New Jersey Turnpike Authority
P.O. Box 5042, Woodbridge, NJ 07095

May 18, 2018

Document Change Announcement

2016 Standard Supplementary Specifications
QPL Qualification Criteria Updates
DCA2018SS-04

Subject: Revisions to

Division 500 – Incidental Construction
Division 700 – Landscaping
Division 800 – Traffic Control
Division 900 – Materials

Description of Change:

This DCA updates QPL qualification criteria in Division 900 and clarifies materials information in select Sections of Divisions 500, 700 and 800.

Notice to New Jersey Turnpike Authority Staff and Design Consultants
Effective immediately, all contracts currently in the design phase shall incorporate the revisions herein. For advertised contracts awaiting the opening of bids this revision shall be incorporated via addendum. Contact your New Jersey Turnpike Authority Project Manager for instruction.

The revisions may be accessed on the Authority's webpage:
http://www.state.nj.us/turnpike/professional-services.html

Recommended By:

5-18-18
J. Lawrence Williams, P.E.
Deputy Chief Engineer - Construction

Approved By:

Robert J. Fischer, P.E.
Chief Engineer

Distribution: Senior Staff Engineering, Law, Maintenance and Operations Depts., UTCA, AGC, All Prequalified Consultant Firms, File

NOTE: All text herein is ADDED to the latest version of the 2016 Standard Supplementary Specifications.

DIVISION 500 – INCIDENTAL CONSTRUCTION

SECTION 502 – STORM DRAINS

502.02 Materials.

Delete the fourth paragraph and replace it with the following:

The pipe joint patch material shall be as specified in Subsection 917.09.

SECTION 503 – MANHOLES AND INLETS

503.02 Materials.

Add the following:

BRICK MASONRY UNITS 916.02

SECTION 510 – GUIDE RAIL

510.02 Materials.

Add the following:

POSTS AND RECYCLED/SYNTHETIC BLOCKOUTS 915.02

SECTION 515 – DELINEATORS

515.02 Materials.

Add the following:

ALUMINUM SHEET SIGN PANELS AND INCIDENTAL HARDWARE 912.01

SIGN COPY AND BACKGROUND 912.02

SECTION 516 – PAVEMENT STRIPES AND MARKINGS

516.04 Methods of Construction

(E) Defective Thermoplastic Stripes or Markings.

Delete Part (2), Step 2, and replace it with the following:

Step 2: All retroreflectance measurements will be made on a clean, dry surface.

(F) Removal of Painted Pavement Stripes.

Delete the 8th paragraph and replace with the following:

Hydromilling shall be used in the removal of existing or temporary painted stripes on pavement and concrete-wearing surfaces which are scheduled to remain. The hydromilling system shall be as specified in Subsection 919.51. The area of removal includes the area of the stripe plus 1 inch on all sides. Hydromilling shall not be used when the temperature is 35°F and falling.

(J) Determination of Acceptability.

Delete the 4th paragraph and replace it with the following:

The Contractor shall furnish a retroreflectometer for the Engineer's use in determining the retroreflectance values of the various traffic stripes or traffic markings. This equipment is for the sole use of the Engineer and will become the property of the Contractor after Acceptance.

SECTION 520 – TOLL ISLANDS

520.02 Materials.

Add the following:

LIGHT FIXTURES .....922.05(B)

FIRE EXTINGUISHERS AND MOUNTING BRACKETS .....922.05(C)

STAIRWELL GRATING .....922.05(A)

SECTION 522 – TEST PITS

522.03 Methods of Construction.

Delete the third paragraph, including companies listed (1) through (4).

SECTION 524 – IMPACT ATTENUATOR

524.02 Materials.

Add the following:

TEMPORARY IMPACT ATTENUATOR 920.15

524.04 Measurement.

Delete the entire section and replace it with the following:

Impact Attenuator (Cartridge), ___Bays, ___" Wide are TNR Impact attenuators installed on a permanent basis and shall be measured by the number constructed. Each unit shall consist of a total energy absorbing system composed of the required number of bays and required width.

Impact Attenuator, Type_____ will be measured by the number of each installed.

Bullnose Thrie Beam Attenuator will be measured by the number of each installed.

Furnishing Temporary Impact Attenuator (Cartridge), ___ Bays, ___" Wide will be measured by the number of each complete unit installed to the maximum number provided in the Proposal that are installed simultaneously.

Placing and Removing Temporary Impact Attenuator (Cartridge) will be measured by the total number of complete units placed in each location as prescribed. Removal of temporary impact attenuators will not be measured for payment.

Repair Temporary Impact Attenuators (Cartridge) will be measured by the number of bays to be replaced or repaired to the satisfaction of the Engineer.

524.05 Payment.

Delete the 1st paragraph and replace it with the following:

Payment will be made under:

PAY ITEM	*PAY UNIT*
IMPACT ATTENUATOR (CARTRIDGE), ___ BAYS, ___" WIDE	EACH
IMPACT ATTENUATOR, TYPE _____	EACH
BULLNOSE THRIE BEAM ATTENUATOR	EACH
FURNISHING TEMPORARY IMPACT ATTENUATOR (CARTRIDGE), __BAYS, ___" WIDE	EACH
PLACING AND REMOVING TEMPORARY IMPACT ATTENUATOR (CARTRIDGE)	EACH
REPAIR TEMPORARY IMPACT ATTENUATORS (CARTRIDGE)	EACH

SECTION 530 – RAISED PAVEMENT MARKERS

530.02 Materials.

Delete the entire Subsection and replace it with the following:

Materials shall conform to the following Subsections:

RAISED PAVEMENT MARKERS AND ADHESIVE	923.46

SECTION 533 – THERMOPLASTIC RUMBLE STRIPS

533.02 Materials.

Delete the entire Subsection and replace it with the following:

Materials shall conform to the following Subsections:

THERMOPLASTIC RUMBLE STRIPS	923.49

DIVISION 700 – LANDSCAPING

SECTION 711 - IRRIGATION SYSTEM

711.02 Materials.

Delete the 3rd paragraph and replace it with the following:

Manual shut-off valve shall be a copper sweat ball valve, 2 inches or smaller.

