer jacket shall be accomplished in a similar manner except that the reinsulation shall extend approximately 4 inches onto the adjacent jacket at each end.

The shielded lead-in cable shall be continued (no splices) from the splices to the loop wires, to the controller cabinet terminals only.

The completed loop installation, including the shielded lead-in to the controller cabinet, shall have a minimum of 50 megohms leakage resistance to ground. This resistance shall be tested after the splice is made between the loop wires (twisted pair) and shielded lead-in.

The Contractor, in addition to measuring the leakage to ground, shall, by test instruments capable of measuring electrical values of the installed loop wires and lead-ins, measure induced AC voltage, inductance in microhenries, high "Q" indication, and the resistance of the conductors in ohms. Upon measuring the loops, the Contractor shall report to the Engineer any unusual readings, or readings not in agreement with the calculated values. Testing of the loop may take place during or after the installation of the loop. When a loop is found to be not in accordance with calculated values, a new loop will be installed in its place at the Contractor's expense.

The pavement temperatures shall be 40°F and rising before the sealer is placed. All work involving the sealer shall be done in compliance with the manufacturer's specifications. When the loop embedding sealer has set sufficiently to open the loop to traffic, but the surface remains tacky, the loop may be dusted with cement to facilitate opening the loop to traffic.

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, confirmation light, and all other 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.

T.13.04 METHOD OF MEASUREMENT.

T.13.04.1 Traffic Detector Loop. "Traffic Detector Loops" will be measured by the number of linear feet of saw cut actually made in accordance with the Plans and/or as directed by the Engineer.

T.13.04.2 Traffic Detector Relays - Loop, 2 and 4 Channel. "Traffic Detector Relays - Loop, 2 and 4 Channel" will be measured by the number of units actually furnished and installed in accordance with the Plans and/or as directed by the Engineer.

T.13.04.3 Pedestrian Detectors. "Pedestrian Detector-Pushbutton with Sign" and "Accessible Pedestrian Detector-Pushbutton with Sign" will be measured by the number of units actually furnished and installed in accordance with the Plans and/or as directed by the Engineer.

T.13.05 BASIS OF PAYMENT.

T.13.05.1 Traffic Detector Loop. The accepted quantities of "Traffic Detector - Loop" will be paid for at the contract unit price per linear foot of saw cut as listed in the Proposal. The price so-stated constitutes full and complete compensation for all materials, tools, labor and equipment, including saw cut, loop cable, flexible PVC or vinyl conduit under the curb, sealing compound, splicing and connecting, testing, and all incidentals required to finish the work, complete in place and accepted by the Engineer.

When replacing existing loops, the cost of installing flexible conduit between the handhole and the curb shall be included in the cost of the loop.

T.13.05.2 Traffic Detector Relays - Loop, 2 and 4 Channel. The accepted quantity of "Traffic Detector Relays - Loop, 2 and 4 Channel" will be paid for at their respective contract unit prices per each type or types as listed in the Proposal. The prices so-stated constitute full and complete compensation for all labor, materials, tools, and equipment, and all incidentals required to finish the work, complete in place and accepted by the Engineer.

T.13.05.3 Pedestrian Detectors. The accepted quantity of "Pedestrian Detectors –Pushbutton with Sign" and "Accessible Pedestrian Detector-Pushbutton with Sign" 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, equipment, and all incidentals required to finish the work, complete in place and accepted by the Engineer.

Remove **Subsection M.01.05.1, General Requirements**, pages M-2 and M-3 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

SECTION M.01.05

COARSE AGGREGATE FOR BITUMINOUS CONCRETE AND PORTLAND CEMENT CONCRETE

M.01.05.1 General Requirements. Aggregates accepted for State project use shall meet the applicable requirements of the Department and AASHTO (M43, M80) Specifications except where amended or noted herein.

Crushed quarry rock and processed (crushed and/or screened) gravel aggregates shall be durable and shall not be weathered such that they degrade with handling and working, and shall be kept free of deleterious or organic matter.

Coarse aggregates shall meet the particular Los Angeles Abrasion and Crushing criteria specified in Table II **Subsection M.01.10** for use in asphalt or Portland cement concrete, and shall meet the criteria for soundness in **Subsection M.01.11** as measured by Sodium Sulfate loss. Aggregates shall be resistant to degradation by freeze and thaw and resistant to acid attack.

If lithology or physical character indicate that aggregates may be susceptible to degradation by freeze-thaw or acid attack, or potentially adversely reactive with Portland cement, the Department may require additional appropriate laboratory testing be performed to demonstrate that the aggregate is suitable for the intended use.

At least once a year the Department shall test and evaluate each single-source aggregate to be provided by all producers supplying State contracts.

Remove **Subsections M.15.17(b), Accessible Pedestrian Detector – Pushbutton w/ Sign (APD) and (c), Configuration Device**, pages AC-310 and AC-311 of the April 2016 Compilation of Approved Specifications in its entirety and replace them with the following.

M.15.17

PEDESTRIAN PUSHBUTTON DETECTORS

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, when the traffic signal is operating in a flashing mode; and when a passive pedestrian detection system is in place that activates the locator tone only at times when a pedestrian is present near the APD. 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, for concurrent pedestrian crossings (when some vehicles have a green signal during the pedestrian interval) the audible WALK indication shall be a verbal speech message that is patterned after the model: “Smith Street. Walk sign is on to cross Smith Street.”, and for exclusive pedestrian crossings (when all vehicles have a red

signal during the pedestrian interval) the audible WALK indication shall be a rapid-tick percussive tone as described above. 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 at times when the WALK signal is not on shall be accompanied by the audible verbal speech message "Wait." Where both (a) less than ten (10) feet separate the APD from another APD, and (b) the APD is associated with a concurrent pedestrian crossing (when some vehicles have a green signal during the pedestrian interval), such audible verbal speech message "Wait" shall be followed by an audible verbal speech information message patterned after the model "Wait to cross Smith Street at First Avenue." All verbal 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 waterproof 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.

