

## **TABLE OF CONTENTS OF SPECIAL PROVISIONS**

Note: This Table of Contents has been prepared for the convenience of those using this contract with the sole express purpose of locating quickly the information contained herein; and no claims shall arise due to omissions, additions, deletions, etc., as this Table of Contents shall not be considered part of the contract.

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December 3, 2014  
FEDERAL AID PROJECT NO. N/A  
STATE PROJECT NO. 35-195

Pavement Preservation on I-95

Town of Darien, City of Norwalk  
Federal Aid Project No. N/A

The State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, Form 816, 2004, as revised by the Supplemental Specifications dated July 2014 (otherwise referred to collectively as "ConnDOT Form 816") is hereby made part of this contract, as modified by the Special Provisions contained herein. . The State of Connecticut Department of Transportation's "Construction Contract Bidding and Award Manual" ("Manual"), May 14, 2010 edition or latest issue, is hereby made part of this contract. If the provisions of this Manual conflict with provisions of other Department documents (not including statutes or regulations), the provisions of the Manual will govern. The Manual is available upon request from the Transportation Manager of Contracts. The Special Provisions relate in particular to the Pavement Preservation on I-95 in the Town of Darien and the City of Norwalk.

## **CONTRACT TIME AND LIQUIDATED DAMAGES**

In order to minimize the hazard, cost and inconvenience to the traveling public, pollution of the environment and the detriment to the business area, it is necessary to limit the time of construction work, which interferes with traffic as specified in Article 1.08.04 of the Special Provisions.

There will be two assessments for liquidated damages and they will be addressed in the following manner:

1. For this contract, an assessment per day for liquidated damages, at a rate of Three Thousand Four Hundred Dollars (\$3,400.00) per day shall be applied to each calendar day the work runs in excess of the One Hundred Ninety-Four (194) allowed calendar days for the contract.
2. For this contract, an assessment per hour for liquidated damages shall be applied to each hour, or any portion thereof, in which the Contractor interferes with normal traffic operations during the restricted hours given in Article 1.08.04 of the Special Provisions. The liquidated damages shall be as shown in the following tables entitled "Liquidated Damages Per Hour" for each hour, or any portion thereof, in

which the Contractor interferes with normal traffic operations during the restricted hours.

For the purpose of administering this contract, normal traffic operations are considered interfered with when:

1. Any portion of the travel lanes or shoulders is occupied by any personnel, equipment, materials, or supplies including signs.
2. The transition between the planes of pavement surfaces is at a rate of one inch in less than fifteen feet longitudinally.

**LIQUIDATED DAMAGES PER HOUR**

35-195

Route I-95 NB 3 Lane Section From Darien (MP 10.67) To Norwalk (15.91)		
If Working Periods Extends Into	1 Lane Closure	2 Lane Closure
1st Hour of Restrictive Period	\$ 500	\$ 500
2nd Hour of Restrictive Period	\$ 500	\$ 20,000
3rd Hour or any Subsequent Hour of Restrictive Period	\$ 500	\$ 60,000

Route I-95 SB 3 Lane Section From Darien (MP 10.67) To Norwalk (15.91)		
If Working Periods Extends Into	1 Lane Closure	2 Lane Closure
1st Hour of Restrictive Period	\$ 35,000	\$ 90,000
2nd Hour of Restrictive Period	\$ 60,000	\$ 100,000
3rd Hour or any Subsequent Hour of Restrictive Period	\$ 60,000	\$ 100,000

The above liquidated damages apply to those hours shown on the Limitation of Operations charts designated with a "3" or "E".

For those hours on the Limitation of Operations charts designated with a "2", the liquidated damages shown above for "1 Lane Closure" shall apply when only one lane is open to traffic.

For each hour shown on the Limitation of Operations charts designated with an "E", liquidated damages of \$500 per hour shall apply for each hour, or part thereof, if all available shoulder widths are not available to traffic.

Liquidated damages in the amount of \$500 shall apply for each hour, or part thereof, that the Contractor interferes with existing traffic operations on any ramps during the non-allowable hours.

## **NOTICE TO CONTRACTOR – PRE-BID QUESTIONS AND ANSWERS**

Questions pertaining to DOT advertised construction projects must be presented through the CTDOT Pre-Bid Q and A Website. The Department cannot guarantee that all questions will be answered prior to the bid date. **PLEASE NOTE - at 12:01 am, the day before the bid, the subject project(s) being bid will be removed from the Q and A Website, Projects Advertised Section, at which time questions can no longer be submitted through the Q and A Website. At this time, the Q and A for those projects will be considered final, unless otherwise stated and/or the bid is postponed to a future date and time to allow for further questions and answers to be posted.**

If a question needs to be asked the day before the bid date, please contact the Contracts Unit staff and email your question to [dotcontracts@ct.gov](mailto:dotcontracts@ct.gov) immediately.

Contractors must identify their company name, contact person, contact email address and phone number when asking a question. The email address and phone number will not be made public.

The questions and answers (if any) located on the Q and A Website are hereby made part of the bid/contract solicitation documents (located on the State Contracting Portal), and resulting contract for the subject project(s). It is the bidder's responsibility to monitor, review, and become familiar with the questions and answers, as with all bid requirements and contract documents, prior to bidding. By signing the bid proposal and resulting contract, the bidder acknowledges receipt of, and agrees to the incorporation of the final list of Q and A, into the contract document.

Contractors will not be permitted to file a future claim based on lack of receipt, or knowledge of the questions and answers associated with a project. All bidding requirements and project information, including but not limited to contract plans, specifications, addenda, Q and A, Notice to Contractors, etc., are made public on the State Contracting Portal and/or the CTDOT website.

## **NOTICE TO CONTRACTOR – ADJACENT PROJECT**

The Contractor is hereby notified that there is a project currently in construction nearby. The adjacent project is State project number 102-278 which involves the construction of auxiliary lanes on Interstate 95 between Interchange 15 and Interchange 14. The project also proposes improvements on Route 1.

Project 102-278 is within the pavement preservation project limits and is anticipated to be completed in the summer of 2015. The Contractor shall follow the lane closure restrictions mentioned in Section 1.08 – Prosecution and Progress when there are adjacent projects. To minimize interruption to traffic and work between the two projects, the Contractor shall **start the pavement preservation project on the southern end (Interchange 10)**.

## **NOTICE TO CONTRACTOR – MEET SCHEDULE**

To complete the milling and paving operations, as well as the asphaltic plug joint system within the allotted calendar days, the contractor may be required to use multiple crews.

## **NOTICE TO CONTRACTOR – POLYMER-MODIFIED ASPHALT WITH WARM-MIX TECHNOLOGY CONTROL SECTION**

This project includes the use of a polymer-modified asphalt binder, performance-graded PG76-22 which also requires the use of warm-mix technology, in the item PMA S0.5. There shall be a control section included in this project as outlined below.

**Control Section 1 - PMA:** There shall be a control section of PMA in the surface lift which will be placed without the warm-mix additive but with the polymer-modified PG76-22 asphalt binder), to consist of the first day of PMA S0.5 production, extend from curb to curb, with a minimum quantity of 900 tons of PMA S0.5 and a maximum of 1800 tons of PMA S0.5 placed at the thickness specified in the plans.

The control section will follow the requirements of Section M.04 and follow polymer-modified asphalt binder manufacturer's recommendations for mixing, production, and placement temperatures. This material shall be paid under the item PMA S0.5. In addition to documentation submitted as the normal course of the project, the location of the control section shall be submitted to the Engineer in writing no later than 24 hours after placement, and shall include at a minimum the following information:

Project Number:

Route:

Beginning MilePoint to the nearest 0.01 miles:

Ending MilePoint to the nearest 0.01 miles:

Direction (NB, SB, EB, WB):

Quantity of Tons of PMA S0.5 placed:

Date and Time placement began:

Date and Time placement ended:

Number of Paver Passes:

Weather Conditions at start and end (ambient temperature, cloud cover, precipitation) of control section production:

Please refer to the current Connecticut DOT Highway Log for milepoint references that can be used to locate the control section within 0.01 miles by measuring from known route tiepoints.

The current Highway Log can be accessed online at

<http://www.ct.gov/dot/cwp/view.asp?a=3609&q=430368> (DOT – Publications – Other – Other Reports) and clicking on a hyperlink in the line stating “Highway Log (pdf 3.3 mb) (zip 966 kb)”.

## **NOTICE TO CONTRACTOR – STAGING AND STORAGE AREAS**

The Contractor is hereby notified that there is to be no staging and/or storing of material and/or equipment within the 100-year floodplain, floodway, stream channel encroachment line, gore areas, or areas with a natural resource impact without review and written approval by the Office of Environmental Planning (OEP) or by the District Environmental Coordinator (DEC). If staging and/or storing of material and/or equipment is allowed within these regulated areas, the Contractor must provide a flood contingency plan to the OEP or the DEC for review and approval.

The Contractor is also hereby notified that any staging and/or storing of material and/or equipment throughout the project is only permitted on existing pavement surfaces without review and written approval by the Office of Environmental Planning (OEP) or by the District Environmental Coordinator (DEC).

All staging and/or storage areas will be reviewed and approved by the Engineer.

No surplus material due to construction activities is to be disposed of on Department property.

The Contractor's attention is directed to the fact that only limited stockpiling and storage within the project are available for use. It may be required that the Contractor, according to his means and methods, make arrangements to have available for his use sufficient storage and staging areas outside of the limits of the project.

In all cases, the Contractor shall adhere to and comply with Section 1.10 - Environmental Compliance, of the Standard Specifications for Roads, Bridges and Incidental Construction Form 816 and any Supplements thereto.

## **NOTICE TO CONTRACTOR – LONGITUDINAL JOINT PATCHING**

Due to deteriorated longitudinal joints it is recommended to use Item 0406125A – Bituminous Concrete Surface Patch to repair the existing longitudinal joints in the direction of traffic opposite of where work will begin. It is recommended to complete this patching to the southbound direction of traffic prior to work starting on the northbound direction of I-95.

**Note:** In addition to using Item 0406125A – Bituminous Concrete Surface Patch to repair the longitudinal joints it will also be used for deteriorated areas after milling.

## **NOTICE TO CONTRACTOR – TRAFFIC MONITORING STATION**

It shall be the responsibility of the Contractor to replace the loop detectors and piezo sensors at existing Traffic Monitoring Station ATR No. 30 in the City of Norwalk, which will be disturbed as a result of milling and paving on I-95. Existing cabinet with associated electric and telephone services, handholes, and conduit shall be reused, except for 1" liquidtight flexible nonmetallic conduit stubbing into roadway. Existing 1" liquidtight flexible nonmetallic conduit stubbing into roadway shall be removed from handholes to edge of pavement to make room for the installation of new conduit. New 1" liquidtight flexible nonmetallic conduit shall be installed from handholes 1' into shoulder. Existing No. 14 loop wires shall be removed from handholes, existing 14/2 cables and piezo sensor cables shall be removed from conduit, handholes, junction boxes, and cabinet, and existing No. 8 bare copper grounding conductor shall be removed from handholes. Existing 14/2 cables and existing piezo sensor cables shall be disconnected from terminal blocks in cabinet prior to milling of pavement. The Contractor shall install twelve type 1 piezo sensors along with piezo cable from sensor to cabinet. The Contractor shall install six loop detectors. Loop detectors shall be installed in final pavement course and spliced to new 14/2 cables in existing handholes. Existing handholes shall have rigid metal conduit and handhole covers bonded with a new No. 8 bare copper grounding conductor. All wiring within the cabinet shall be neat, firm, labeled and connected to the appropriate terminal blocks. The insulation and drain wire of each loop detector cable and the jacket of each piezo sensor cable shall be removed from only the last 2" at terminals to minimize electrical interference and cable shall be connected to the terminals using spade lugs. The Contractor shall clearly mark each loop detector cable and piezo sensor cable to identify the loop detector and piezo sensor to which it is connected, as stated in the general notes and labeled on the site plans. The Contractor shall properly identify all loop detectors and piezo sensors at terminals with strip tags, as labeled on the site plans.