DIVISION 800 – TRAFFIC CONTROL

SECTION 801 – TRAFFIC CONTROL ON AUTHORITY ROADWAYS

801.02 Materials.

Add the following:

CONCRETE MOUNTED DELINEATORS .....923.18(A)

801.03 Methods of Construction.

Delete the 6th paragraph of Part 801.03(C)(2) and replace it with the following:

All precast concrete construction barrier that does not meet the following criteria, as determined by the Engineer prior to placement on the roadway, shall be rejected for use:

- No more than three cracks in the middle 6 feet of the barrier.
- All cracks must be less than ⅛ inch wide.
- No gouges in the lower half of the face exposed to traffic.
- No reinforcing steel shall be exposed.
- The key way must be intact.
- Lifting devices shall be intact.
- Face exposed to traffic must be clean of all road dirt.
- Concrete barrier delineators shall be in place.
- Interlock must accept key full depth without projection of key cap above barrier.
- The full key way must be available.

Delete Part 801.03(C)(5) and replace it with the following:

(C) Traffic Control Devices.

(5) Impact Attenuators (Cartridge).

Impact attenuators (cartridge) refer to crushable, energy absorbing systems. Refer to Section 524 for requirements.

801.04 Measurement

Delete the 19th paragraph and replace it with the following:

Impact Attenuators (Cartridge) , ___Bays, ___" Wide will be measured separately for payment in accordance with Subsection 524.04.

801.05 Payment.

Delete the 13th paragraph and replace it with the following:

Payment for the various items related to **Impact Attenuators** shall be in accordance with Subsection 524.05.

DIVISION 900 – MATERIALS

SECTION 902 - AGGREGATES

902.05 Coarse Aggregate.

Delete the last paragraph of Part (B).

Replace the first paragraph of Part (F) with the following:

(F) Lightweight aggregate manufactured from dredged sediment required or allowed to be used as structural fill shall be a rotary kiln material meeting the requirements of ASTM C330.

SECTION 905 – CONCRETE, MORTAR AND GROUT

905.09 Lightweight Concrete

(A) Manufactured Lightweight Aggregate Concrete.

(2) Aggregate.

Delete the second line of the first paragraph and replace with:

The aggregate shall conform to ASTM C330.

905.10 Grout.

Add the following after the end of the last paragraph:

Grout shall conform to ASTM C476.

905.11 Mortar

Delete the entire paragraph and replace with:

Mortar shall conform to ASTM C270. Use Type N, S or M mortar as per project requirements.

905.12 Non-Shrink, High-Strength Mortar, Paved Concrete Decks

Add the following after the end of the first paragraph.

The material shall conform to ASTM C928 and the following requirements as per ASTM C109:

Time	Minimum Compressive Strength (psi)
3 hours	5,000 psi
24 hours	6,000 psi
7 days	7,500 psi
28 days	10,000 psi

905.14 Non-Shrink, High-Strength Mortar, Bare Concrete Decks

Add the following after the end of the first paragraph.

The material shall conform to ASTM C928 and the following requirements as per ASTM C109:

Time	Minimum Compressive Strength (psi)
3 hours	1,000 psi
24 hours	5,000 psi
7 days	6,000 psi
28 days	7,000 psi

905.15 Non-Shrink, High Early Strength Mortar

Delete the first paragraph and replace it with the following:

Non-shrink, high early strength mortar shall be a material packaged and ready for mixing immediately prior to use in accordance with the manufacturer's instructions. The material shall conform to the requirements of ASTM C1090 and C1107, and the following AASHTO specifications: M201, R39, T22, T105, T106, T131, T162, T177, T231, and T260.

The material shall conform to the following requirements (in both neat and extended form):

Test Requirement	Minimum	Maximum
Initial Set (minutes)	30	-
Expansion (%)	-	0.4
Contraction (%)	-	0.0
3 Hour Compressive Strength (psi)	2000	-
7 Day Compressive Strength (psi)	6000	-
1 Day Bond Strength (psi)	200	-
Freeze-Thaw % (25 cycles)	-	1.0
Total Chloride Content (% by weight)	-	0.05
Total Sulfate Content (% by weight)	-	5.0

905.16 Elastomeric Concrete

Delete the third paragraph and replace it with the following:

The material shall conform to the following requirements:

Test Requirement	Procedure	Minimum Requirements
Resilience	ASTM C579-01	70%
5-hour compressive strength	ASTM C579-01 (modified)	500 psi
24-hour compressive strength	ASTM C579-01 (modified)	2000 psi
7-day Tensile	ASTM D638	150 psi
7-day Tear	ASTM D624	40 lbf/in
Pot Life	As per Engineer's direction	5 minutes

905.20 Epoxy Injection Systems

Delete the first paragraph and replace with:

Epoxy injection systems shall have the following features:

(1) Separate feed lines to the mixing chamber

(2) Automatic mixing and metering pump

(3) Ability to thoroughly mix the epoxy components in the mixing chamber

(4) Operator control of the epoxy flow from the mixing chamber

(5) Clean, legible, accurate pressure gauges easily viewable by the operator

(6) Ability to provide an uninterrupted pressure head to continually force epoxy into the cracks

(7) Injection pressure from 0 to at least 200 PSI

(8) Capable of metering each epoxy component to within 3.0% of the epoxy manufacturer's mix ratio

SECTION 906 – CONCRETE ADMIXTURES, CURING MATERIALS, AND FILM EVAPORATORS

906.07 Curing Materials

Replace Part (F) with the following:

(F) Evaporation Retarders.