An individual control unit for each APD shall be installed in the pedestrian signal head associated with each APD. All programmable settings of the APD control unit shall be able to be wirelessly reconfigured by a technician standing next to the APD and using either (A) the manufacturer's APD programming application installed on an external device (laptop, tablet, or smart phone) or (B) a configuration device designed by the APD manufacturer specifically for such purpose. Each APD shall also allow for a wired cable connection to be used for reprogramming (via cable with standard USB connections between the APD and an external device) as an alternate to wireless connection should the latter fail for any reason. Regardless of the number of individual APDs that are included in the Contract, two (2) copies of the (A) manufacturer's APD programming application or configuration device and (B) cable with USB connections shall be furnished to the Department's Traffic Maintenance section prior to the APD field testing required by **Subsection T.13.03.3**.

c. Accessible Pedestrian Detector – Configuration Device. (Subsection Deleted)

Remove **Subsection M.16.04.7, Parking Sign, Mile Marker, and Delineator Posts**, page M-87 of the RI Standard Specifications for Road and Bridge Construction and replace it with the following.

M.16.04

SIGN SUPORTS AND STRUCTURES

M.16.04.7 Parking Sign, Mile Marker, and Delineator Posts.

a. Parking Sign Posts. Posts for parking sign mountings shall be U-channel shape made from steel conforming to ASTM A499 and galvanized in accordance with ASTM A123. Each post shall have a weight of 3 pounds per foot and shall include 3/8-inch diameter mounting holes spaced 1 inch on center for a minimum distance of 5 feet from the top of the post.

b. Mile Marker Post. Posts for mile marker mountings shall conform to the requirements of Para. a above, except that the mounting holes shall extend a minimum distance of half the overall post length from the top of the post.

c. Delineator Posts. Posts for delineator mountings shall be U-channel shape made from steel conforming to ASTM A499 and galvanized in accordance with ASTM A123. Each post shall have a minimum weight of 1.12 pounds per foot and shall include 3/8-inch diameter mounting holes spaced at 1 inch on center for a minimum distance of half the overall post length from the top of the post.

COMPILATION OF APPROVED SPECIFICATIONS

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

**REVISIONS
SUPPLEMENTAL SPECIFICATIONS
SPECIAL PROVISIONS**

SUPPLEMENT NO. 19

JULY 2018

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938	Price Adjustments	AC19-17
938.1000	Price Adjustments	AC19-20

Remove **Subsection 108.03, Prosecution and Progress**, pages 1-56 to 1-69 of the RI Standard Specifications for Road and Bridge Construction its entirety and replace it with the following.

108.03

PROSECUTION AND PROGRESS

108.03 PROSECUTION AND PROGRESS.

a. General Requirements.

1. Project Schedule Program.

The Contractor shall develop and maintain an integrated project management and controls program through Completion of all Projects. The Contractor shall initiate the Schedule Development process upon its receipt of the Post-Qualification notification letter. The Special Provisions of the Contract shall identify the applicable schedule requirements, according to the following levels:

- Schedule Level A. Projects with a high level of complexity, impact to the motoring public or community, and/or larger size Projects.
- Schedule Level B. Projects of average to moderate complexity, moderate impact to the motoring public or community, and/or average size.
- Schedule Level C. Smaller projects with minimal to no complexity, and minimal impact to the community. Examples include Projects such as resurfacing, maintenance, and landscaping.

2. The Contractor's schedule is the primary tool for the Contractor to organize and communicate its plan to timely complete the Project. The Contractor's Schedule shall include all Contract requirements, including Work performed by the State, Contractor, subcontractors, vendors, suppliers, utilities, regulatory agencies, and any other third party. The Contractor's Schedule is used to identify the Critical Path and near-critical activities, assess progress, perform contemporaneous delay analyses, project time and resources required for tasks, and identify opportunities for mitigation, if necessary.

3. If the Contractor fails to provide an acceptable Project Baseline Schedule and Project Schedule Update in accordance with the requirements of the Contract, the Contractor shall be responsible for all delays and resulting costs to the Project.

4. The Department may withhold progress payments if the Contractor fails to submit required Schedule Submissions, including but not limited to Schedule Development, Schedule Updates, Project Meeting Minutes and Recovery Schedule Submissions.

5. Software. The software used to generate the Critical Path Method (CPM) Schedule shall be capable of producing schedules in accordance with the requirements of the Contract Documents and fully

compatible with software utilized by the Engineer, including Primavera Project Planner (P6 Professional Release 8.3) or approved equivalent.

b. Schedule Development.

1. Schedule Development Submittals.

Scheduling and Schedule Submittals shall be based on the defined schedule level. The Schedule Development Process shall commence on the date that the Post-Qualification notification letter is provided to the Contractor, which will be deemed Day 1 for all Schedule Submittals.

2. Meetings will be held as necessary to facilitate the Schedule Development Process. Each Submission shall incorporate the comments from the previous Submission(s). If any Schedule Development Submission does not conform to the Contract, the Contractor shall revise and resubmit prior to proceeding to the next step. Each Submission shall include electronic files in their corresponding format.

The table below details the required Submissions and their corresponding Submission due dates for each schedule level.