The Contractor shall notify "Call Before You Dig," telephone: 1-800-922-4455 for the location of public underground facilities in accordance with Section 16-345 of the Regulations of the Public Utilities Regulatory Authority. In areas adjacent to underground lighting circuitry and Incident Management System (IMS), the Contractor is required to hand excavate. The Contractor will be responsible for locating, verifying the location of, and protecting all lighting and IMS appurtenances above and below ground. Any damage caused to the lighting system or IMS will be the responsibility of the Contractor, and will be replaced by the Contractor at his own expense, as directed by the Engineer. Mark out of the lighting circuitry and IMS will not relieve the Contractor of responsibility.

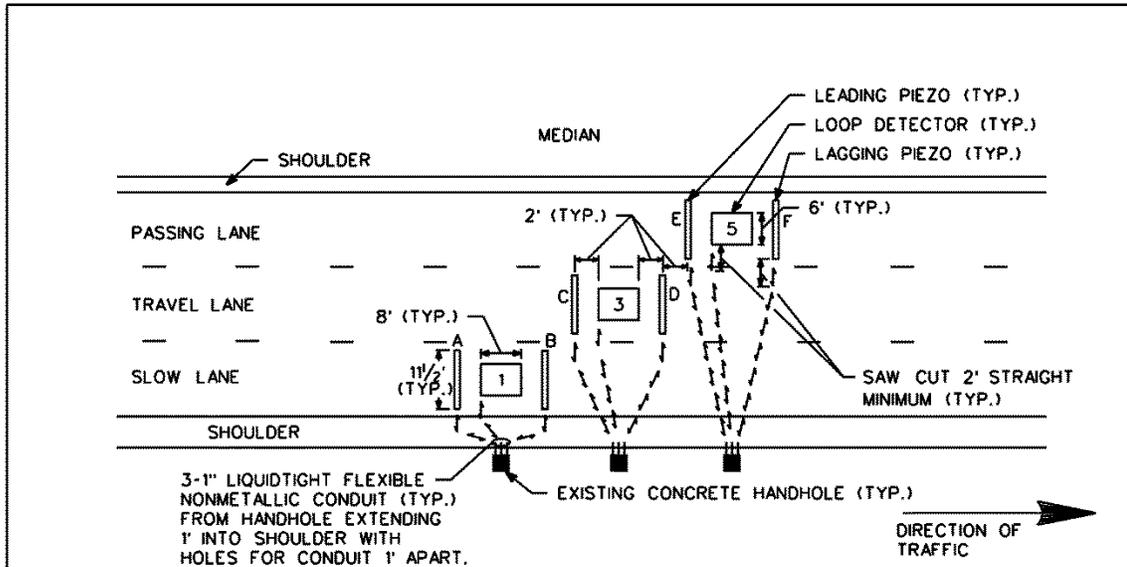
The Contractor shall notify the project inspector when access to the cabinet is required. The project inspector shall contact Ms. Hwai-Man Lin of CONNDOT's Office of Systems Modeling and Forecasting's Traffic Monitoring section at telephone no. 860-594-2106 for the Contractor to gain access to the cabinet. The project inspector shall inform Ms. Lin of the commencement of loop detector and piezo sensor installation 7 days prior to the start of work in order to provide an

opportunity for a representative of the Traffic Monitoring section to be present during the installation. Also, the project inspector shall provide Ms. Lin 7 days' notice prior to disturbing the site.

The Contractor shall notify the project engineer when all traffic monitoring station work is completed. The project engineer shall contact Mr. Zoltan Rigo of CONNDOT's Facilities Design Electrical section at telephone no. 860-594-2780 to schedule a semi-final inspection.

All information needed to complete the work is shown on 8½" x 11" plan sheets, details and specifications.

<b>LEGEND:</b>	
	TRAFFIC CONTROLLER CABINET AND FOUNDATION
	REMOVE TRAFFIC CONTROLLER CABINET AND FOUNDATION
	CONCRETE HANDHOLE - TYPE III
	EXISTING CONCRETE HANDHOLE
	REMOVE EXISTING CONCRETE HANDHOLE
---	RIGID METAL CONDUIT
- - - - -	SAW CUT
	WOOD POLE
	LIGHT STANDARD
	OVERHEAD SIGN
	CANTILEVER SIGN
	SIDE MOUNTED SIGN
	LOOP DETECTOR
	TYPE 2 PIEZO SENSOR
	TYPE 1 PIEZO SENSOR
	SOLAR POWER SYSTEM
<b>NOTES:</b>	
1. ALL CABINETS TO BE FIELD LOCATED OR AS SHOWN ON PLAN. INSTALL CONCRETE SIDEWALK ON CABINET DOOR SIDE PER STANDARD INSTALLATION DETAIL.	
2. LOOP AND PIEZO INSTALLATION SHALL COMPLY WITH SECTION 10.00 GENERAL CLAUSES FOR HIGHWAY ILLUMINATION AND TRAFFIC SIGNAL PROJECTS.	
3. SINGLE CONDUCTORS SHALL BE STRANDED COPPER, INSULATION TYPE THWN AND RATED FOR 600 VOLTS.	
4. THE REMOVAL OF BRUSH IS TO BE INCLUDED UNDER THE ITEM TRAFFIC CONTROLLER CABINET BASE MOUNTED.	
5. RIGID METAL CONDUIT IN CONCRETE HANDHOLES SHALL BE BONDED WITH NO. 8 BARE COPPER GROUNDING CONDUCTOR.	
6. ANY UNUSED CONDUIT SHALL BE CAPPED WITH A MALLEABLE IRON CAP.	
7. THE CONTRACTOR SHALL PROVIDE THE STATE A COMPLETE SET OF REPRODUCIBLE AS-BUILT DRAWINGS CLEARLY INDICATING ANY DEVIATIONS FROM THE DESIGN AS SHOWN ON THESE DRAWINGS.	
8. THE CONTRACTOR SHALL SCHEDULE WORK TO AVOID OTHER HIGHWAY PROJECTS IN AFFECTED WORK AREA. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE WITH OTHER HIGHWAY PROJECTS IN THE AREA.	
9. THE STATE SHALL RESERVE THE RIGHT TO PRIORITIZE SITES AND SCHEDULE SITE CONSTRUCTION SEQUENCE TO AVOID CONFLICTS WITH OTHER HIGHWAY PROJECTS.	
10. ALL HANDHOLES SHALL BE LOCATED APPROXIMATELY 4' OFF EDGE OF ROAD. HANDHOLES SHALL NOT BE INSTALLED DIRECTLY UNDER GUIDE RAIL OR ON TOP OF UNDERGROUND LIGHTING CIRCUITRY AND INCIDENT MANAGEMENT SYSTEM CONDUIT.	
11. THE CABINET DOOR SHALL BE LOCATED SO THE DETECTORS AND SENSORS ARE VISIBLE WHILE FACING THE CABINET OPENING.	
12. ALL TRAVEL LANES ARE 12' UNLESS NOTED.	
13. ALL TEMPORARY REMOVAL AND/OR RELOCATION OF GUIDE RAIL OR FENCING SHALL BE CONSIDERED INCLUDED IN THE GENERAL COST OF THE WORK.	
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CONNECTICUT DEPARTMENT OF TRANSPORTATION BUREAU OF ENGINEERING & CONSTRUCTION DIVISION OF FACILITIES AND TRANSIT	
LEGEND AND GENERAL NOTES FOR TRAFFIC MONITORING STATION	
10/8/14	SCALE - NONE



1. LOOP DETECTORS TO BE 6' X 8', 4 TURNS EACH, UNLESS NOTED.
2. LOOP DETECTORS TO BE INSTALLED IN THE CENTER OF EACH LANE, UNLESS NOTED.
3. LOOP DETECTORS AND PIEZO SENSORS TO BE FIELD LOCATED SO THAT NO SAW CUTS WILL BE MADE THROUGH CONCRETE EXPANSION JOINTS OR POOR PAVEMENT.
4. ALL SAW CUT HOME RUNS SHALL BE A MINIMUM 1' APART.
5. ALL LEAD-IN WIRE PAIRS SHALL BE TWISTED TOGETHER FIVE (5) TURNS PER FOOT WHEN IN CONDUIT.
6. LOOP CABLES SHALL HAVE 2' OF SLACK IN HANDHOLES.
7. PIEZO SENSORS TO BE INSTALLED IN THE CENTER OF EACH LANE, UNLESS NOTED.
8. ALL LOOP DETECTOR & PIEZO SENSOR LEADS SHALL BE COLOR CODED WITH TAPE IN CABINET, HANDHOLES & JUNCTION BOXES AS FOLLOWS:  
 LEADING LOOPS & PIEZOS = 1 BAND OF TAPE  
 LAGGING LOOPS & PIEZOS = 2 BANDS OF TAPE

LOOP NO.:	PIEZO NO.:	TAPE COLOR:
1.2	-- A.B	-- RED
3.4	-- C.D	-- BLUE
5.6	-- E.F	-- ORANGE
7.8	-- G.H	-- YELLOW
9.10	-- I.J	-- BROWN
11.12	-- K.L	-- PURPLE
13.14	-- M.N	-- GRAY
15.16	-- O.P	-- PINK