Evaporation retardant shall be a high quality, water-based compound that is specifically designed to form a thin monomolecular film to reduce rapid moisture loss from the concrete surface prior to curing.

SECTION 907 – JOINTS

907.02 Joint Sealers.

(E) Silicone Joint Seal

Delete the first paragraph and replace it with:

The material shall conform to the following requirements:

Test Requirement	Procedure	Specification ASTM D5893
Tack Free Time, minutes	ASTM C679	5 Hours + 10 minutes
Accelerated Weathering	ASTM C793	Satisfactory
Flow	ASTM C693	No Flow
Modulus of Elongation	ASTM D412	600% (Minimum)
Bond, Non-Immersed	ASTM D5329	Satisfactory

907.08 Rubber Asphalt Concrete

Delete the first paragraph and replace with:

Rubber asphalt concrete shall consist of aggregate and binder mixed as per manufacturer's instructions.

(A) Binder.

Add the following after the end of the first paragraph:

The material shall conform to ASTM D6114.

SECTION 912 – SIGN MATERIALS

912.03 U-Channel Post.

Delete the section and replace it with the following:

U-Channel post for mounting signs and delineators shall be a steel sign support conforming to ASTM A499, Grade 50 or 60, Manual for Assessing Safety Hardware (MASH) compliant. Installation shall be in accordance with manufacturer's recommendations. For repair or replacement of sign posts that are damaged, components made by other manufacturers shall not be used for replacement parts.

SECTION 913 - PAINTS AND COATINGS

913.04 Traffic Paint and Marking.

(E) Pliant, Polymer Rubber Marking Materials.

Delete the entire Paragraph and replace it with the following:

Pliant, polymer rubber marking materials, when used, shall consist of white or yellow preformed patterned markings with white (clear) or yellow retroreflective beads incorporated. The preformed markings shall be affixed to pavement using a pressure sensitive adhesive and following manufacturer's recommendations. Preformed markings shall be ready for traffic immediately after application.

When measured with a handheld retroreflectometer the tape shall have initial, minimum retroreflectance values conforming to ASTM E 1710, with entrance angle = 88.76°.

Observation Angle	Specific Luminance

(Degrees)	White (Millicandelas per square foot per footcandle)	Yellow (Millicandelas per square foot per footcandle)
1.05	500	300

Note: The angular aperture of both the photoreceptor and the light projector shall be six minutes of arc. The reference axis shall be taken perpendicular to the test sample.

SECTION 914 - FENCE

914.01 Chain Link Fence

Replace Paragraph (F) with the following:

(F) Barbed Wire.

Barbed Wire shall be Type I, aluminum-coated steel barbed wire conforming to the requirements of ASTM A585.

SECTION 918 – ELECTRICAL MATERIALS

918.07 Cable and Wire.

(D) Outdoor Network Cable.

Delete the first paragraph and replace it with the following:

Outdoor network cable shall consist of 24 AWG solid bare copper conductors, Category 5e or better rated twisted pairs, polyolefin insulation, inner LLPE jacket, overall shield (100% coverage), 24 AWG stranded TC drain wire, industrial grade sunlight- and oil-resistant LLPE jacket.

(F) Fiber Optic Cable – Multi-Mode.

Delete the first paragraph and replace it with the following:

Fiber Optic Cable - Multimode shall be tight buffered breakout type cable. No splices are permitted, except as required for terminations, unless shown on the plans.

(H) Twisted Pair Communication Cable.

Delete the first paragraph and replace it with the following:

Twisted Pair Communication Cable shall consist of 4 pairs of #24AWG stranded copper conductors, each pair individually shielded, covered by a PVC jacket.

Delete the last paragraph of this Paragraph.

(I) SOOW Multi Conductor Power Cable.

Delete the third and fourth paragraphs and replace them with the following:

Provide cord grip connectors at each cable entry/exit point of the luminaire.

918.08 Conduit and Fittings.

(F) Duct Bank Spacers.

Delete the first paragraph and replace it with the following:

Spacers shall be prefabricated and made out of high impact Polystyrene.

918.11 Radio Coaxial Cable.

Delete the first paragraph and replace it with the following:

Coaxial Cable, copper conductors with foam polyethylene insulation, 50 Ohm characteristic impedance. (Unless otherwise noted in the Contract Plans.)

918.23 Underbridge Lighting Luminaires.

Delete the second paragraph and replace it with the following:

Ballast characteristics shall conform to integral ballast specifications set forth in Subsection 918.21. Each luminaire shall be equipped with a 6A internal fuse, conforming to applicable requirements of Subsection 918.04.

Delete the last paragraph and replace it with the following:

The photometric data to be submitted, as part of the shop drawing submittal, shall conform to applicable requirements set forth in Subsection 918.21.

918.33 Pole Mounted ITS Enclosure.

Delete the last paragraph.

918.34 Video Encoder.

(A) Electrical Specifications.

Delete the "SFP Module" row from the table.

918.38 Traffic Sensor Wireless Access Point (TS-WAP)

Delete the first paragraph and replace it with the following:

The Traffic Sensor Wireless Access Point shall serve as a communication hub for the in-pavement wireless sensors (918.37). A wireless access point shall be able to support at least 48 sensors. An access point shall be factory-configured to support powering from a Power-Over-Ethernet Power Injector with 110VAC input. Maximum power consumption of the wireless access point shall be 2 Watts.