STEP	STEP DESCRIPTION*	SCHEDULE LEVEL			ENGINEER REVIEW DEADLINE (After receipt of submission)
		A	B	C	
Step 1	Scheduler's Resume	Day 3		-	3 days
Step 2	Initial Schedule Framework	Day 7	-	-	4 days
Step 3	Complete Schedule Framework	Day 14	Day 14	-	5 days
Step 4	Preliminary Schedule	Day 28	Day 28	Day 28	7 days
Step 5	Baseline Schedule – Activities and Logic	Day 42	Day 42	Day 42	7 days
Step 6	Baseline Schedule – Bid Item Loaded	Day 70**	Day 70**	Day 70**	7 days
Step 7	Baseline Schedule – Resource Loaded Schedule	Day 84	-	-	7 days
Step 8	Project Baseline Schedule	Day 98	Day 98	Day 98	7 days
All days are calendar days					

*Refer to Section 4 for Technical Scheduling Requirements; refer to the Special Provisions for project specific information, including Project Groups, ID Standards, Milestones and Activity Data.

**Required by Day 70 but no earlier than 10 Days after NTP.

The requirements for each Schedule Development Submission are listed below.

Step 1: Scheduler's Resume: The Contractor shall retain a scheduler(s) dedicated full-time to the Project with a minimum of three (3) years' experience on Projects similar in size and scope. The scheduler shall be responsible for developing, updating and maintaining the Schedule. The Contractor shall submit the resume of the proposed scheduler(s) to the Engineer within three days of receipt of the Post Qualification notification letter. The Engineer may impose additional conditions based upon qualifications submitted. The scheduler shall be present at all required meetings, including but not limited to the Schedule Development, Schedule Update, and any other meetings which may affect the project Schedule.

Step 2: Initial Schedule Framework:

- a) Work Breakdown Structure (WBS)
- b) Activity Codes: All Contractor defined activity code values.
- c) Calendars: All Contractor defined calendars
- d) Contractor's Submittal List (including all required Contractor Submittals)
- e) Potential VECP, when not otherwise prohibited in the Contract or alternate sequencing/methods.

Step 3: Complete Schedule Framework:

- a) All requirements of Step 2 with prior comments addressed.
- b) Activity Data for all Milestones, Submittals, Procurement and Work by Others. Data includes:
 - (1) Activity ID;
 - (2) WBS ID;
 - (3) Responsibility (RESP) Code;
 - (4) Activity Type; and
 - (5) Calendar IDs.
- c) Resource Definitions (Level A only): labor resources, work types, and equipment resources detailed by crews, incorporating all Engineer comments to date.

Step 4: Preliminary Schedule:

- a) All requirements of Step 3 with prior comments addressed.
- b) Activity Data, including all logic, for all work required to be performed within the first 120 days after the NTP.
- c) All work after the first 120 days from NTP shall be shown in summary activities (summary activities shall not have durations greater than 60 days).
- d) Narrative explaining the sequence of the work and all critical Submittals and activities.

Step 5: Baseline Schedule – Activities and Logic:

- a) All requirements of Step 4 with prior comments addressed.
- b) Completed Schedule showing all work activities and logic for the complete Contract.
- c) Narrative Report.

Step 6: Baseline Schedule - Bid Item Loaded:

- a) All requirements of Step 5 with prior comments addressed.
- b) Complete Bid Item Loaded Schedule.

- c) Schedule Narrative which shall explain the use of resources and an explanation of all logic changes since the Baseline Schedule Submittal.

Step 7: Baseline Schedule - Resource Loaded Schedule (Level A Only):

- a) All requirements of Step 6 with prior comments addressed.
- b) Resource loading completed for all activities in the Schedule for the entire Project.
- c) Schedule Narrative, which shall explain the use of resources and an explanation of all logic changes made since the Baseline Schedule Submittal.

Step 8: Project Baseline Schedule:

- a) The Contractor shall incorporate and integrate all comments from the previous Steps into the Project Baseline Schedule to conform to the Plans and Specifications.
- b) The Project Baseline Schedule shall be revised and resubmitted until approved by the Engineer. The Contractor shall not change the Project Baseline Schedule after approval by the Engineer.

c. Project Schedule Updates.

Project Update Meetings shall be held every two weeks for Level A and monthly for Levels B and C from the time of Notice to Proceed to the completion of the Project. The Contractor shall be required to attend each meeting with all their update information (data as of the data date) compiled in advance. The Contractor shall furnish meeting minutes from the previous Project Meeting, a complete and accurate report of the current progress, a printed Critical Path report, a report of the days gained or lost relative to the Substantial Completion date and any other completion dates and a depiction of how future Work plans shall meet the Contract completion dates and depiction of how future work plans shall meet the contract completion dates. Failure to attend meetings or submit Schedule Updates may result in withheld Progress Payments. At each meeting, the Contractor shall provide sufficient copies of the updated schedules in the format acceptable by the Engineer.

The Contractor shall submit an electronic copy of the Schedule Update Submittals on the scheduled Project Update Meeting date, or no later than two (2) working days after the Project Schedule Update Meeting. Updates shall be submitted even in the absence of a Project Schedule Update Meeting. The Engineer shall have five (5) working days to review the Schedule Update Submittal. The Schedule Updates shall contain the following components:

- (i) Schedule Update Narrative;
- (ii) Schedule Activity Report – Past Month and Remaining;
- (iii) Schedule Activity Report Longest Path (per completion date);
- (iv) Two week Look Ahead Schedule;
- (iv) Predecessor/Successor Report;
- (v) Schedule Data File;
- (vi) Previous Meeting Minutes, and
- (vii) other reports requested by the Engineer.

Additional Requirements for Schedule Level “A” Projects:

- (i) the Contractor is required to submit a Four-Week Look Ahead Schedule rather than a Two-Week Look Ahead Schedule, and

- (ii) a monthly Resource Utilization Report.

All Schedule data, logic and duration changes, and any modifications to the Schedule shall be addressed and discussed with the Engineer at the Project Schedule Update Meeting. This shall be done prior to the Contractor submitting their final Schedule Updates.