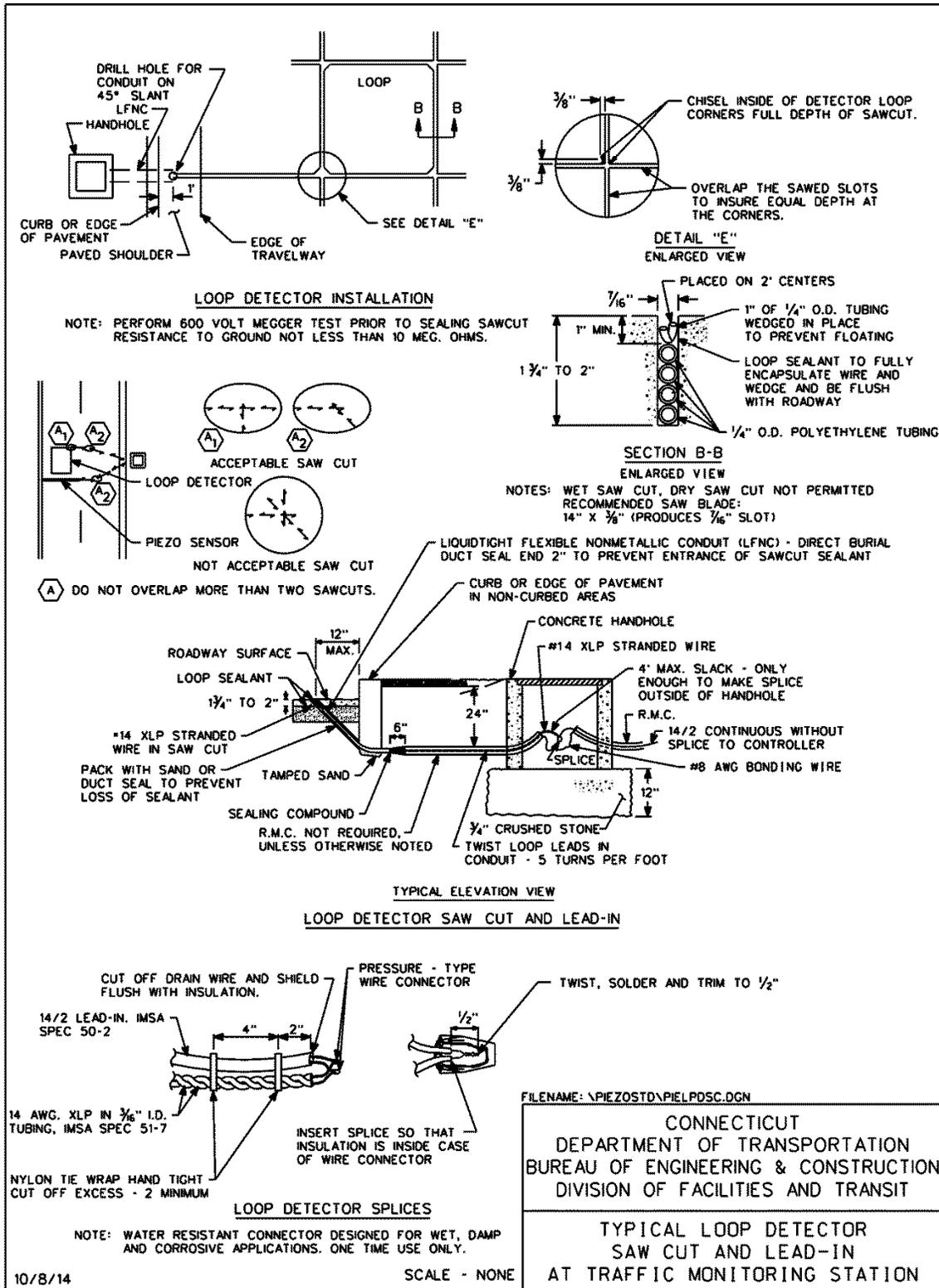
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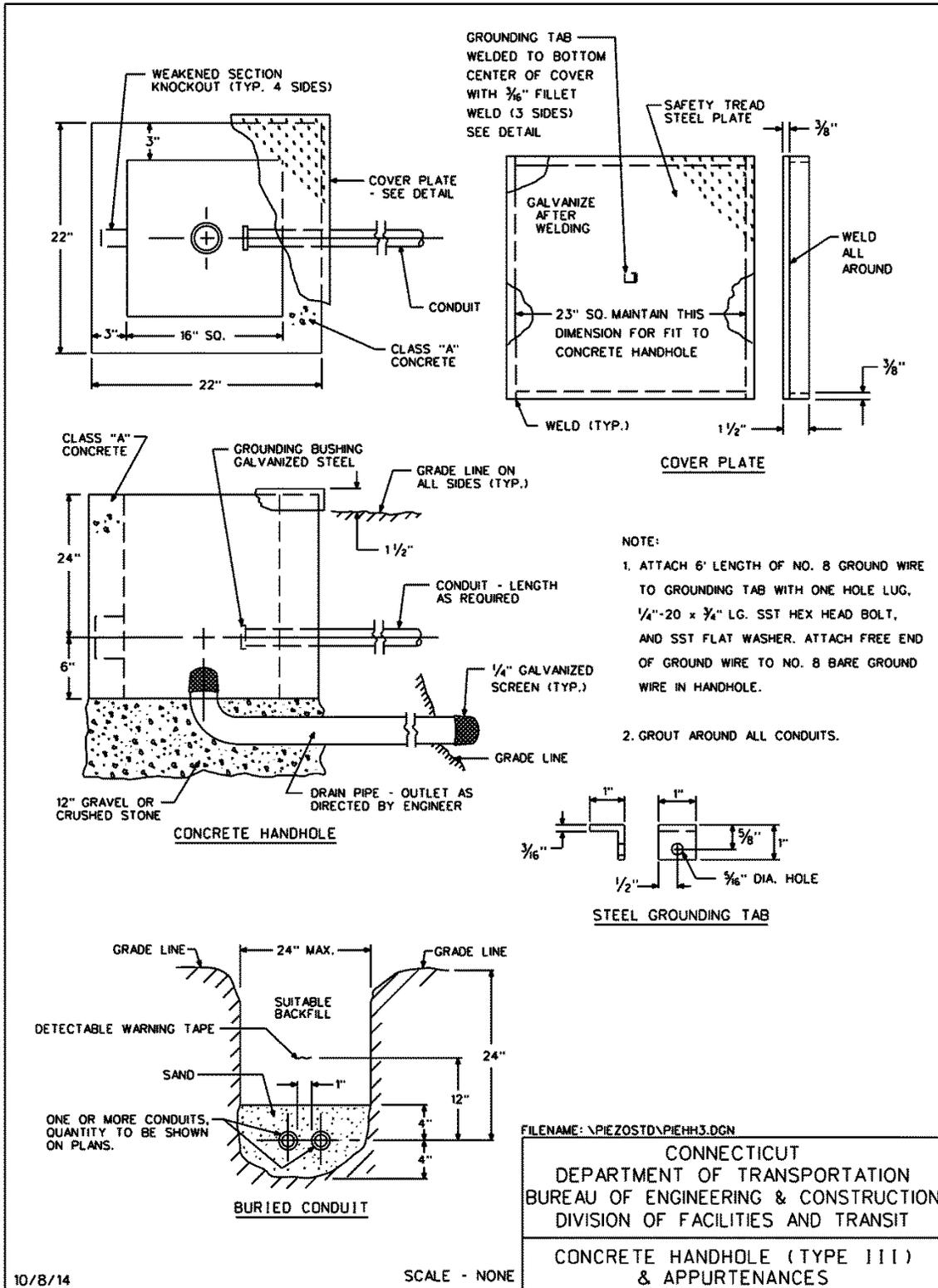
CONNECTICUT  
 DEPARTMENT OF TRANSPORTATION  
 BUREAU OF ENGINEERING & CONSTRUCTION  
 DIVISION OF FACILITIES AND TRANSIT

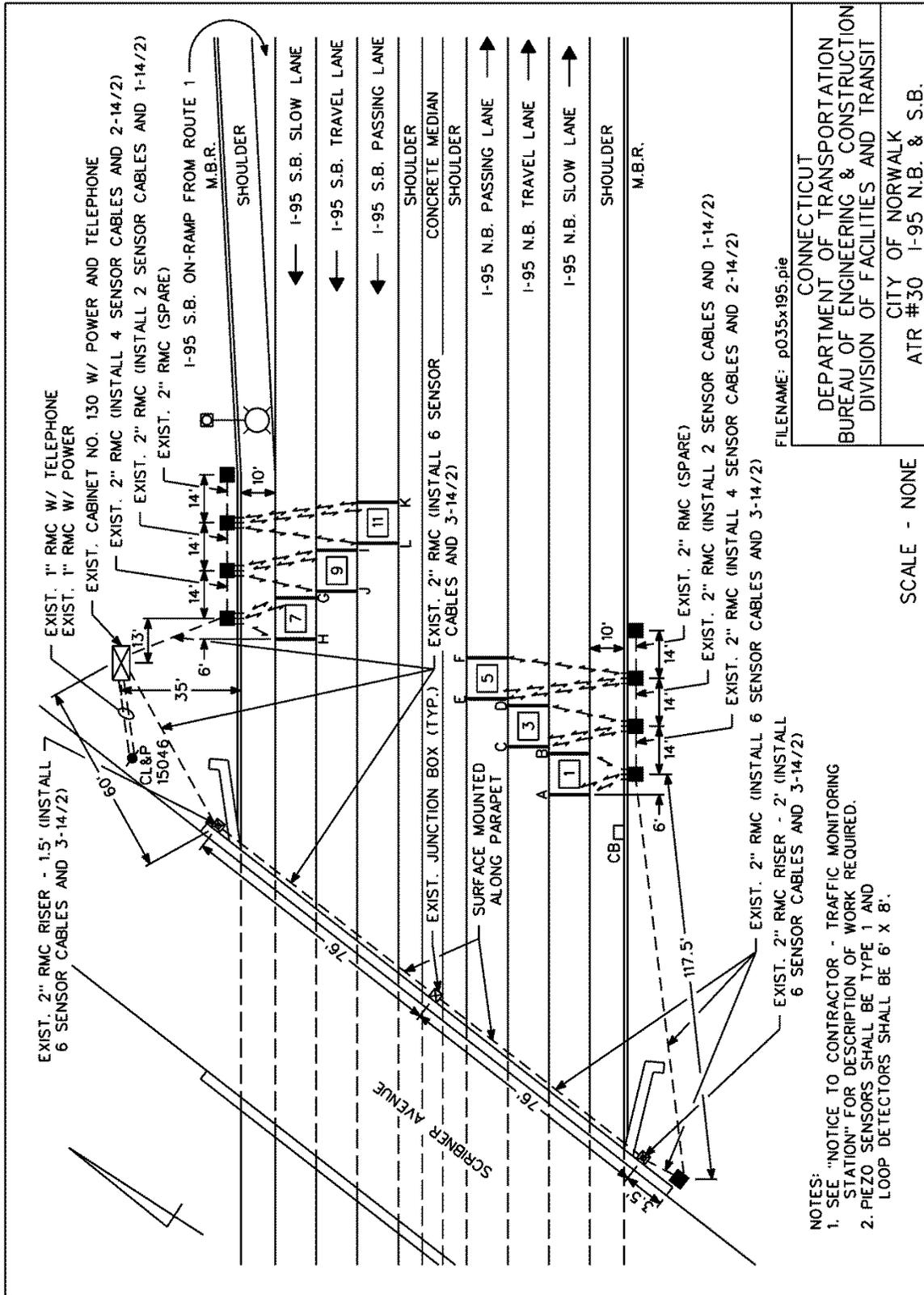
TWO PIEZOS (TYPE 1) &  
 ONE LOOP PER LANE  
 AT TRAFFIC MONITORING STATION

10/8/14

SCALE - NONE







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CONNECTICUT  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING & CONSTRUCTION  
DIVISION OF FACILITIES AND TRANSIT

CITY OF NORWALK  
ATR #30 I-95 N.B. & S.B.

SCALE - NONE

## **NOTICE TO CONTRACTOR – TRAFFIC SIGNALS**

The Contractor is hereby notified that certain conditions pertaining to the installation of new signal equipment and maintenance of traffic signal operations are required when relevant, as part of this contract.

### **Qualified/Unqualified Workers**

#### **U.S. Department of Labor**

**Occupational Safety & Health Administration (OSHA) [www.osha.gov](http://www.osha.gov)**

**Part Number 1910**

**Part Title Occupational Safety & Health Administration**

**Subpart S**

**Subpart Title Electrical**

**Standard Number 1910.333**

**Title Selection and use of work practices**

Under Maintenance and Protection of Traffic (M&PT) and Temporary Signalization the Contractor is required to keep in operation the following: all vehicle and pedestrian signals including necessary support structures; all vehicle and pedestrian detection; the pre-emption system; and coordination to the master, if in a system.

The contractor will be held liable for all damage to existing equipment resulting from his or his subcontractor's actions.

A credit will be deducted from monies due the Contractor for all maintenance calls responded to by Department of Transportation personnel.