Delete the first paragraph of Paragraph (A) and replace it with the following:

The access point shall have a host processor consisting of 66 MHz Coldfire processor, 4 MB of flash memory, and 16 MB of DRAM. The Ethernet interface shall have the following characteristics:

918.39 Traffic Sensor Wireless Repeater (TS-WR)

Delete the second paragraph and replace it with the following:

The Wireless Repeater shall have a minimum battery life of Eight (8) years in active service.

918.40 In-pavement Wireless Sensor.

Delete the last paragraph.

918.43 Media Converter.

Delete the last sentence of Paragraph (F), Part (2).

918.44 CCTV Remote Power Unit.

Delete the second paragraph.

918.46 Rodent Blocking.

Delete the first paragraph and replace it with the following:

The rodent blocking material shall consist of a wad of corrosion resistant copper mesh capped with a pest control foam sealant.

918.47 Polymer Concrete Junction Box.

Delete the first paragraph and replace it with the following:

Polymer concrete junction box Type PS shall be of configuration and dimensions as shown on the Plans.

918.48 Network Switch.

Delete the last paragraph.

918.49 Coaxial Cable.

Delete the first paragraph and replace it with the following:

Coaxial Cable shall consist of RG-6 cable, 18AWG solid bare copper conductors with foam polyethylene insulation, 75 Ohm characteristic impedance.

918.51 CCTV Surge Protector.

Delete the fourth paragraph.

918.52 Variable Message Signs (VMS).

Delete the table and replace it with the following:

Enclosure:	**Shallow depth with front or rear accessibility for maintenance**
Panel Height (max):	**8ft – 6 in (Rear Access), 8ft – 6 in (Front Access)**
Panel Width(max):	**26ft – 6 in (Rear Access), 24ft – 0 in (Front Access)**
Panel Depth(max):	**1ft – 5 in (Rear Access), 1ft – 5 in (Front Access)**
Weight (max):	**2500 lbs (Rear Access), 2500 lbs (Front Access)**
Display Modules:	**Exposed face modular LED boards (no mask) removable from the front or rear of the sign.**
Pixels:	**RGB pixels, 20mm pitch (distance between pixels). 30 Deg nominal viewing cone with a half power angle of 15 Deg.**
Communications:	**NTCIP 1203 (latest NJTA accepted version)**
Power Source:	**120/240VAC, Single Phase**
Max. Power:	**6400 Watts**

918.53 Variable Speed Limit Signs (VSLS).

Delete the table and replace it with the following:

Configuration:	**Full matrix, full color LED, capable of displaying two-digit speed limits. Typical operation will be white numerals on black background.**
Enclosure:	**Sign enclosure is rear accessible for maintenance.**
Height (max):	**6ft – 0 in**
Width (max):	**5ft – 0 in**
Depth (max):	**1ft – 0 in**

Weight (max):	250 lbs
Display Modules:	Exposed face modular LED boards (no mask) removable from the rear of the sign.
Pixels:	RGB pixels, 20mm pitch (distance between pixels). 30 Deg nominal viewing cone with a half power angle of 15 Deg.
Communications:	NTCIP 1203 (latest NJTA accepted version)
Power Source:	120/240VAC, Single Phase.
Max. Power:	300 Watts

SECTION 919 - LANDSCAPING MATERIALS

919.29 Wire Rope.

Add the following after the end of the first paragraph:

The material shall conform to ASTM A1007 and ASTM A1023.

919.51 Hydromilling.

Delete this entire Subsection and replace it with the following:

Hydromilling shall be performed by use of a mobile, high-pressure water jetting system with the operating pressure of 40,000 psi, maximum flow of 13 gpm and maximum nozzle rotation speed of 3000 rpm.

SECTION 920 – TRAFFIC CONTROL DEVICES

920.04 Flashing Lights.

Delete the entire Subsection and replace it with the following:

Flashing lights shall be amber color, minimum six-inch diameter, battery powered LED lights. The lights shall be capable of being mechanically mounted or affixed to concrete barrier in accordance with the manufacturer's instructions so as to withstand passing traffic and wind/weather without becoming detached.

920.05 Batteries.

Delete the entire Subsection and replace it with the following:

Batteries shall not contain mercury or cadmium. Batteries shall be lantern type with a minimum life of 30 days under continuous flashing operation. Batteries shall be capable of being fully recharged in no more than one hour from a completely discharged condition.

920.06 Signs and Overlay Panels.

Delete Paragraph (B) and replace it with the following:

(B) Non-Reflective Sign Lettering, Symbols and Border.

Non-reflective sign lettering, symbols and border shall be opaque black vinyl with glossy finish and from an approved supplier as listed on the QPL, or an approved equal. Application may be either prior to or after sheeting application. Each sign panel shall also have the Authority identification, as shown on the Plans.

920.07 Folding Sign Stands.

The following is added:

Folding sign stands shall be designed to securely hold wood, aluminum or roll-up signs, and shall include top and bottom brackets to secure the sign. The stand shall include springs and/or dampers to resist signs from coming loose in winds up to 90 mph. The crash performance of the sign stand shall demonstrate that the sign and stand do not become projectiles that may enter the vehicle when struck.

920.08 Concrete Barrier.

Delete the 2nd paragraph and replace it with the following:

Concrete construction barrier and interlocking devices shall be in accordance with the Traffic Protection (TP) Standard Drawings. The Contractor may submit alternate barrier systems with interlocking devices that meet NCHRP Report 350 – Test Level 3 requirements to the Engineer for review and approval.