Changes to the accepted Baseline Schedule will be detailed in the Schedule Update Narrative. The acceptance and inclusion of these changes will not be the sole basis of acceptance or entitlement to any time extension(s) or monetary compensation.

Schedule Update Submittals will never be used as the sole basis for any adjustment in the Contract Time(s), regardless of their acceptance by the Engineer. Any acceptance of the Schedule Update Submittal by the Engineer, either expressed or implied, will only apply to the issue of progress.

d. Schedule Requirements. The Department will provide the Contractor with templates during Schedule Development. The Schedules shall be developed and maintained in accordance with the following requirements:

1. Schedule Narrative: A description of the sequence of events summarizing the detailed Milestone Status, Critical Path, and all changes made to the Schedule, including Actual Dates, logic revisions, and Calendar and Duration changes. All Project Schedule Submissions shall include a Schedule Narrative as follows:

- (a) Preliminary Schedule Narrative. The Preliminary Schedule Narrative shall:

- (1) Identify the data date and schedule file name.

- (2) Describe the planned flow of work, including details of all key or driving activities/resources for the first 120 calendar days and summarize Project activities thereafter. Summary activities shall not be greater than 60 calendar days in duration.

- (3) Identify proposed alternative methods and product substitutions.

- (4) Include responses to all Engineer's comments and identify and explain all changes made to the Schedule Submission.

- (5) Identify key constraints and potential problems affecting the Contractor's Work.

- (6) For Schedule Level "A" Projects, the Preliminary Schedule Narrative includes:

- (i) A detailed summary of planned labor utilization for the Project for the first 120 calendar days, including the average and maximum number of workers by craft designation on site each month, the shifts to be worked and actual and potential labor resource limitations.

- (ii) A detailed summary of planned operated equipment utilization for the first 120 calendar days, including each type of operated equipment, the quantity each month, the criteria for

mobilizing and demobilizing to and from the site and actual and potential resource limitations.

(b) Baseline Schedule Narrative. The Baseline Schedule Narrative shall:

(1) Identify the data date and schedule file name.

(2) Describe the planned flow of Work identifying all key or driving resources.

(3) Identify proposed alternative methods and product substitutions.

(4) Include responses to all Engineer's comments and identify and explain all changes made to the Schedule Submission.

(5) Explain treatment of adverse weather in the Baseline Schedule, including all activities that contain contingency days for adverse weather. Lack of preparation for normal adverse weather is non-excusable.

(6) Identify key constraints and potential problems affecting the Contractor's Work.

(7) For Schedule Level "A" Projects, the Baseline Schedule Narrative shall:

(i) Summarize planned labor utilization for the Project, including the average and maximum number of workers by craft designation on site each month, the shifts to be worked and actual and potential labor resource limitations.

(ii) Summarize planned operated equipment utilization, including each type of operated equipment, the quantity each month, the criteria for mobilizing and demobilizing to and from the site and actual and potential resource limitations.

(iii) Identify resolutions to constraints and potential problems, such as interface with plant operations, coordination with third parties, temporary Contractor facilities or fixed equipment planned for use.

(c) The Schedule Update Narrative shall:

(1) Identify the Update Period, the data date, and the schedule file name.

(2) Detail the Work accomplished in the past two weeks and Work planned for the next two weeks.

(3) Identify and explain why any planned Work was not accomplished and how it affects the Project.

(4) Describe the activities driving the current critical path to each Milestone or Phase Completion Work.

(5) Identify proposed alternative methods and product substitutions.

(6) Include responses to all Engineer's comments and identify and explain all changes made to the Schedule Submission.

(7) Identify any proposed elective changes, including the activities and logic changed, a description of the scope of the elective change, its effect on the Project, driving resources and key constraints.

2. Additional Requirements for Schedule Level A.

(a) Identification of activities with critical or near critical float (within ten (10) Working Days of the Critical Path) that were planned to occur during the Update Period, but did not occur or occurred later than the scheduled late start or late finish date, and an explanation of these delays. Identification of delays to activities taking place off the Project site, e.g., Submittal preparation, fabrication, and delivery activities.

(b) Provide a listing of all activities which have surpassed their planned duration by more than twenty (20) percent and justification for maintaining original planned durations for future activities of like work.

(c) A summary of changed plans for labor utilization for the Project, identifying the average and maximum number of workers on site each month. Identify actual and potential labor resource limitations. A summary of the actual labor utilization used over the past month.

(d) A summary of changed plans for equipment utilization for the Project, identifying each type of operated equipment to be used on the Work, the planned quantity of each type of operated equipment utilized each month, and all changes to the criteria for mobilizing and demobilizing each piece of equipment to and from the site. Identify actual and potential equipment resource problems. A summary of the actual equipment utilized over the past month.

3. CPM Schedules.

All CPM Schedules shall utilize a Work-Breakdown Structure (WBS) developed by the Contractor. The WBS shall be used as the primary code for displaying and organizing the graphical output schedules utilized for the project, unless otherwise directed by the Engineer. Title case shall be used for WBS and activity descriptions. The following is the basic dictionary for the WBS:

(a) Basic Structure for WBS, where XX are contract specific, alpha-numeric characters that will be defined by the Engineer.

XX.00 Contract Name

XX.10 Milestones

- XX.15 Summary Activities
- XX.30 Procurement/Shop Drawings
- XX.40 Utility/RR & Work by Others
- XX.60 Construction

(b) Project Naming Standards:

- Preliminary Project Schedule: PS00
- Baseline Schedule: BL00
- Bi-Weekly Status Schedules: Uxxx
- Recovery Schedule: Rxxx

(c) Project Milestones, Interim Completion Dates and Phase Completion Dates. The Contractor shall include Milestones, Interim Completion Dates and/or Phase Completion Dates, if specified in the Contract. Late Finish Constraints shall be assigned to these dates.