All existing traffic signal equipment, in particular the Loop Vehicle Detector Sawcut shall be removed from the areas of proposed roadway changes or reconstruction prior to excavation.

The 30 Day Test on traffic control equipment, as specified in Section 10.00, Article 10.00.10 - TESTS, will not begin until the items listed below are delivered to the Department of Transportation, Traffic Signal Lab in Rocky Hill.

Four (4) sets of cabinet wiring diagrams. Leave one set in the controller cabinet.  
All spare load switches and flash relays.

**NOTICE TO CONTRACTOR – USE OF STATE POLICE OFFICERS**

The Department will reimburse services of State Police Officers as a direct payment to the Department of Emergency Services and Public Protection. Payment for State Police Officers utilized by the Contractor for its convenience, not approved by the Engineer, is the responsibility of the Contractor. No separate payment item for State Police Officers is included in this contract.

Any costs associated with coordination and scheduling of State Police Officers will be included under the cost of Item No. 0971001A – Maintenance and Protection of Traffic.

## **NOTICE TO CONTRACTOR – VOLUNTARY PARTNERING**

The Connecticut Department of Transportation (ConnDOT) intends to encourage the foundation of a cohesive partnership with the Contractor and its principal subcontractors on this project. This partnership will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objectives are effective and efficient contract performance and completion within budget, on schedule, and in accordance with plans and specifications.

This partnership will be bilateral in makeup, and participation will be totally voluntary. Any cost associated with effectuating this partnering will be agreed to by both parties and will be shared equally.

To implement this partner initiative, the Contractor and ConnDOT will meet and plan a partnering development seminar/team building workshop. At this planning session arrangements will be made to determine attendees at the workshop, agenda of the workshop, duration and location. Persons required to be in attendance will be the ConnDOT District Engineer and key project personnel, the Contractor's on/site project manager and key supervision personnel of both the prime and principal subcontractors. The project design engineers and key local government personnel will also be required to have Regional/District and Corporate/State level managers on the project team.

Follow/up workshops will be held periodically throughout the duration of the Contract as agreed by the Contractor and ConnDOT.

The establishment of a partnership charter on a project will not change the legal relationship of the parties to the Contract nor relieve either party from any of the terms of the Contract.

ConnDOT and the Contractor will jointly select a facilitator to conduct the partnering workshops. The Contractor will obtain the services of the chosen facilitator and ConnDOT will reimburse the Contractor for fifty percent (50%) of the costs agreed to between ConnDOT and the Contractor.

**NOTICE TO CONTRACTOR – SECTION 4.06 AND M.04 MIX DESIGNATION EQUIVALENCY**

Sections 4.06 and M.04 have been replaced in their entirety with the Special Provisions included as part of this contract. These Special Provisions reflect changes in mix designations for various types of hot-mix asphalt (HMA). The following table is to be used to associate mix designations noted on the plans with that in the contract specifications and related documents. Mix designations on each row are equivalent and refer to a single mix, which shall be subject to the requirements of the Special Provisions replacing Sections 4.06 and M.04.

**Mix Designation Equivalency Table**

<b>Official Mix Designation</b>	<b>Equivalent Mix Designation (a)</b>	<b>Equivalent Mix Designation (b)</b>
<b>(c)</b>	Superpave 1.5 inch	Superpave 37.5 mm
<b>HMA S1</b>	Superpave 1.0 inch	Superpave 25.0 mm
<b>HMA S0.5</b>	Superpave 0.5 inch	Superpave 12.5 mm
<b>HMA S0.375</b>	Superpave 0.375 inch	Superpave 9.5 mm
<b>HMA S0.25</b>	Superpave 0.25 inch	Superpave 6.25 mm
<b>(d)</b>	Superpave #4	Superpave #4
<b>Bituminous Concrete Class 1</b>	N/A*	N/A*
<b>Bituminous Concrete Class 2</b>	N/A*	N/A*
<b>Bituminous Concrete Class 3</b>	N/A*	N/A*
<b>Bituminous Concrete Class 4</b>	N/A*	N/A*
<b>Bituminous Concrete Class 12</b>	N/A*	N/A*

**(a)** This mix designation is generally included with projects where the English measurement system is used. The mix designation may contain both the English measurement system designation and the SI (metric) measurement system designation, one of which would be in parenthesis.

**(b)** This mix designation is generally included with projects where the SI (metric) measurement system is used. The mix designation may contain both the English measurement system designation and the SI measurement system designation, one of which would be in parenthesis.

**(c)** This mix is no longer in use except by contract-specific Special Provision; if this mix is called for in the Plans but no such Special Provision is included for this contract a suitable substitute must be approved by the Engineer.

**(d)** This mix is no longer in use except by contract-specific Special Provision; if this mix is called for in the Plans but no such Special Provision is included for this contract a suitable substitute must be approved by the Engineer.

\* N/A = Not applicable; mix designation has not changed.

## **NOTICE TO CONTRACTOR – SUPERPAVE DESIGN LEVEL INFORMATION**

Hot-Mix Asphalt (HMA) and Polymer-Modified Asphalt (PMA) constructed according to the Superpave mix-design system are required to attain a Superpave Design Level and are required to use a Performance Graded (PG) binder. The Superpave Design Levels required for this project are listed in Table 1. The required PG binder is indicated for each mix with an “X” in the appropriate box in Table 1.

**TABLE 1 – Superpave Design Level and Performance Graded (PG) Binder**

Mix Designation	PG Binder		Route 95	Route	Route	Route	Route
	PG 64-22	PG 76-22	Design Level				
HMA S0.25	-	-	-	-	-	-	-
HMA S0.375	X	-	2	-	-	-	-
HMA S0.5	-	-	-	-	-	-	-
HMA S1	-	-	-	-	-	-	-
PMA S0.25	-	X	2	-	-	-	-
PMA S0.375	-	-	-	-	-	-	-
PMA S0.5	-	X	3	-	-	-	-
PMA S1	-	-	-	-	-	-	-

**Note:** Please note that PMA mix designations typically use PG 76-22 and HMA mix designations use PG 64-22.

## **NOTICE TO CONTRACTOR – TRAFFIC DRUMS AND TRAFFIC CONES**

Traffic Drums and 42-inch (1 m) Traffic Cones shall have four six-inch (150 mm) wide stripes (two - white and two - orange) of flexible bright fluorescent sheeting.

The material for the stripes shall be one of the following, or approved equal:

- 3M Scotchlite Diamond Grade Flexible Work Zone Sheeting, Model 3910 for the white stripes and Model 3914 for the orange stripes,
- Avery Dennison WR-7100 Series Reboundable Prismatic Sheeting, Model WR-7100 for the white stripes and Model WR-7114 for the orange stripes.

## **NOTICE TO CONTRACTOR – NCHRP 350 REQ. FOR WORK ZONE TRAFFIC CONTROL DEVICES**

### **CATEGORY 1 DEVICES (traffic cones, traffic drums, tubular markers, flexible delineator posts)**

Prior to using the Category 1 Devices on the project, the Contractor shall submit to the Engineer a copy of the manufacturer's self-certification that the devices conform to the requirements in National Cooperative Highway Research Program (NCHRP) Report 350 or the AASHTO Manual for Assessing Safety Hardware (MASH), as appropriate.

### **CATEGORY 2 DEVICES (construction barricades, construction signs and portable sign supports)**

Prior to using Category 2 Devices on the project, the Contractor shall submit to the Engineer a copy of the Letter of Acceptance issued by the FHWA to the manufacturer documenting that the devices (both sign and portable support tested together) have been crash tested and have approval in writing from FHWA conforming to the requirements in National Cooperative Highway Research Program (NCHRP) Report 350 or the AASHTO Manual for Assessing Safety Hardware (MASH), as appropriate.

Specific requirements for these devices are included in the Special Provisions.

Information regarding NCHRP Report 350 and AASHTO Manual for Assessing Safety Hardware (MASH) may be found at the following web sites:

**FHWA:** [http://safety.fhwa.dot.gov/roadway\\_dept/Policy\\_guide/road\\_hardware/](http://safety.fhwa.dot.gov/roadway_dept/Policy_guide/road_hardware/)

**ATSSA:** <http://www.atssa.com/resources.aspx>

**NOTE:** The portable wooden sign supports that have been traditionally used by most contractors in the State of Connecticut do NOT meet NCHRP Report 350 criteria and shall not be utilized on any project advertised after October 01, 2000.

### **CATEGORY 3 DEVICES (Truck-Mounted Attenuators & Work Zone Crash Cushions)**

Prior to using Category 3 Devices on the project, the Contractor shall submit to the Engineer a copy of the Letter of Acceptance issued by the FHWA to the manufacturer documenting that the devices have been crash tested and have approval in writing from FHWA conforming to the requirements in National Cooperative Highway Research Program (NCHRP) Report 350 or the AASHTO Manual for Assessing Safety Hardware (MASH), as appropriate.

**SECTION 1.02 – PROPOSAL REQUIREMENTS AND CONDITIONS**

**Article 1.02.04 – Examination of Plans, Specifications, Special Provisions and Site of Work:**

*Replace the third sentence of the last paragraph with:*

The Department cannot ensure a response to inquiries received later than ten (10) days prior to the original scheduled opening of the related bid.

## **SECTION 1.05 – CONTROL OF THE WORK**

**Article 1.05.02 - Plans, Working Drawings and Shop Drawings  
is supplemented as follows:**

**Subarticle 1.05.02 - (2) is supplemented by the following:**

### **Traffic Signal Items:**

When required by the contract documents or when ordered by the Engineer, The Contractor shall prepare and submit catalog cuts, working drawings and/or shop drawings for all traffic signal items, except Steel Span Poles and Mast Arm Assemblies when applicable, to the Division of Traffic Engineering for approval before fabrication. The packaged set of catalog cuts, working drawings and/or shop drawings shall be submitted either in paper (hard copy) form or in an electronic portable document format (.pdf). The package submitted in paper form shall include one (1) set. Catalog cuts shall be printed on ANSI A (8 ½” x 11”; 216 mm x 279mm; letter) sheets. Working drawings and shop drawings shall be printed on ANSI B (11” x 17”; 279 mm x 432 mm; ledger/tabloid) sheets.

Please mail to:

Lisa N. Conroy, P.E.  
Transportation Supervising Engineer  
Connecticut Department of Transportation  
Division of Traffic Engineering – Electrical  
2800 Berlin Turnpike  
P.O. Box 317546  
Newington, Connecticut 06131-7546  
(860) 594-2985

The packaged set submitted in an electronic portable document format (.pdf) shall be in an individual file with appropriate bookmarks for each item. The electronic files for catalog cuts shall be created on ANSI A (8 ½” x 11”; 216 mm x 279mm; letter) sheets. Working drawings and shop drawings shall be created on ANSI B (11” x 17”; 279 mm x 432 mm; ledger/tabloid) sheets.

Please send the pdf documents via email to:

[lisa.conroy@ct.gov](mailto:lisa.conroy@ct.gov)

When these items are included in the project, the submission for **Steel Span Poles and Mast Arm Assemblies** shall follow the format and be sent to the “Engineer of Record” as described in the Steel Span Pole and Steel Mast Arm Assembly special provision.

## **SECTION 1.06 – CONTROL OF MATERIALS**

### **Article 1.06.01 – Source of Supply and Quality:**

Add the following:

#### **Traffic Monitoring Station Items**

For the following items the Contractor shall submit a complete description of the item, together with eight (8) copies of shop drawings, cuts and other descriptive literature which completely illustrates such items presented for formal approval. Such approval shall not change the requirements for a certified test report and materials certificate as may be called for.