920.09 Flags.

The following is added:

The reflective sheeting shall meet the following minimum performance criteria:

Criterion	Coefficient of Reflection	Reference
Initial reflectivity (5° entrance angle, 0.2° observation angle)	500 average, 330 minimum	ASTM E908-08, ASTM E810-03
Abrasion	100	CEN – EN 530 Method 2
Flexing	100	ISO 7854 Method A
Cold fold	100	ISO 4675
Wet reflectivity	100	ANSI/ISEA 107-2015

920.10 Removable Wet Weather Pavement Marking Tape.

Delete the 3rd paragraph and Notes (A) through (D) and replace it with the following:

When measured with a handheld retroreflectometer the tape shall have initial, minimum retroreflectance values conforming to:

(A) Dry Condition – ASTM E 1710

Entrance Angle = 88.76°

Observation Angle	Specific Luminance	
(Degrees)	White (Millicandelas per square foot per footcandle)	Yellow (Millicandelas per square foot per footcandle)

1.05	500	300

Note: The angular aperture of both the photoreceptor and the light projector shall be six minutes of arc. The reference axis shall be taken perpendicular to the test sample.

(B) Continuous Wet Condition – ASTM E 2176

Entrance Angle = 88.76°

Observation Angle	Specific Luminance	
(Degrees)	White (Millicandelas per square foot per footcandle)	Yellow (Millicandelas per square foot per footcandle)
1.05	250	200

920.13 Vehicle Lights.

Delete the entire Subsection and replace it with the following:

Vehicle lights shall consist of a minimum of two six-inch diameter flashing or rotating amber lights mounted on or above the top of the vehicle such that they are visible from a 360-degree angle. Lights shall appear to turn on and off regularly from any viewing direction at a rate of 60 to 260 cycles per minute. Flashing lights shall achieve full brightness during each cycle.

920.16 Traffic Pylons.

The following is added:

The high-intensity wraps shall be silver (white) retroreflective sheeting meeting the requirements of ASTM D-4956, Type III.

920.17 Modular Glare Screen System.

Delete the 2nd paragraph and replace it with the following:

Reflective tape three (3) inches wide and six (6) inches high shall be applied to the blades every ten (10) feet. The tape shall be high intensity grade reflective sheeting. The tape color shall be white when traffic is to the left and yellow when traffic is to the right. Tape shall be applied vertically centered on the blade on the edge closest to passing traffic.

920.18 Truck Mounted Attenuator.

Delete the section and replace it with the following:

The truck mounted attenuator shall be MASH Test Level 3 compliant. The attenuator shall have a minimum of 72 square inches of high intensity orange retroreflective sheeting toward the extremities on each side of the equipment. A minimum of 144 square inches of the sheeting shall be visible from each direction. The rear facing of the attenuator shall have 4-inch wide black stripes on high intensity retroreflective yellow sheeting in an inverted chevron pattern. All retroreflective sheeting shall meet the requirements of ASTM D-4956, Type III. The attenuator shall have a standard trailer lighting system, including brake lights, tail lights, turn signals and ICC bar lights. The truck mounted attenuator shall be attached to the truck in accordance with the manufacturer's instructions, including hydraulic tilting system and backup structures.

920.20 Non-Gating, Re-Directive Impact Attenuator.

Delete the entire Subsection and replace it with the following:

Non-gating, re-directive impact attenuator shall be an impact attenuator system that is Manual for Assessing Safety Hardware (MASH) compliant to Test Level 3 (TL-3) and configurable for compliance for speeds from 45 mph to 62 mph. After a typical head-on collision, the system shall be capable of being reset in the field with a minimum of spare parts and without repairs to major components.

SECTION 922 – TOLL BOOTHS, ISLANDS, AND CANOPIES

922.02 Booth Shell.

(B) Panels.

Delete the first sentence of the first paragraph and replace with:

Panels shall be stainless steel.

922.04 Internal Electrical Work

(D) Booth Lights.

Delete the entire Paragraph (D) and replace it with the following:

Booth Lights - Booth light fixtures shall contain four (4) cool white 20-Watt fluorescent lamps, recessed type. The housing shall be 19-gauge steel. The frame shall be stainless steel with Alba glass panels. Wiring sockets, high power factor 120 Volt Type Class P trigger start ballasts to operate the lamps shall be provided. The finish shall be baked white synthetic enamel. Clips shall be provided for mounting in the booth metal ceiling.

922.05 Toll Islands.

(E) Fire Extinguishers and Mounting Brackets.

Delete the entire Paragraph and replace it with the following:

Fire extinguishers shall be multipurpose dry chemical (A B C) type portable fire extinguisher. Extinguishers shall have a capacity of 20 pounds with a U/L rating of 20A:120B:C, a replaceable valve stem seal, pressure gauge, pull pin upright squeeze grip operation, with a mounting bracket for outdoor installation on concrete bumper blocks at the required toll islands or other Engineer approved locations.

SECTION 923 – MISCELLANEOUS

923.04 Canopy Drain.

Delete the entire section and replace with the following:

Canopy drains shall have a cast iron body with combined flashing clamp and gravel stop, 8½ inch diameter flange, with a low-profile polyethylene dome. Drain leader shall be galvanized steel pipe conforming to the requirements of ASTM A53.

923.06 Dampproofing And Waterproofing.

(D) Membrane Waterproofing for Bridge Decks.