(d) Activity Codes. The CPM Schedules shall contain activity code classifications and code values. The Contractor shall propose a coding structure for the Engineer's review and acceptance. The activity code structure combined with the activity identification number shall provide the capability to organize information by location, road or ramp, structure, work type, Subcontractor, discipline, etc., as deemed necessary by the Engineer. The Contractor shall reserve three (3) code classifications (fields) and a minimum of six (6) characters for the Engineer's use.

RESP code will be utilized for identification of responsible party. RESP values shall be discussed at the Schedule Development Meetings.

(e) Activity Descriptions. An activity description shall consist of a work function, construction element and specific location of Work. No two activities will have the same description. Non-specific terminology shall not be used in the activity's description. Any abbreviations used in the activity descriptions shall be defined in the Schedule Narrative Report. The activity description shall be left-justified and in title case.

(f) Activity Durations. The CPM Schedule shall incorporate a minimal number of activities with durations less than two (2) working days and more than twelve (12) working days. The Contractor may request permission from the Engineer to assign durations greater than twelve (12) working days. If the Engineer accepts the Contractor's request to use a long duration, the reason for the request shall be detailed in the Preliminary and Baseline Schedule Narratives.

(g) Activity Type. The following types of activities are required in the Schedule:

(1) Milestones – The Contractor shall only use this Activity Type for Milestones, Interim Completion Dates and Phased Completion Dates as specified in the Contract.

(2) Summary (Hammock and Level of Effort Activities) Schedule Activities –The Contractor shall maintain a Summary Activity Schedule. These schedule activities shall remain in all of the Schedule Submittals. The predecessor and successor activities of the Summary Activities may be

modified to include all those activities that are entered into the Schedule and considered part of the respective Summary Activity's scope of work.

(3) Task Activities - This is the primary activity type. All activities other than Milestone and Summary as defined above shall be task activities.

(h) Activity Dates. Activity Early and Late Start and Finish dates shall be calculated for each activity based upon the schedule data date, actual dates, schedule logic, schedule constraints, calendars, and original duration or remaining duration in accordance with the scheduling parameters defined in this section.

The Contractor shall provide actual start and finish dates to the Engineer for approval. In the event of a disagreement, the Engineer will assign the dates to be used for the activities at issue.

(i) Activity Bid Item Loading. All bid items listed in the proposal pages shall be assigned to its corresponding schedule activity or distributed to a group of activities through the use of Primavera's resources dictionary and resource assignment.

The total value and quantities of the activities allocated to each bid item shall equal the total value and quantities of the corresponding bid item listed in the proposal.

(j) Calendars. The Contractor shall include the below referenced calendars in the Schedule or may request approval from the Engineer to create additional calendars. It is the responsibility of the Contractor to schedule the Work in accordance with the Contract. The Contractor shall not schedule Work during winter shutdown or other contract shutdown periods unless permitted by Contract or as permitted by the Engineer. If work during the winter shutdown period is approved by the Engineer, the Department will not consider delays during this time period eligible for a time extension.

The following calendars are:

- Calendar 1 - 5-day workweek (includes Holidays and Winter Shut Down)
- Calendar 2 - Procurement
- Calendar 3 - 6-day workweek (includes Holidays and Winter Shut Down)
- Calendar 4 - 7-day workweek (includes Holidays and Winter Shut Down)
- Calendar 5 - 5-day workweek (includes Holidays and No Winter Shut Down)
- Calendar 6 - 6-day workweek (includes Holidays and No Winter Shut Down)
- Calendar 7 - 7-day workweek (includes Holidays and No Winter Shut Down)
- Calendar 8 - Interstate 5-day workweek (includes Holidays & Winter Shut Down)
- Calendar 9 - Interstate 6-day workweek (includes Holidays & Winter Shut Down)
- Calendar A - Seeding
- Calendar B - Wetland Seeding
- Calendar C- Plants B&B

(k) Data Date.

The following are the definitions of the data dates for the CPM Schedules:

- (i) Preliminary CPM Schedule –Date of Bid Opening
- (ii) Baseline CPM Schedule –Date of Bid Opening
- (iii) Status Update Schedules –TBD at Schedule Development Meeting

(l) Logic.

(1) The logic in the Schedules shall represent the progression of time and the sequence of work performed within the Contract Time(s). The CPM Schedules shall conform to the following requirements:

(2) Every activity shall have logically assigned predecessors and successors. Unless otherwise specified, “Bid Opening” shall be the only activity without a predecessor, “Substantial Completion” and each Milestone or Phase Completion shall be the only activities without successors.

Activity Constraints are limited to the use of Start-No-Earlier-Than and Finish-No-Later-Than, for access restraints and Completion Milestone(s) or Phase(s). The Contractor shall request permission from the Engineer to use these constraints for other activities prior to the incorporation in the CPM Schedule. The use of “Zero Free Float,” “Start-On,” “Expected Finish,” “Mandatory Start” or “Mandatory Finish” is prohibited.

Activity lag durations shall not have a negative value unless approved by the Engineer. Activity lags shall not be used in lieu of logic relationships.

Redundant ties to preceding activities in a sequential series of activities is not allowed. A tie representing a different constraint will not be considered redundant.

(m) Schedule Layout Requirements. The Engineer will provide the Contractor with the required layouts and templates for the Schedule.

(n) Schedule Calculations. Performing scheduling calculations requires the following settings.