Loop Wire  
14/2 Cable  
Piezo Sensor (Including Sensor Cable)  
Piezo Installation Procedure  
Piezo Epoxy  
Piezo Sensor Cable Sawcut Sealant  
Loop Detector Sawcut Sealant

Required catalog cuts for all items listed above shall be submitted in one package at the same time. All approvals or disapprovals and comments will be returned in one package.

When required by the contract documents or when ordered by the Engineer, the Contractor shall prepare and submit eight (8) sets of catalog cuts and/or shop drawings for all **traffic monitoring station items** in one package at the same time to the following for approval prior to ordering or fabrication.

Mr. Gregory M. Dorosh  
Transportation Principal Engineer  
Connecticut Department of Transportation  
P.O. Box 317546  
Newington, Connecticut 06131-7546  
Attention: Jon H. Andrews

#### **Traffic Signal Items**

For the following traffic signal items the Contractor shall submit a complete description of the item, working drawings, catalog cuts and other descriptive literature which completely illustrates such items presented for formal approval. Such approval shall not change the requirements for a certified test

report and materials certificate as may be called for. All shop drawings shall be submitted at one time, unless otherwise approved by the engineer.

Loop Vehicle Detection  
Loop Sealant  
Loop Lead-in Wire

When required by the contract documents or when ordered by the Engineer, the Contractor shall prepare and submit nine (9) sets of catalog cuts and/or shop drawings for all **traffic signal items** to the Division of Traffic contact noted in Article 1.05.02-2 of the contract special provisions for approval before fabrication.

**Article 1.06.07 – Certified Test Reports and Materials Certificates:**

- 1) For the materials in the following items, a Certified Test Report will be required confirming their conformance to the requirements set forth in these plans or specifications or both. Should the consignee noted on a Certified Test Report be other than the Prime Contractor, then Materials Certificates shall be required to identify the shipment.

**Traffic Monitoring Station Items**

Piezo Sensor  
Piezo Sensor Cable

- 2) For the materials in the following items, a Materials Certificate will be required confirming their conformance to the requirements set forth in these plans or specifications or both.

**Traffic Monitoring Station Items**

Piezo Sensor  
Piezo Epoxy  
Piezo Sensor Cable Sawcut Sealant

**Traffic Signal Items**

Loop Vehicle Detection  
Loop Sealant  
Loop Lead-in Wire

**SECTION 1.07 – LEGAL RELATIONS AND RESPONSIBILITIES**

**Article 1.07.10 - Contractor’s Duty to Indemnify the State against Claims for Injury or Damage:**

*Add the following after the only paragraph:*

“It is further understood and agreed by the parties hereto, that the Contractor shall not use the defense of Sovereign Immunity in the adjustment of claims or in the defense of any suit, including any suit between the State and the Contractor, unless requested to do so by the State.”

## **SECTION 1.08 – PROSECUTION AND PROGRESS**

### **Article 1.08.03 - Prosecution of Work:**

Add the following:

The Contractor shall notify the Traffic Signal Lab at Telephone (860) 258-0346 or (860) 258-0349 two weeks (14) days prior to starting work on computer controlled signalized intersections only. This notice will initiate work to be completed by others. The Contractor shall be responsible for any timely updates that need to be reported to this Unit for the successful coordination of work by others.

The Contractor shall notify the project engineer on construction projects, or the district permit agent on permit jobs, when all traffic signal work is completed. This will include all work at signalized intersections including loop replacements, adjusting existing traffic signals or any relocation work including handholes. The project engineer or district permit agent will notify the Division of Traffic Engineering to coordinate a field inspection of all work.

### **Article 1.08.04 - Limitation of Operations - Add the following:**

In order to provide for traffic operations as outlined in the Special Provision "Maintenance and Protection of Traffic," the Contractor will not be permitted to perform any work which will interfere with the described traffic operations on all project roadways as follows:

#### **Route I-95**

On the following State observed Legal Holidays:

New Year's Day  
Good Friday, Easter\*  
Memorial Day  
Independence Day  
Labor Day  
Columbus Day  
Thanksgiving Day\*\*  
Christmas Day

The following restrictions also apply:

On the day before and the day after any of the above Legal Holidays.

On the Friday, Saturday, and Sunday immediately preceding any of the above Holidays celebrated on a Monday.

On the Saturday, Sunday, and Monday immediately following any of the above Holidays celebrated on a Friday.

\* From 6:00 a.m. the Thursday before the Holiday to 8:00 p.m. the Monday after the Holiday.

\*\* From 6:00 a.m. the Wednesday before the Holiday to 8:00 p.m. the Monday after the Holiday.

During all other times

The Contractor shall maintain and protect traffic as shown on the accompanying "Limitation of Operations" charts, which dictate the minimum number of lanes that must remain open for each day of the week.

The Contractor will be allowed to halt Route I-95 traffic for a period not to exceed 10 minutes to perform necessary work as approved by the Engineer, between 12:01 a.m. and 5:00 a.m. on all non-Holiday days.

**Project No. 35 – 195  
Limitation of Operations Chart  
Minimum Number of Lanes to Remain Open**

Route: I – 95 Northbound Location: Within Project Limits Number of Through Lanes: 3								Route: I – 95 Southbound Location: Within Project Limits Number of Through Lanes: 3							
Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Hour Beginning	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Mid	2	2	2	2	2	2	2	Mid	1	1	1	1	1	1	1
1 AM	1	1	1	1	1	1	1	1 AM	1	1	1	1	1	1	1
2 AM	1	1	1	1	1	1	1	2 AM	1	1	1	1	1	1	1
3 AM	1	1	1	1	1	1	1	3 AM	1	1	1	1	1	1	1
4 AM	1	1	1	1	1	1	1	4 AM	1	1	1	1	1	1	1
5 AM	2	2	2	2	2	1	1	5 AM	2	2	2	2	2	2	1
6 AM	E	E	E	E	E	2	1	6 AM	E	E	E	E	E	2	1
7 AM	E	E	E	E	E	3	2	7 AM	E	E	E	E	E	3	2
8 AM	E	E	E	E	E	3	2	8 AM	E	E	E	E	E	3	2
9 AM	3	3	3	3	3	3	3	9 AM	3	3	3	3	3	3	3
10 AM	3	3	3	3	3	3	3	10 AM	3	3	3	3	3	3	3
11 AM	3	3	3	3	3	3	3	11 AM	3	3	3	3	3	3	3
Noon	3	3	3	3	3	3	3	Noon	3	3	3	3	3	3	3
1 PM	3	3	3	3	3	3	3	1 PM	3	3	3	3	3	3	3
2 PM	3	3	3	3	3	3	3	2 PM	3	3	3	3	3	3	3
3 PM	E	E	E	E	E	3	3	3 PM	E	E	E	E	E	3	3
4 PM	E	E	E	E	E	3	3	4 PM	E	E	E	E	E	3	3
5 PM	E	E	E	E	E	3	3	5 PM	E	E	E	E	E	3	3
6 PM	E	E	E	E	E	3	3	6 PM	3	3	3	3	E	3	3
7 PM	3	3	3	E	E	3	3	7 PM	3	3	3	3	3	3	3
8 PM	3	3	3	3	3	3	3	8 PM	2	2	2	3	3	3	3
9 PM	2	2	2	3	3	3	3	9 PM	2	2	2	2	3	3	3
10 PM	2	2	2	3	3	3	2	10 PM	2	2	2	2	2	3	3
11 PM	2	2	2	2	2	3	2	11 PM	1	1	1	2	2	2	2

**On Holidays and within Holiday Periods, all Hours shall be ‘E.’**

**‘E’ = maintain existing traffic operations = all available travel lanes, including exit only lanes, climbing lanes and all available shoulder widths shall be open to traffic during this period**

### **Ramps and Turning Roadways**

Monday through Friday between 6:00 a.m. and 6:00 p.m.  
Saturday and Sunday between 10:00 a.m. and 6:00 p.m.

During construction on I-95 ramps, with prior approval of the Engineer, the Contractor may close any ramps within the project limits from 9:00 p.m. to 6:00 a.m. on all non-Holiday days and erect a detour route in accordance with the Contract Plans and Special Provision Item No. 0971001A – Maintenance and Protection of Traffic. The Contractor shall only be allowed to close one ramp at a time.

The Contractor shall notify the Engineer at least 14 days in advance of the start of the any ramps closures.

### **All Other Roadways**

Monday through Friday between 6:00 a.m. and 6:00 p.m.  
Saturday and Sunday between 10:00 a.m. and 6:00 p.m.

### **Additional Lane Closure Restrictions**

It is anticipated that work on adjacent projects will be ongoing simultaneously with this project. The Contractor shall be aware of those projects and anticipate that coordination will be required to maintain proper traffic flow at all times on all project roadways, in a manner consistent with these specifications and acceptable to the Engineer.

The Contractor will not be allowed to perform any work that will interfere with traffic operations on a roadway when traffic operations are being restricted on that same roadway, unless there is at least a one mile clear area length where the entire roadway is open to traffic or the closures have been coordinated and are acceptable to the Engineer. The one mile clear area length shall be measured from the end of the first work area to the beginning of the signing pattern for the next work area.

## **SECTION 4.06 BITUMINOUS CONCRETE**

Section 4.06 is being deleted in its entirety and replaced with the following:

### **4.06.01—Description**

### **4.06.02—Materials**

### **4.06.03—Construction Methods**

### **4.06.04—Method of Measurement**

### **4.06.05—Basis of Payment**

**4.06.01—Description:** Work under this section shall include the production, delivery and placement of a non-segregated, smooth and dense bituminous concrete mixture brought to proper grade and cross section. This section shall also include the method and construction of longitudinal joints. The Contractor shall furnish ConnDOT with a Quality Control Plan as described in Article 4.06.03.

The terms listed below as used in this specification are defined as:

**Bituminous Concrete:** A concrete material that uses a bituminous material (typically asphalt) as the binding agent and stone and sand as the principal aggregate components. Bituminous concrete may also contain any of a number of additives engineered to modify specific properties and/or behavior of the concrete material. For the purposes of this Specification, references to bituminous concrete apply to all of its sub-categories, for instance those defined on the basis of production and placement temperatures, such as hot-mix asphalt (HMA) or warm-mix asphalt (WMA), those categories derived from the mix-design procedure used, such as “Marshall” mixes or “Superpave” mixes, or those defined on the basis of composition, such as polymer-modified asphalt (PMA).

**Course:** A lift or multiple lifts comprised of the same bituminous concrete mixture placed as part of the pavement structure.

**Density Lot:** All material placed in a single lift and as defined in Article 4.06.03.

**Disintegration:** Wearing away or fragmentation of the pavement. Disintegration will be evident in the following forms: Polishing, weathering-oxidizing, scaling, spalling, raveling, potholes or loss of material.

**Dispute Resolution:** A procedure used to resolve conflicts resulting from discrepancies between the Engineer and the Contractor’s density results that may affect payment.

**Hot Mix Asphalt (HMA):** A bituminous concrete mixture typically produced at 325°F.

**Lift:** An application of a bituminous concrete mixture placed and compacted to a specified thickness in a single paver pass.

Marshall: A bituminous concrete mix design used in mixtures designated as “Bituminous Concrete Class ( )”.