Delete the first paragraph and replace it with:

Membrane Waterproofing for Bridge Decks shall consist of a primer, preformed membrane sheet and mastic. Membrane waterproofing shall conform to Section 21 of the AASHTO Bridge Construction Specifications, 4th Edition, except that the minimum air and concrete temperature at time of installation shall be 40 degrees Fahrenheit. The material shall conform to the following:

(E) Epoxy Resin Waterproofing.

Delete the first paragraph and replace it with the following:

Epoxy Resin Waterproofing shall consist of a liquid coating of a two component epoxy resin sealing compound and sand to be applied to horizontal concrete as per the requirements listed below. The material shall conform to ASTM C881 and have a water absorption of 0.1% as per ASTM D570 (24-hour immersion).

(I) Methacrylate Crack Sealer.

Delete the first paragraph and replace it with the following:

The high molecular weight methacrylate (HMWM) resin shall be low viscosity and non-fuming.

The material shall conform to the following requirements:

Test Requirement	Procedure	Minimum Requirements
Viscosity	ASTM D2849	Less than 25 cps
Density		8.4 lb/gal @ 77ºF
Flash Point		200ºF
Vapor Pressure	ASTM D323	1mm Hg @ 77ºF
TG (DSC)	ASTM D3418	136º F
Gel Time		40 minutes for 100g mass
Percent Solids		90% by Weight
Bond Strength	ASTM C882	1500 psi

923.08 Epoxy Bonding Compound.

Add the following after the first paragraph.

The epoxy bonding compound shall be a 2-component, epoxy-resin, bonding system for application to concrete. It shall conform to the requirements of ASTM C881. If used in load-bearing applications, the material shall conform to the requirements of ASTM C881, Type 4 or 5, Grade 1 or 2, Class B or C as per project requirements.

923.09 Epoxy Mortar.

(B) Aggregate.

Delete the first paragraph and replace it with the following:

Aggregate shall be clean sand consisting of hard angular particles completely free of dust. In hardness it shall be at least equal to a rating of 7 on Mohs Hardness scale. Gradation of the aggregate shall be as follows:

923.18 Delineators.

Delete the entire Subsection and replace it with the following:

Retroreflective sheeting for delineators shall be as specified in Section 912.02. Affix yellow, white or red reflective sheeting to the traffic-facing side of the delineator according to the manufacturer's recommendations. Aluminum backed delineator panels shall meet specifications for signs in Section 912. Drivable flexible delineators and concrete barrier delineators shall meet the following minimum physical requirements:

(A) Concrete Mounted Delineators.

Concrete barrier delineators shall consist of a polymer or extruded polycarbonate resin base that permits the delineator unit to be side-mounted or top-mounted to concrete barrier, with a flexible joint between the retroreflective portion and the adhesive portion of the unit so that the delineator does not become a projectile when struck. Concrete barrier delineators as specified in Section 801 shall be 3 inches wide by 3 inches high if side mounted and shall be a minimum of 4 inches wide by 8 inches high if top mounted. The minimum thickness shall be 1/8 inch.

(B) Drivable Flexible Delineators.

Drivable flexible delineator markers shall be made of a fiberglass reinforced, thermosetting, high-density polymer resin or an extruded polycarbonate resin, which are resistant to ultraviolet and infrared radiation. The retroreflective portion of a drivable flexible delineator marker shall be 4 inches wide by 8 inches high and the minimum thickness shall be 1/8 inch. Installation shall be as per manufacturer's recommendations.

The marker shall meet the following criteria:

(1) Design.

The marker shall be a single piece marker capable of simple, permanent installation by one person using a manual driving tool. The marker, upon proper installation, shall resist displacement from wind and vehicle impact forces. The marker shall be of a sufficient cross sectional design to accept retroreflective sheeting with reinforcing support ribs incorporated longitudinally along each edge, to provide sheeting protection and structural rigidity. The bottom end of the marker shall be pointed for ease of ground penetration.

(2) Material.

The marker shall be constructed of a durable, UV resistant, continuous glass fiber and marble reinforced, thermosetting composite material which is resistant to impact, ozone, and hydrocarbons within a service temperature range of -40°F to +140°F.

Sheeting and lettering shall be as approved by the Engineer, if not included in Supplementary Specifications.

The marker shall exhibit good workmanship and shall be free of burns, discoloration, cracks, bulges or other objectionable marks which would adversely affect the marker's performance or serviceability. Each marker shall be permanently identified with the manufacturer's name and the month and year of fabrication. The letters shall be a minimum of 3/8-inch in height, and permanently affixed to the rear of the marker. A black line shall be stamped horizontally across the front of the marker near the bottom to indicate proper burial depth.

(3) Physical and Mechanical Requirements.

The flexible marker shall conform to the shape and overall dimensions as recommended or supplied by the manufacturer. The nominal marker width shall accommodate a four-inch wide delineator and provide adequate daytime delineation. The marker shall be of such length to provide the required height above the road surface, as per MUTCD, with a minimum embedment of 24 inches.

The marker shall have the minimum mechanical properties as follows:

Property	ASTM Test Method	Minimum Value

Ultimate Tensile Strength	D 638	50,000 psi
Ultimate Compressive Strength	D 638	45,000 psi
Specific Gravity	D 792	1.7
Weight % Glass Reinforcement	D 2584	50%
Barcol Hardness	D 2583	47

The marker shall be pigmented throughout the entire cross-section so as to produce a uniform color that is an integral part of the material. Ultraviolet resistant materials shall be incorporated in the construction to inhibit fading or cracking of the delineator upon field exposure.

(4) Cold Flexibility.

A four-foot tall marker shall be conditioned for a minimum of two hours at -40°F ± 3°F. The unit shall then be held at the bottom end in a vertical position and the top end bent 90 degrees such that it parallels the floor. The marker shall return to within 5 degrees of the upright position within 30 seconds. The bend test shall be repeated three times in quick succession, completing the test within 2.5 minutes of post removal from the conditioning temperature.