- (1) Turn off automatic scheduling and leveling.
- (2) When scheduling activities, apply retained logic.
- (3) Calculate the start-to-start lag from early start.
- (4) Schedule durations as contiguous.
- (5) Show open ends as non-critical.
- (6) Calculate total float as finish float.

(7) Summary calculations shall use Calendar No. 1 and the weighting factor for determining percent complete shall be duration.

(8) Set the auto-inserting option on automatic with a minimum increment of three (3).

(9) Initially set critical activities using defined critical as total float less than one (1). This option may be changed at the direction of the Engineer.

(10) Set language for output as U.S. English.

(o) Submittals and Procurement. The Schedule shall include activities for all items within the Contractor's Submittal List (CSL). Each submittal item shall have an activity for submittal preparation, review, fabrication, and delivery. The Contractor is responsible for the accuracy and completeness of its schedule activities, and for any delays resulting from inaccurate or incomplete submissions.

e. Review and Acceptance of Project Schedule Submittals.

The Engineer will review Schedule Submittals for conformance with the requirements of the Contract Documents. The planning, scheduling, and execution of the Work and the accuracy of any Project Schedule is the responsibility of the Contractor. The Contractor remains responsible for errors in any previously accepted Project Schedule, including but not limited to omitted activities, activity durations, relationships between activities, resource allocation, or any float suppression techniques. The Engineer may direct the Contractor to address and adjust schedules that do not accurately reflect the Work at any time, with no additional cost to the State. Acceptance of any Project Schedule does not relieve the Contractor of any responsibility for the completion of the work in conformance with all Contract requirements.

f. Progress Delays.

The Contractor shall identify and promptly report to the Engineer all schedule and progress delays during the prosecution of the work. Whenever the Project Schedule Update indicates late critical path progress by 20% or more in Contract Time, or at the Engineer's request, the Contractor shall develop and submit a Recovery Schedule in the form of a proposed Baseline Schedule Revision.

The Contractor is not relieved from the submission of Project Schedule Updates during the development of a Recovery Schedule.

The Recovery Schedule shall illustrate a clear process and procedure for eliminating or mitigating said delays to the Contract Time(s). The Recovery Schedule shall be submitted within (30) calendar days of the corresponding Project Schedule Update and is subject to approval by the Engineer.

Non-Excusable Delays: The development and submission of the Recovery Schedule shall be at no additional cost to the State.

Excusable Delays: The State may reimburse the Contractor for the costs of the development the Recovery Schedule.

The Engineer may withhold progress payments, either in whole, or in part if the Contractor fails to submit a Recovery Schedule.

1. Baseline Schedule Revisions.

Project Baseline Schedule Revisions shall conform to all requirements for approval of the Project Baseline Schedule and associated updates, including but not limited to inclusion of added or deleted activities, changes to logic or relationships, and a distribution of costs for the added Work or changes.

The Engineer shall review and comment on this revision within 14 calendar days of its submission.

The final draft of the proposed Baseline Schedule Revision shall incorporate all approved changes and be submitted for acceptance within 5 calendar days following the Engineer's approval.

The approved Baseline Schedule Revision shall be referred to as “Baseline Schedule of Record – rev #” in subsequent Project Schedule Update submittals.

A Baseline Schedule Revision is required whenever there is a change to the Baseline Schedule of Record or its corresponding Project Schedule Update, and whenever a Progress Delay threshold is triggered.

Remove **Subsection 109.06, Partial Payments**, pages 1-83 and 1-84 of the RI Standard Specifications for Road and Bridge Construction in its entirety and replace it with the following.

109.06

PAYMENT FOR WORK

109.06 PAYMENT FOR WORK.

a. General. The Department will make payment for Work before the Project is accepted and final payment is made. These payments for Work will be processed via progress payments. To receive a payment for Work, the Contractor shall prepare an invoice in accordance with **Subsection 109.06(c)**. The Department may suspend progress payments if the Contractor does not comply with the terms of the Contract or the Engineer's instructions or written directives. The Department will notify the Contractor whenever progress payments will be suspended. Processing of progress payments for work prior to the Department's acceptance and final payment of the Work does not constitute the Department's acceptance of the Work, and does not relieve the Contractor of responsibility for the Work, which includes but is not limited to:

1. Protecting, repairing, correcting, maintaining, or renewing the Work where necessary to meet Contract requirements before acceptance.
2. Replacing or repairing all defective Work or materials used in the construction of the Work, and repairing all damage to other work or materials whose damage is attributable to such defective Work or materials.
3. All defects or damage that the Engineer may discover on or before the Engineer's acceptance and final payment of the Work. The Engineer is the sole judge of these defects or damage.

b. Frequency. The Department will make progress payments bi-weekly (every two weeks) in accordance with established Department procedures. Progress payments will be subject to a 5 percent retainage. Retainage will be released incrementally in accordance with **Subsection 105.16** and the Department's Release of Retainage Procedures.

c. Invoice for Payment for Work. The Contractor shall submit an invoice for payment bi-weekly (every two weeks), and, as requested by the Engineer, a weekly progress report for review detailing the items included in the invoice. The Contractor shall utilize and complete invoice forms supplied by the Department, including a certification for payment, in accordance with the instructions contained thereon.

d. Invoice for Partial Payment for Materials, Supplies, and Equipment. The Engineer may allow invoicing as provided above and permit partial payments for those materials, supplies, and equipment delivered to an approved location but not yet incorporated into the Work. Payment for

materials, supplies and equipment furnished at an approved site but not yet incorporated into the Work will not exceed the lesser of the following amounts:

1. 100 percent of the cost incurred by the Contractor, or
2. 80 percent of the value calculated by multiplying the quantity of the item delivered by the unit price for the corresponding item in the Bid Schedule.