Polymer Modified Asphalt (PMA): A bituminous concrete mixture containing a polymer modified asphalt binder in accordance with contract specifications.

Production Lot: All material placed during a continuous daily paving operation.

Quality Assurance (QA): All those planned and systematic actions necessary to provide confidence that a product or facility will perform as designed.

Quality Control (QC): The sum total of activities performed by the vendor (Producer, Manufacturer, and Contractor) to ensure that a product meets contract specification requirements.

Superpave: A bituminous concrete mix design used in mixtures designated as “S\*” Where “S” indicates Superpave and \* indicates the sieve related to the nominal maximum aggregate size of the mix.

Segregation: A non-uniform distribution of a bituminous concrete mixture in terms of volumetrics, gradation or temperature.

Warm Mix Asphalt (WMA): A bituminous concrete mixture that can be produced and placed at reduced temperatures than HMA using a qualified additive or technology.

**4.06.02—Materials:** All materials shall conform to the requirements of Section M.04.

**1. Materials Supply:** The bituminous concrete mixture must be from one source of supply and originate from one Plant unless authorized by the Engineer. Bituminous Concrete plant QC plan requirements are defined in Section M.04.

**2. Recycle Option:** The Contractor has the option of recycling reclaimed asphalt pavement (RAP) or Crushed Recycled Container Glass (CRCG) in bituminous concrete mixtures in accordance with Section M.04. CRCG shall not be used in the final lift of the surface course.

**4.06.03—Construction Methods:**

**1. Material Documentation:** All vendors producing bituminous concrete must have their truck-weighing scales, storage scales, and mixing plant automated to provide a detailed ticket.

Delivery tickets must include the following information:

- a. State of Connecticut printed on ticket.
- b. Name of producer, identification of plant, and specific storage bin (silo) if used.
- c. Date and time of day.

English

- d. Mixture Designation If RAP is used, the plant printouts shall include RAP dry weight, percentage and daily moisture content. If WMA technology is used, the technology and the additive rate or the water injection rate must be noted on the ticket. Class 3 mixtures for machine-placed curbing must state "curb mix only".
- e. Net weight of mixture loaded into truck (When RAP is used, RAP moisture shall be excluded from mixture net weight).
- f. Gross weight (Either equal to the net weight plus the tare weight or the loaded scale weight).
- g. Tare weight of truck – Daily scale weight.
- h. Project number, purchase order number, name of Contractor (if Contractor other than Producer).
- i. Truck number for specific identification of truck.
- j. Individual aggregate, RAP, and virgin asphalt high/target/low weights shall be printed on batch plant tickets (For drum plants and silo loadings, the plant printouts shall be printed out at 5 minute intervals maintained by the vendor for a period of three years after the completion of the project).
- k. For every mixture designation the running daily total delivered and sequential load number.

The net weight of mixture loaded into the truck must be equal to the cumulative measured weight of its components.

The Contractor must notify the Engineer immediately if, during the production day, there is a malfunction of the weighing or recording system in the automated plant or truck-weighing scales. Manually written tickets containing all required information will be allowed for one hour, but for no longer, provided that each load is weighed on State-approved scales. At the Engineer's sole discretion, trucks may be approved to leave the plant if a State inspector is present to monitor weighing. If such a malfunction is not fixed within forty-eight hours, mixture will not be approved to leave the plant until the system is fixed to the Engineer's satisfaction. No damages will be considered should the State be unable to provide an inspector at the plant.

The State reserves the right to have an inspector present to monitor batching and /or weighing operations.

**2. Transportation of Mixture:** Trucks with loads of bituminous concrete being delivered to State projects must not exceed the statutory or permitted load limits referred to as gross vehicle weight (GVW). The Contractor shall furnish a list of all vehicles and allowable weights transporting mixture.

The State reserves the right to check the gross and tare weight of any delivery truck. A variation of 0.4 percent or less in the gross or tare weight shown on the delivery ticket and the certified scale weight shall be considered evidence that the weight shown on the delivery ticket is correct. If the gross or tare weight varies from that shown on the delivery ticket by more than 0.4 percent, the Engineer will recalculate the net weight. The Contractor shall take action to correct discrepancy to the satisfaction of the Engineer.

If a truck delivers mixture to the project and the ticket indicates that the truck is overweight, the load will not be rejected but a “Measured Weight Adjustment” will be taken in accordance with Article 4.06.04.

The mixture shall be transported from the mixing plant in trucks that have previously been cleaned of all foreign material and that have no gaps through which mixture might inadvertently escape. The Contractor shall take care in loading trucks uniformly so that segregation is minimized. Loaded trucks shall be tightly covered with waterproof covers acceptable to the Engineer. Mesh covers are prohibited. The front and rear of the cover must be fastened to minimize air infiltration. The Contractor shall assure that all trucks are in conformance with this specification. Trucks found not to be in conformance shall not be allowed to be loaded until re-inspected to the satisfaction of the Engineer.

Truck body coating and cleaning agents must not have a deleterious effect on the transported mixture. The use of solvents or fuel oil, in any concentration, is strictly prohibited for the coating of the inside of truck bodies. When acceptable coating or agents are applied, truck bodies shall be raised immediately prior to loading to remove any excess agent in an environmentally acceptable manner.

**3. Paving Equipment:** The Contractor shall have the necessary paving and compaction equipment at the project site to perform the work. All equipment shall be in good working order and any equipment that is worn, defective or inadequate for performance of the work shall be repaired or replaced by the Contractor to the satisfaction of the Engineer. During the paving operation, the use of solvents or fuel oil, in any concentration, is strictly prohibited as a release agent or cleaner on any paving equipment (i.e., rollers, pavers, transfer devices, etc.).

Refueling of equipment is prohibited in any location on the paving project where fuel might come in contact with bituminous concrete mixtures already placed or to be placed. Solvents for use in cleaning mechanical equipment or hand tools shall be stored clear of areas paved or to be paved. Before any such equipment and tools are cleaned, they shall be moved off the paved or to be paved area; and they shall not be returned for use until after they have been allowed to dry.

Pavers: Each paver shall have a receiving hopper with sufficient capacity to provide for a uniform spreading operation and a distribution system that places the mix uniformly, without segregation. The paver shall be equipped with and use a vibratory screed system with heaters or burners. The screed system shall be capable of producing a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Pavers with extendible screed units as part of the system shall have auger extensions and tunnel extenders as necessary. Automatic screed controls for grade and slope shall be used at all times unless otherwise authorized by the Engineer. The controls shall automatically adjust the screed to compensate for irregularities in the preceding course or existing base. The controls shall maintain the proper transverse slope and be readily adjustable, and shall operate from a fixed or moving reference such as a grade wire or floating beam.

English

**Rollers:** All rollers shall be self-propelled and designed for compaction of bituminous concrete. Rollers types shall include steel-wheeled, pneumatic or a combination thereof and may be capable of operating in a static or dynamic mode. Rollers that operate in a dynamic mode shall have drums that use a vibratory or oscillatory system or combination of. The vibratory system achieves compaction through vertical amplitude forces. Rollers with this system shall be equipped with indicators that provide the operator with amplitude, frequency and speed settings/readouts to measure the impacts per foot during the compaction process. The oscillatory system achieves compaction through horizontal shear forces. Rollers with this system shall be equipped with frequency indicators. Rollers can operate in the dynamic mode using the oscillatory system on concrete structures such as bridges and catch basins if at the lowest frequency setting.

Pneumatic tire rollers shall be self-propelled and equipped with wide-tread compaction tires capable of exerting an average contact pressure from 60 to 90 pounds per square inch uniformly over the surface, adjusting ballast and tire inflation pressure as required. The Contractor shall furnish evidence regarding tire size; pressure and loading to confirm that the proper contact pressure is being developed and that the loading and contact pressure are uniform for all wheels.

**Lighting:** For paving operations, which will be performed during hours of darkness, the paving equipment shall be equipped with lighting fixtures as described below, or with approved lighting fixtures of equivalent light output characteristics. A sufficient number of spare lamps shall be available on site as replacements in the event of failures. The Contractor shall provide brackets and hardware for mounting light fixtures and generators to suit the configuration of the rollers and pavers. Mounting brackets and hardware shall provide for secure connection of the fixtures, minimize vibration, and allow for adjustable positioning and aiming of the light fixtures. Lighting shall be aimed to maximize the illumination on each task and minimize glare to passing traffic. The Contractor shall provide generators on rollers and pavers of the type, size, and wattage, to adequately furnish 120 V AC of electric power to operate the specified lighting equipment. A sufficient amount of fuel shall be available on site. There shall be switches to control the lights. Wiring shall be weatherproof and installed to all applicable codes. The minimum lighting requirements are found in tables 4.06-1 and 4.06-2:

**Table 4.06-1: Paver Lighting**

<b>Fixture</b>	<b>Quantity</b>	<b>Remarks</b>
Type A	3	Mount over screed area
Type B (narrow) or Type C (spot)	2	Aim to auger and guideline
Type B (wide) or Type C (flood)	2	Aim 25 feet behind paving machine

**Table 4.06-2: Roller Lighting**

<b>Fixture*</b>	<b>Quantity</b>	<b>Remarks</b>
Type B (wide)	2	Aim 50 feet in front of and behind roller
Type B (narrow)	2	Aim 100 feet in front of and behind roller
<b>OR</b>		
Type C (flood)	2	Aim 50 feet in front of and behind roller
Type C (spot)	2	Aim 100 feet in front of and behind roller

\*All fixtures shall be mounted above the roller.

Type A: Fluorescent fixture shall be heavy-duty industrial type. It shall be enclosed and sealed to keep out dirt and dampness. It shall be UL listed as suitable for wet locations. The fixture shall contain two 4-foot long lamps - Type "F48T12CWHO". The integral ballast shall be a high power factor, cold weather ballast, and 120 volts for 800 MA HO lamps. The housing shall be aluminum, and the lens shall be acrylic with the lens frame secured to the housing by hinging latches. The fixture shall be horizontal surface mounting, and be made for continuous row installation.

Type B: The floodlight fixture shall be heavy-duty cast aluminum housing, full swivel and tilt mounting, tempered-glass lens, sealed door, reflector to provide a wide distribution or narrow distribution as required, mogul lamp socket for 250 watt Metal Halide lamp, 120 volt integral ballast, and be UL listed as suitable for wet locations.

Type C: The power beam holder shall have ribbed die cast aluminum housing and a clear tempered-glass lens to enclose the fixture. There shall be an arm fully adjustable for aiming, with a male-threaded mount with serrated teeth and lock nuts. There shall be a 120-volt heatproof socket with extended fixture wiring for an "Extended Mogul End Prong" lamp base. The fixture shall have gaskets, and shall be UL listed as suitable for wet locations. The lamps shall be 1000-watt quartz PAR64, both Q1000PAR64MFL (flood) and Q1000PARNSP (spot) will be required.

Material Transfer Vehicle (MTV): A MTV shall be used when placing a bituminous concrete surface course as indicated in the contract documents. A surface course is defined as the total thickness of the same bituminous concrete mix that extends up to and includes the final wearing surface whether it is placed in a single or multiple lifts, and regardless of any time delays between lifts.

The MTV must be a self-propelled vehicle specifically designed for the purpose of delivering the bituminous concrete mixture from the delivery truck to the paver. The MTV must have the capability to remix the bituminous concrete mixture.