(5) Cold Impact Resistance.

The marker shall be conditioned a minimum of two hours at -40°F ± 3°F. A minimum two-pound spherical weight shall be dropped a distance of five feet through a virtually frictionless vertical guide to impact the surface of the marker at mid-section. The surface of the post being struck by the steel ball shall be in a horizontal position with the post supported and held in position at both ends. The post shall be subjected to five impact tests concentrated near the middle of the post within 10 minutes from the removal from the environmental chamber. Fracturing, cracking, or splitting of the posts, shall constitute failure.

Another conditioned marker shall be struck flush against a flat solid surface three times within two minutes after removal from the conditioning chamber. To strike the marker, it should be manually swung through a 90-degree arc, and the marker shall not fracture or shatter upon impact.

(6) Vehicle Impact Resistance.

The Marker shall be capable of self-erecting and remain functional after being subjected to a series of ten head-on impacts by a typical passenger sedan at 55 mph. The marker shall retain a minimum of 60% of its sheeting.

923.20 Skid Resistant Coating.

Delete the second paragraph and replace with:

Coatings shall be a two-component, high solids, epoxy system containing abrasive granules or silica aggregate, applied in two coats. The material shall conform to ASTM C881, Type III (Grade and Class as per project requirements) and shall have a maximum weight loss of 0.04 grams (1,000 cycles) as per the Taber Abrader test.

923.22 Epoxy Resin System.

(A) Epoxy Resin for Injection

Delete the first paragraph and replace it with:

Epoxy resin system for injection materials to fill structural voids and cracks shall be a two component, 100% solids, moisture insensitive, high modulus, high strength epoxy resin adhesive. The material shall

conform to ASTM C881(type, grade and class as per project requirements). The material used shall be such that the final mixture after mixing with the aggregate shall have a minimum compressive strength of 10,000 psi.

(B) Epoxy/Resin/Grout for Anchor Bolts in Nominal Holes

Delete the first paragraph and replace it with the following:

Epoxy resin system for injection material to install anchor bolts in non-tension applications in drilled holes of a nominal diameter shall conform to ASTM C881 (type, grade and class per project requirements), have a minimum compressive strength of 10,000 psi per ASTM D695 and a minimum bond strength of 2,000 psi per ASTM C882.

(C) Epoxy/Resin/Grout for Anchor Bolts in Oversize Holes

Delete the first paragraph and replace it with the following:

Epoxy resin system for injection material to install bearing anchor bolts in non-tension applications in drilled or preformed holes of up to 3" in diameter shall conform to ASTM C881 or ASTM C1107 (type, grade and class per project requirements), have a minimum compressive strength of 10,000 psi per ASTM C109 and a minimum bond strength of 2,000 psi per ASTM C882.

923.23 Epoxy Crack Sealant.

Delete the first paragraph and replace it with the following:

The material shall be an epoxy resin gel and conform to ASTM C881 and AASHTO M235 (type, grade and class as per project requirements) and have a minimum bond strength of 2,500 psi.

923.24 Crack Spanning Membrane.

Delete the second paragraph and replace it with the following:

Ensure that the material is applied in accordance with manufacturer's instructions.

923.28 Sealant.

Delete the first paragraph and replace it with the following:

Sealant shall be a high performance, moisture-cured, one-compound polyurethane base elastomeric sealant and shall conform to ASTM C920, Type S (grade, class and use as per project requirements).

923.31 Bonding Agent.

Delete the first sentence of the first paragraph and replace it with the following:

The material shall conform to ASTM C881 (grade, class and use as per project requirements) and have a minimum bond strength of 2,500 psi.

923.32 Anti-Corrosion Coating.

Delete the first paragraph and replace it with the following:

The material shall conform to the requirements of ASTM D3963.

923.40 Z-Turn Attenuator

Delete the entire Subsection and replace it with the following:

The attenuators for Z-Turns shall be as specified in Subsection 920.20.

923.46 Raised Pavement Markers and Adhesive.

Delete the entire Subsection and replace it with the following:

Raised pavement markers shall be iron castings to which a replaceable prismatic reflective element is attached and shall conform to the requirements of ASTM D4383. Raised pavement markers shall be able to

withstand snow plowing in two opposing directions without sustaining any damage. When measured with a handheld retroreflectometer, the tape shall have initial, minimum retroreflectance values conforming to ASTM E809:

Entrance Angle = 0°

Observation Angle	Specific Luminance		
(Degrees)	White (Millicandelas per lux)	Yellow (Millicandelas per lux)	Red (Millicandelas per lux)
0.2	279	167	70

Entrance Angle = 20°

Observation Angle	Specific Luminance		
(Degrees)	White (Millicandelas per lux)	Yellow (Millicandelas per lux)	Red (Millicandelas per lux)
0.2	112	67	28

The adhesive used to bond the raised pavement markers to the pavement shall be a two-component standard set type epoxy. The adhesive bond strength shall be a minimum of 12 psi when measured in accordance with ASTM D4383.

923.49 Thermoplastic Rumble Strips.

Material for thermoplastic rumble strips shall conform to the physical and chemical requirements of AASHTO M 249.

SECTION 929 – TRENCHLESS TECHNOLOGY MATERIALS

929.01 Casing Pipe

Casing pipe shall satisfy the following requirements:

(A) Steel

Steel casing pipe shall be in accordance with ASTM A53 Grade B, ASTM A139 Grades B, C, D, or E, or ASTM A252 Grades 2 or 3. Sections of steel casing shall be welded or joined by an approved jointing system.