For verification of costs, the Contractor shall provide the Engineer with an original paid supplier's invoice for the furnished materials, supplies or equipment within thirty (30) days after receiving the partial payment. Otherwise, the amount of the partial payment will be deducted from subsequent invoices.

The Engineer will not approve any payment for perishable plant materials until such plant materials are planted as specified in the Contract.

e. Engineer's Review of Contractor's Request for Payment for Work and Request for Partial Payment for Materials, Supplies, and Equipment. Upon receipt of the Contractor's invoice, the Engineer will review the invoice and may approve or reject payment or portions thereof. The Engineer will notify the Contractor in writing of any modifications and/or rejection of the invoice. Modifications and reasons for the change will be made to the Excel spreadsheet in the columns provided. In the case of a rejection, the Engineer will request that the invoice be resubmitted.

f. Subcontractor Payments and Release of Retainage. The Contractor shall notify RIDOT within 7 days upon the Contractor's assessment that the subcontractor's work is complete and ready for inspection for partial acceptance by RIDOT.

The Contractor shall make progress payments to the subcontractor incrementally as the Contractor is paid progress payments by RIDOT, with each progress payment made no more than 30 days from when so paid by RIDOT. The Work of a subcontractor will be inspected by RIDOT within 14 days of the date of Contractor's notification for partial acceptance. Within 30 days of partial acceptance of the completed subcontract work, the Department will pay the Contractor for all work covered by the acceptance including the relevant portion of retainage due the subcontractor. Within 30 days of receipt of such payment, the Contractor shall pay the subcontractor for all accepted subcontract work including all retainage owed. The Contractor must obtain RIDOT's prior written consent for good cause delays in or postponement of payment to the subcontractor.

Procedures for Section 109.06 - Payment for Work

The Contractor shall prepare an invoice to apply for a payment for work completed. This invoice shall utilize the Request for Payment templates supplied by the Department, including the following attachments:

A. Detailed Invoice - The detailed invoice shall be submitted in both hard copy and Excel® and include the following information:

1. The date of the invoice.
2. The Project Name and State and Federal-Aid Project Numbers.
3. The Contract Item number(s) and name(s) for which the Contractor is seeking payment, as they appear in the Contract Proposal.
4. The date(s) each Contract Item was performed.
5. Name of Contractor/Subcontractor(s) that performed the work.
6. The location(s) where the Work associated with each Contract Item was performed, cross referenced to the location(s) shown in the Distribution of Quantities.
7. Invoiced Item Quantities: The quantity of each Contract Item performed by date and by location since the previous invoice.

For Lump Sum Items, the Contractor shall provide the percentage of work completed since the previous invoice. Prior to the start of work, the Contractor shall submit a Lump Sum Item Breakdown for the Engineer's review, acceptance and allocation of payments for the item, in accordance with **Section 109.07** of the Standard Specifications.

All calculations shall conform to the Method of Measurement and Basis of Payment portions of the appropriate Item Code(s). Documentation shall include, but is not limited to, backup calculations, measurements, sketches, and related supporting information.

8. Cumulative Item Quantities: A cumulative total of the quantities performed for each Contract Item, including the current request.
9. Bid Prices: The Contract Price for each Contract Item, including Unit Bid Items and Lump Sum Bid Items as applicable, shall be listed for each item being invoiced.
10. Extended Prices: Calculate the extended price of each item being invoiced in this request.

For Unit Bid Items, this is to be calculated by multiplying each item quantity completed during the invoice period by its Contract Unit Bid Price (i.e., $\text{Extended Price } \$ = \text{Qty. Invoiced} \times \text{Unit Bid Price}$).

For Lump Sum Items, this is to be calculated by multiplying each item by the percentage of

work completed during the invoice period by its Lump Sum Bid Price (i.e., Extended Price \$ = % Complete-this-invoice-period x Lump Sum Bid Price).

11. Total Invoice Price: Sum all extended prices calculated in step 10 and report this amount as the total amount being invoiced under the request.

B. Certificates of Compliance - A list of the Certificate(s) of Compliance attached or that have been submitted to the Department, including date(s) submitted, for the work that is listed on the invoice in accordance with **Section 106.04, Certification of Compliance**.

C. Certified Payrolls - A list of the certified payrolls attached or that have been submitted to the Department, including date(s) submitted, for the work that is listed on the invoice. List all outstanding payrolls yet to be submitted by week ending date and Contractor\Subcontractor(s).

D. Subcontractor Payments - A list of all payments (including all retainage payments) made to date to subcontractors for amounts previously billed and paid by the State for the related project.

E. Extra Work- A list of approved and/or potential extra work subject to approval, including dates(s) when the work was identified and/or approved, and a description and associated cost(s) of the work, including information pertaining to when and by whom the work was performed.

F. EEO Certification - A statement that all EEO documentation has been submitted as required by the Contract.

G. As-Built Data - A set of as-built data in hard copy or electronic form of the work billed on the invoice, including plans, sketches, diagrams and all other information necessary for resulting in a complete and accurate set of as-built data representing the work completed. A final set of as-built plans is also required in accordance with **Section 934.03.3 (h), Field Control and Construction Layout**. □

General - Outstanding or missing documentation for Items A through G above will be a basis for rejection and/or modification of the Request for Payment.

Remove **SECTION 938, PRICE ADJUSTMENTS**, pages 9-73 to 9-74 of the RI Standard Specifications for Rhode and Bridge Construction and page AC-247 of the Compilation of Approved Specifications, May 2016 in their entirety and replace them with the following.

SECTION 938

PRICE ADJUSTMENTS

938.01 DESCRIPTION. The intent of this provision is to ensure adequate and fair compensation for unpredictable and fluctuating costs which, from time to time, occur in the prices of Liquid Asphalt, Diesel Fuel and Steel, as described below. The price adjustment provisions are made part of the Contract to provide for more cost-effective risk-balanced bids and to optimize competition in those areas where more risk is to be assumed by the Contractor. This applies to both lump sum and unit price items.