The use of a MTV will be subject to the requirements stated in Article 1.07.05- Load Restrictions. The Engineer may limit the use of the vehicle if it is determined that the use of the MTV may damage highway components, utilities, or bridges. The Contractor shall submit to the Engineer at time of pre-construction the following information:

- The make and model of the MTV to be used.
- The individual axle weights and axle spacing for each separate piece of paving equipment (haul vehicle, MTV and paver).
- A working drawing showing the axle spacing in combination with all three pieces of equipment that will comprise the paving echelon.

**4. Seasonal Requirements:** Paving, including placement of temporary pavements, shall be divided into two seasons, In-Season and Extended Season. In-Season paving shall occur from May 1 – October 14, and Extended Season shall occur from October 15- April 30. The following requirements shall apply unless otherwise authorized or directed by the Engineer:

- Bituminous concrete mixes shall not be placed when the air or subbase temperature is below 40°F regardless of the season.
- Should paving operations be scheduled during the Extended Season, the Contractor's Quality Control Plan for placement described in Section 9. "Contractor Quality Control Plan for Placement" shall include a separate section titled "Extended Season Paving" and address minimum delivered mix temperature, maximum paver speed, enhanced rolling patterns and the method to balance mixture delivery and placement operations. Work covered by the section on Extended Season paving shall not commence until the Engineer's comments have been incorporated into the section and approved.
- Should placement of the final lift of bituminous concrete be scheduled during the Extended Season, the Contractor is required to submit this plan to the Engineer for review 30 days prior to the paving operation.

**5. Superpave Test Section:** The Engineer may require the Contractor to place a test section whenever the requirements of this specification or Section M.04 are not met.

The Contractor shall submit the quantity of mixture to be placed and the location of the test section for review and acceptance by the Engineer. The equipment used in the construction of a passing test section shall be used throughout production.

If a test section fails to meet specifications, the Contractor shall stop production, make necessary adjustments to the job mix formula, plant operations, or procedures for placement and compaction. The Contractor shall construct test sections, as allowed by the Engineer, until all the required specifications are met. All test sections shall also be subject to removal as set forth in Article 1.06.04.

**6. Transitions for Roadway Surface:** Transitions shall be formed at any point on the roadway where the pavement surface deviates, vertically, from the uniform longitudinal profile as specified on the plans. Whether formed by milling or by bituminous concrete mixture, all transition lengths shall conform to the criteria below unless otherwise specified.

Permanent Transitions: A permanent transition is defined as any transition that remains as a permanent part of the work. All permanent transitions, leading and trailing ends shall meet the following length requirements:

- a) Posted speed limit is greater than 35 MPH: 30 feet per inch of vertical change (thickness)
- b) Posted speed limit is 35 MPH or less: 15 feet per inch of vertical change (thickness).
- c) Bridge Overpass and underpass transition length will be 75 feet either
  - (1) Before and after the bridge expansion joint, or
  - (2) Before or after the parapet face of the overpass.

In areas where it is impractical to use the above described permanent transition lengths the use of a shorter permanent transition length may be permitted when approved by the Engineer.

**Temporary Transitions:** A temporary transition is defined as a transition that does not remain a permanent part of the work. All temporary transitions shall meet the following length requirements:

- a) Posted speed limit is greater than 35 MPH
  - (1) Leading Transitions = 15 feet per inch of vertical change (thickness)
  - (2) Trailing Transitions = 6 feet per inch of vertical change (thickness)
- b) Posted speed limit is 35 MPH or less
  - (1) Leading and Trailing = 4 feet per inch of vertical change (thickness)

**Note:** Any temporary transition to be in-place over the winter shutdown period, holidays, or during extended periods of inactivity (more than 7 calendar days) shall conform to the "Permanent Transition" requirements shown above.

**7. Spreading and Finishing of Mixture:** Prior to the placement of the bituminous concrete, the underlying base course shall be brought to the plan grade and cross section within the allowable tolerance. Immediately before placing the mixture, the area to be surfaced shall be cleaned by sweeping or by other means acceptable to the Engineer. The bituminous concrete mixture shall not be placed whenever the surface is wet or frozen. The Engineer will verify the mix temperature by means of a probe or infrared type of thermometer. A probe type thermometer, verified by the Department on an annual basis, must be used in order to reject a load of mixture based on temperatures outside the range stated in the placement QC plan.

**Placement:** The bituminous concrete mixture shall be placed and compacted to provide a smooth, dense surface with a uniform texture and no segregation at the specified thickness and dimensions indicated in the plans and specifications.

When unforeseen weather conditions prevent further placement of the mix, the Engineer is not obligated to accept or place the bituminous concrete mixture that is in transit from the plant.

In advance of paving, traffic control requirements shall be set up daily, maintained throughout placement, and shall not be removed until all associated work including density testing is completed.

The Contractor shall inspect the newly placed pavement for defects in the mixture or placement before rolling is started. Any deviation from standard crown or section shall be immediately remedied by placing additional mixture or removing surplus mixture. Such defects shall be corrected to the satisfaction of the Engineer.

Where it is impractical due to physical limitations to operate the paving equipment, the Engineer may permit the use of other methods or equipment. Where hand spreading is permitted, the mixture shall be placed by means of suitable shovels and other tools, and in a uniformly loose layer at a thickness that will result in a completed pavement meeting the designed grade and elevation.

Placement Tolerances: Each lift of bituminous concrete placed at a uniform specified thickness shall meet the following requirements for thickness and area. Any pavement exceeding these limits shall be subject to an adjustment or removal. Lift tolerances will not relieve the Contractor from meeting the final designed grade. Lifts of specified non-uniform thickness, i.e. wedge or shim course, shall not be subject to thickness and area adjustments.

- a) Thickness- Where the total thickness of the lift of mixture exceeds that shown on the plans beyond the tolerances shown in Table 4.06-3, the longitudinal limits of such variation including locations and intervals of the measurements will be documented by the Engineer for use in calculating an adjustment in accordance with Article 4.06.04.

**TABLE 4.06-3 Thickness Tolerances**

<b>Mixture Designation</b>	<b>Lift Tolerance</b>
Class 4 and S1	+/- 3/8 inch
Class 1, 2 and 12 and S0.25, S0.375, S0.5	+/- 1/4 inch

Where the thickness of the lift of mixture is less than that shown on the plans beyond the tolerances shown in Table 4.06-3, the Contractor, with the approval of the Engineer, shall take corrective action in accordance with this specification.

- b) Area- Where the width of the lift exceeds that shown on the plans by more than the specified thickness of each lift, the longitudinal limits of such variation including locations and intervals of the measurements will be documented by the Engineer for use in calculating the adjustment in Article 4.06.04.
- c) Delivered Weight of Mixture - When the delivery ticket shows that the truck exceeds the allowable gross weight for the vehicle type the quantity of tons representing the overweight amount will be documented by the Engineer for use in calculating an adjustment in accordance with Article 4.06.04.

Transverse Joints: All transverse joints shall be formed by saw-cutting a sufficient distance back from the previous run, existing bituminous concrete pavement or bituminous concrete driveways to expose the full thickness of the lift. A brush of tack coat shall be used on any cold joint immediately prior to additional bituminous concrete mixture being placed.

Tack Coat Application: A thin uniform coating of tack coat shall be applied to the pavement immediately before overlaying and be allowed sufficient time to break (set). All surfaces in contact with the bituminous concrete that have been in place longer than 3 calendar days shall have an application of tack coat. The tack coat shall be applied by a non-gravity pressurized spray system that results in uniform overlapping coverage at an application rate of 0.03 to 0.05 gallons per square yard for a non-milled surface and an application rate of 0.05 to 0.07 gallons per square yard for a milled surface. For areas where both milled and un-milled surfaces occur, the tack coat shall be an application rate of 0.03 to 0.05 gallons per square yard. The Engineer must approve the equipment and the method of measurement prior to use. The material for tack coat shall not be heated in excess of 160°F and shall not be further diluted.

Compaction: The Contractor shall compact the mixture to meet the density requirements as stated in Article 4.06.03 and eliminate all roller marks without displacement, shoving, cracking, or aggregate breakage.

The Contractor shall only operate rollers in the dynamic mode using the oscillatory system at the lowest frequency setting on concrete structures such as bridges and catch basins. The use of the vibratory system on concrete structures is prohibited. Rollers operating in the dynamic mode shall be shut off when reversing directions.

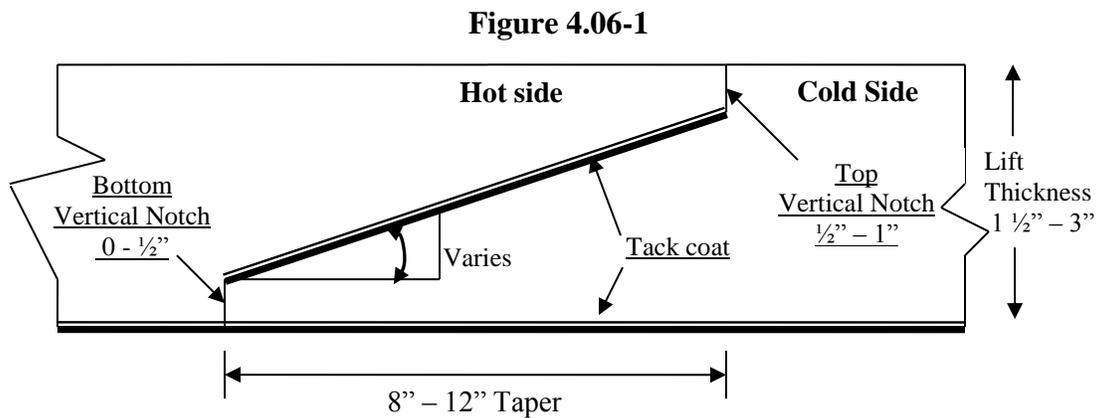
If the Engineer determines that the use of compaction equipment in the dynamic vibratory mode may damage highway components, utilities, or adjacent property, the Contractor shall provide alternate compaction equipment. The Engineer may allow the Contractor to operate rollers in the dynamic mode using the oscillatory system at the lowest frequency setting.

These allowances will not relieve the Contractor from meeting pavement compaction requirements.

Surface Requirements: The pavement surface of any lift shall meet the following requirements for smoothness and uniformity. Any irregularity of the surface exceeding these requirements shall be corrected by the Contractor.

- a) Smoothness- Each lift of the surface course shall not vary more than  $\frac{1}{4}$  inch from a Contractor-supplied 10 foot straightedge. For all other lifts of bituminous concrete, the tolerance shall be  $\frac{3}{8}$  inch. Such tolerance will apply to all paved areas.
- b) Uniformity- The paved surface shall not exhibit segregation, rutting, cracking, disintegration, flushing or vary in composition as determined by the Engineer.

**8. Longitudinal Joint Construction Methods:** Unless noted on the plans or the contract documents or directed by the Engineer, the Contractor shall use Method I- Notched Wedge Joint (see figure 4.06-1) when constructing longitudinal joints where lift thicknesses are between  $1\frac{1}{2}$  and 3 inches, except for S1 and Class 4 mixes. Method II Butt Joint (see figure 4.06-2) shall be used for lifts less than  $1\frac{1}{2}$  inches or greater than 3 inches, and S1 and Class 4 mixes. During placement of multiple lifts of bituminous concrete, the longitudinal joint shall be constructed in such a manner that it is located at least 6 inches from the joint in the lift immediately below. The joint in the final lift shall be at the centerline or at lane lines. Each longitudinal joint shall maintain a consistent offset from the centerline of the roadway along its entire length.