(B) Reinforced Concrete Pipe (RCP)

Reinforced Concrete Pipe casing shall be in accordance with ASTM C76 Classes IV or V. All reinforced concrete pipes shall have steel reinforcement concentric with the pipe wall, and where required, additional reinforcement at the ends of the pipe.

(C) High Density Polyethylene (HDPE)

High Density Polyethylene casing pipe shall be in accordance with ASTM D3350, with cell classifications of PE345444C, PE345454C, PE345464C, or in accordance with AWWA C906 PE4710.

(D) Centrifugally Cast Fiberglass Reinforced Polymer Concrete (CCFRP)

Centrifugally Cast Fiberglass Reinforced Polymer Concrete casing pipe shall be in accordance with ASTM D3262 for non-pressure Sanitary Sewers, ASTM D3754 for Sewer Force Mains and Industrial Effluents, and AWWA C950 for Pressure Water Systems. The fiberglass material shall be in accordance with AWWA M45.

Table 1 - Casing Materials Accepted for Each Acceptable Method

Material	Auger Boring	Pipe Jacking	Microtunneling	Horizontal Directional Drilling	Pipe Ramming
Centrifugally Cast Fiberglass Reinforced Polymer Concrete CCFRP		X	X		
High Density Polyethylene HDPE				X	
Reinforced Concrete Pipe RCP		X	X		
Steel	X	X	X	X	X

Table 2 – Minimum Wall Thickness of Steel Casing

Outside Diameter (in)	Minimum Wall Thickness (in)
≤ 18	1/4
18 ≤ 20	5/16
20 ≤ 26	3/8
26 ≤ 42	1/2
42 ≤ 48	9/16

The table above provides minimum thicknesses allowed. The Contractor's design shall dictate what wall thickness is required based on the site-specific conditions including but not limited to soil conditions, ground water conditions, equipment, reaction shaft, corrosion, and loads.

Table 3 – Minimum Corrosion Rates for Steel Casing (For Use in Contractor's Design)

Environmental Conditions	Sacrificial Steel Thickness (in/year)
Minimum Standard	0.002
Marine or Corrosive	0.005

If corrosion protection other than sacrificial steel is considered, the Contractor's engineer shall consider the potential for abrasion.

If Utility Tunneling is used, steel or concrete liner plates, ribs with wood lagging, or wood box materials shall be in accordance with the approved SSWP.

929.02 Carrier Pipe.

(A) General

The Contractor shall select a carrier pipe material that is capable of withstanding the external loads, chemical attack, internal pressure, corrosion, and insulate current for a 100-year service life. In instances where the casing pipe is also acceptable as a carrier pipe, the casing pipe may serve as the carrier pipe.

929.03 Filler Materials.

Materials shall conform to the following Sections and Subsections:

PORTLAND CEMENT.....905.01

WATER.....905.04

CONCRETE ADMIXTURES, CURING MATERIALS AND FILM EVAPORATORS.....906

(A) Contact Grout

(1) Contact Grout shall be early-strength non-shrink cementitious material suitable for contact grouting between casing pipe and earth.

(2) The cement grout mix design shall be the responsibility of the Contractor.

(3) Up to five percent bentonite may be included in the grout mix design.

(4) Final proportions of materials shall be based on results of tests made on sample mixtures of grout, and included in the submittals of Section 533.

(5) The minimum 28-day compressive strength of two-inch cubes, molded, cured, and tested in accordance with ASTM C109, shall be 2,500 psi.

(6) The Contractor shall be responsible for taking, curing, and breaking of grout test cubes for determining mix design.

(7) An independent laboratory approved by the Engineer may conduct Quality Assurance testing.

(8) A minimum of one set of the grout cubes shall be taken for compressive strength testing each day of grouting.

(9) The Contractor shall measure the specific gravity of grout with a Baroid mud balance or approved equal in every batch of grout mixed.

(B) Controlled Low Strength Material (CLSM)

(1) CLSM shall be a non-shrink cementitious material suitable for grouting the space between the casing pipe and the carrier pipe(s).

(2) CLSM shall not be placed in contact with aluminum pipe, including connections, fixtures, etc., unless the aluminum has been coated with an approved primer.

(3) The CLSM mix design shall be the responsibility of the Contractor.

(4) The CLSM shall be a cement and water mixture. At the Contractors option, it may also contain aggregate with a maximum particle size of less than ¾" or chemical admixtures in any proportions such that the final product meets the strength and flow consistency requirements described herein.

(5) All materials shall be mixed at a stationary mixing plant which is either a continuous or batch type plant, designed to accurately proportion either by volume or by weight, so that when the materials are incorporated in the mix, a thorough and uniform mix will result.

(6) The mix may be transported in open haul units provided the material is placed within 30 minutes of the end of mixing. Use a rotating drum unit capable of 2-6 rpm to transport material which cannot be placed within 30 minutes after the end of mixing.

(7) Perform ASTM D6130, Standard Test Method for Flow Consistency of Controlled Low Strength Material, a minimum of once each day grouting occurs.

(8) During placement, a set of three cylinders shall be cast from each batch for compressive strength testing and shall obtain a 28-day compressive strengths between 40 psi and 150 psi.

(9) The Contractor shall be responsible for taking, curing, and breaking of CLSM test cubes for determining mix design.

(10) An independent laboratory approved by the Engineer may conduct Quality Assurance testing.

(11) A minimum of one set of the CLSM cylinders shall be taken for compressive strength testing each day of grouting.

(12) The Contractor shall measure the specific gravity of grout with a Baroid mud balance or approved equal in every batch of grout mixed.