938.02 DEFINITIONS.

938.02.1 Base Price of Liquid Asphalt and Diesel Fuel. The base price is the unit price of the material (FOB Terminal), as determined by the Department. The base prices for Liquid Asphalt and Diesel Fuel will be determined just prior to the first date that the NOTICE TO CONTRACTORS is advertised in the public press.

938.02.2 Period Price of Liquid Asphalt and Diesel Fuel. The period prices for Liquid Asphalt and Diesel Fuel (FOB Terminal) will be determined for any one-month period following the NOTICE TO PROCEED during which the price varies from the base price.

938.02.3 Base Price (BP) for Steel. The Base Price for Steel will be determined by the Department just prior to the first date that the NOTICE TO CONTRACTORS is advertised in the public press.

938.02.4 Period Price Index (PPI) for Steel. For all steel items, the PPI will be defined as the Bureau of Labor Statistics (BLS) Producer Price Index (PPI) for "Steel Mill Products," Series ID WPU 1017-02 (not seasonally adjusted). The latest version of the index will be used, including any corrections or rebasing of the index. PPI will be defined as the BLS PPI at the time that material is purchased from the mill, as specified by the invoice date.

938.02.5 Base Price Index (BPI) for Steel. For all steel items, the Base Index (BPI) will be defined as the BLS PPI just prior to the first date that the NOTICE TO CONTRACTORS is advertised in the public press.

938.02.6 Period Price (PP) for Steel. The period price for steel shall be calculated as follows: $PP = (BP \times (PPI/BPI))$.

938.03 PRICE ADJUSTMENT. Price adjustments for Liquid Asphalt and Diesel Fuel will be determined by the difference between the Period Price and the Base Price. Price adjustments for Liquid Asphalt and Diesel Fuel 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 steel will be calculated every month that steel is purchased, but only applied when steel price indices vary by more than 5.0 percent.

Price adjustments for work performed after the contract completion date, including approved time extension(s), will be as follows:

Credit due the Contractor will be the lesser amount calculated from the following two algorithms (a and b), whereas credit due the Department will be the 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 extension(s).

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.

938.03.1 Liquid Asphalt Cement. The asphalt content will be the optimum amount used in every ton of bituminous concrete mixture, as determined by the Department's Materials Engineer, using the method for determination of optimum asphalt cement content as set forth in **SECTION M.03** of these Specifications.

The Price Adjustment will be determined by multiplying the total weight of liquid asphalt, in tons, by the difference between the base price and period price.

The Base Price of Liquid Asphalt Cement is set forth in **Special Provision Code 938.1000**.

938.03.2 Diesel Fuel. The fuel for operating the plant, and the fuel for hauling and placing bituminous concrete, will equal the total number of tons of bituminous concrete placed during the month in question times a fuel adjustment factor of 2.5 gallons of fuel per ton of bituminous concrete. Tonnage of bituminous concrete placed during the month in question will equal the sum of the weights indicated on the Daily Automated Recordation printout slips provided at the plant.

The Price Adjustment will be determined by multiplying the total volume of fuel, in gallons, by the difference between the base price and the period price.

No price adjustment will be made unless the amount of the adjustment, plus or minus, exceeds \$250.00 for the month.

The Base Price of Diesel Fuel is set forth in **Special Provision Code 938.1000**.

938.03.3 Steel. Steel price adjustments will apply only when specified in the Contract and only to unfabricated structural steel material, consisting of rolled shapes, plate steel, sheet piling, pipe piles, steel castings, steel forgings, and unfabricated reinforcing steel bars. Payments will only be made for fluctuations in the cost of the steel material used in the items specified. Steel price adjustments will not be made to steel purchased prior to the time of bid opening for conventional contracting methods (design/bid/build) or submittal of price proposals for all other contracting methods.

Steel price adjustments will not include the costs of shop drawing preparation, handling, fabrication, welding, erection, surface preparation, coatings, transportation, storage, staging, installation, profit, overhead, fuel costs, fuel surcharges, or other such charges not related to the cost of the unfabricated structural steel and unfabricated reinforcing steel.

The weight of steel subject to a price adjustment will be calculated based on approved shop drawings.

For all steel items specified above, the Price Adjustment will be determined according to thresholds as follows:

If the absolute value of $[(PP-BP)/BP]$ is less than or equal to a threshold of 0.050, then no price adjustment is made.

If the absolute value of $[(PP-BP)/BP]$ is greater than 0.050, then a price adjustment is made and will apply to the full variance between the Base Price and the Period Price.

If the threshold is exceeded and the PP is higher than the BP, the price adjustment owed to the Contractor is calculated as follows:

- $[PP-BP] \times \text{Weight of steel}$

If the threshold is exceeded and the PP is lower than the BP, the price adjustment owed to the State is calculated as follows:

- $[BP-PP] \times \text{Weight of steel}$

The Base Price of Steel is set forth in **Special Provision Code 938.1000**.

938.1000

PRICE ADJUSTMENTS

DESCRIPTION.

a. Liquid Asphalt Cement. The Base Price of Liquid Asphalt Cement as required to implement **Subsection 938.03.1** of the Standard Specifications is \$_____ per ton.

b. Diesel Fuel. The Base Price of Diesel Fuel as required to implement **Subsection 938.03.2** of the Standard Specifications is \$_____ per gallon.

c. Steel. The Base Price of Steel as required to implement **Subsection 938.03.3** of the Standard Specifications is:

Structural Steel \$_____ per pound;

Reinforcing Steel \$_____ per pound;

Stainless Steel \$_____ per pound.