**Method I - Notched Wedge Joint:**

A notched wedge joint shall be constructed, as shown in the figure using a device that is capable of adjusting the top and bottom vertical notches independently and is attached to the paver screed.

The taper portion of the joint must be placed over the longitudinal joint in the lift immediately below. The top vertical notch must be located at the centerline or lane line in the final lift. The requirement for paving full width "curb to curb" as described in Method II may be waived if addressed in the QC plan and approved by the Engineer.

The taper portion of the wedge joint shall be compacted and not be exposed to traffic for more than 5 calendar days.

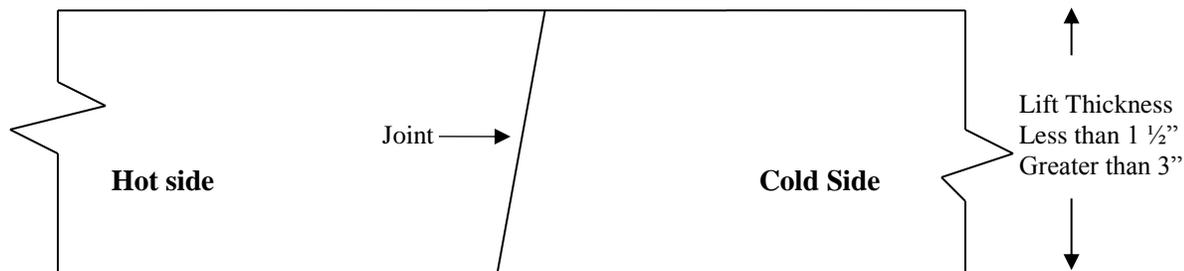
The pavement surface under the wedge joint must have an application of tack coat material. Prior to placing the completing pass (hot side), an application of tack coat must be applied to the exposed surface of the tapered section; regardless of time elapsed between paver passes. The in-place time allowance described in Sub article 4.06.03-7 does not apply to joint construction.

Any exposed wedge joint must be located to allow for the free draining of water from the road surface.

The Engineer reserves the right to define the paving limits when using a wedge joint that will be exposed to traffic.

**Method II - Butt Joint:**

**Figure 4.06-2**

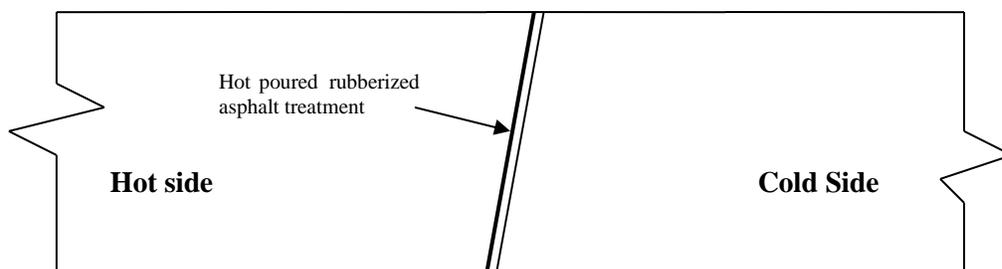


When adjoining passes are placed, the Contractor shall utilize equipment that creates a near vertical edge (refer to figure). The completing pass (hot side) shall have sufficient mixture so that the compacted thickness is not less than the previous pass (cold side). The end gate on the paver should be set so there is an overlap onto the cold side of the joint.

The Contractor shall not allow any butt joint to be incomplete at the end of a work shift unless otherwise allowed by the Engineer. When using this method, the Contractor is not allowed to leave a vertical edge exposed at the end of a work shift and must complete paving of the roadway full width "curb to curb."

**Method III- Butt Joint with Hot Poured Rubberized Asphalt Treatment:** When required by the contract or allowed by the Engineer, Method III (see figure 4.06-3) may be used.

**Figure 4.06-3**



English

All of the requirements of Method II must be met with Method III. In addition, the longitudinal vertical edge must be treated with a joint seal material meeting the requirements of Section M.04 prior to placing a completing pass. The joint seal material shall be applied in accordance with the manufacturer's recommendation so as to provide a uniform coverage and avoid excess bleeding onto the newly placed pavement.

### **9. Contractor Quality Control (QC) Requirements for Placement:**

The Contractor shall be responsible for maintaining adequate quality control procedures throughout the placement operations. Therefore, the Contractor must ensure that the materials, mixture and work provided by Subcontractors, Suppliers and Producers also meet contract specification requirements.

Quality Control Plan: Prior to placement the Contractor shall submit a QCP to the Engineer for approval. The QCP shall be submitted at the pre-construction meeting or a minimum 30 days prior to any production or paving. The QCP shall be in the format provided by the Engineer ([http://www.ct.gov/dot/lib/dot/documents/dconstruction/pat/qcp\\_outline\\_hma\\_placement.pdf](http://www.ct.gov/dot/lib/dot/documents/dconstruction/pat/qcp_outline_hma_placement.pdf)). Work covered by the QCP shall not commence until the Engineer's comments have been incorporated into the QCP and approved. The QCP shall detail every aspect of the placement process and if required, include a separate section on Extended Season paving as described in Section 4. "Seasonal Requirements". Information provided shall include the organization and procedures which the Contractor shall use to control all project site activity. The QCP must address the actions, inspection, or sampling and testing necessary to keep the production and placement operations in control, to determine when an operation has gone out of control and to respond to correct the situation in a timely fashion. The QCP shall also include details on when and who will communicate with personnel at the bituminous concrete plant to determine when immediate changes to the production or placement processes are needed, and to implement the required changes.

In addition the QCP shall also include the name and qualifications of a Quality Control Manager (QCM). The QCM shall be responsible for the administration of the QCP, and any modifications that may become necessary. The QCM shall have the ability to direct all Contractor personnel on the project during paving operations. All Contractor sampling, inspection and test reports shall be reviewed and signed by the QCM prior to submittal to the Engineer.

Approval of the QCP will be based on the inclusion of all of the required information. Approval of the QCP does not relieve the Contractor of its responsibility to comply with the project specifications. The Contractor may modify the QCP as work progresses and must document the changes in writing prior to commencing the next paving operation. These changes include but are not limited to changes in quality control procedures or personnel. Placement may be suspended by the Engineer until the revisions to the QCP have been put into effect.

The Quality Control Plan shall also include the name and qualifications of any outside testing laboratory performing any QC functions on behalf of the Contractor.

**Quality Control Inspection, Sampling and Testing:** The Contractor shall perform all quality control sampling and testing, provide inspection, and exercise management control to ensure that bituminous concrete production and placement conforms to the requirements as outlined in its QCP during all phases of the work.

- a) **Control Charts:** The Contractor shall develop and maintain density control charts and shall submit them to the Engineer. The control charts shall include the project number, test numbers, test parameter, applicable upper and lower specification limits, and test data. The control charts shall be used as part of the quality control system to document the placement process. The control chart(s) shall be updated each day of production, and a copy shall be submitted prior to the next day's production.
- b) **Records of Inspection and Testing:** For each day of placement, the Contractor shall document all test results and inspections on forms approved by the Engineer. The document shall be certified by the Quality Control Manager or his representative that the information in the document is accurate, and that all work complies with the requirements of the contract.

The Contractor shall submit complete and accurate density sampling, testing and inspection documents to the Engineer within 48 hours. The documents shall be submitted in a manner acceptable to the Engineer.

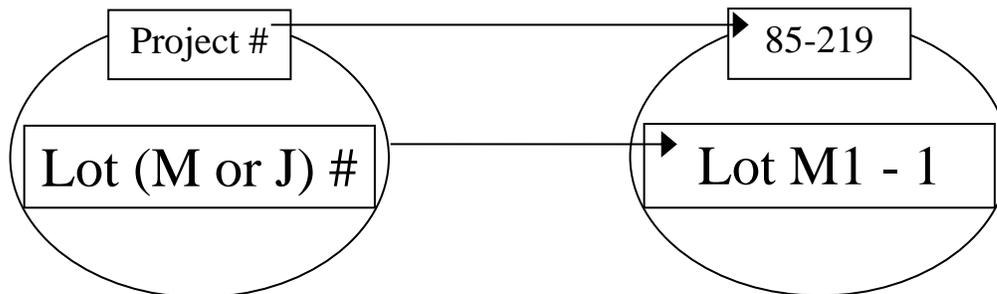
The Contractor may obtain one (1) mat core and one (1) joint core per day for process control, provided this process is detailed in the QCP. The results of these process control cores shall not be used to dispute the Department determinations from the acceptance cores. The Contractor shall submit the location of each process control core to the Engineer for approval prior to taking the core. Additional cores may be obtained to correlate a density gauge used by the contractor for quality control as approved by the Engineer. The core holes shall be filled to the same requirements described in Sub article 4.06.03-10.

**10. Density Testing of Bituminous Concrete Utilizing Core Samples:** This procedure describes the frequency and the method the Contractor shall use to obtain pavement cores for acceptance from the project. Coring shall be performed on each lift specified to a thickness of one and one-half (1 ½) inches or more. Each lift including the longitudinal joints shall be compacted to the degree specified in Tables 4.06-9 and 4.06-10. The density of each core shall be determined using the production lot's average maximum theoretical gravity established from the plant production testing. Bituminous concrete Class 4 and HMA S1 are excluded from the longitudinal joint density requirements.

The Contractor shall extract cores (4 or 6 inch diameter for S0.25, S0.375 and S0.5 mixes, 6 inch diameter for S1.0 mixtures -wet sawed) from sampling locations determined by the Engineer. The Engineer must witness the extraction and labeling of cores, as well as the filling of the core holes. The cores shall be labeled by the Contractor with the project number, lot number, and sub-lot number on the top surface of the core. When labeling the core lot number, include whether the core is from a mat lot or joint lot by using an "M" for a mat core and "J" for a joint core. For example, a core from the first sub-lot of the first mat lot shall be labeled with "Lot M1 – 1". The first number refers to the lot and the second number refers to the sub-lot. Refer to

Figure 4.06-4. The side of the cores shall be labeled with the core lot number and date placed. The project inspector shall fill out a MAT-109 containing the same information to accompany the cores. The Contractor shall deliver the cores and MAT-109 to the Department’s Central Testing Lab in a safe manner to ensure no damage occurs to the cores. The Contractor shall use a container approved by the Engineer. In general the container shall consist of an attached lid container made out of plastic capable of being locked shut and tamper proof. The Contractor shall use foam, bubble wrap, or another suitable material to prevent the cores from being damaged during transportation. Once the cores and MAT-109 are in the container the Engineer will secure the lid using a security seal. The security seal’s identification number must be documented on the MAT-109. The Central Lab will break the security seal and take possession of the cores upon receipt.

**Figure 4.06-4**



Frequency of sampling is in accordance with the following tables:

**TABLE 4.06-4 - TESTING REQUIREMENT FOR BRIDGE DENSITY LOT**

Length of Each Structure (Feet)	MAT – No. of Cores	JOINT - No. of cores
≤ 500'	See Table 4.06-5(A or B)	See Table 4.06-5(A or B)
501' – 1500'	3	3
1501' – 2500'	4	4
2501' and greater	5	5

All material placed on structures less than or equal to 500 feet in length shall be included as part of a standard lot as follows:

**TABLE 4.06-5A – TESTING REQUIREMENT FOR DENSITY LOTS  
≥ 500 TONS**

Lot Type	No. of Mat Cores		No. of Joint Cores		Target Lot Size (Tons)
Lot Without Bridge <sup>(1)</sup>	4		4		2000
Lot With Bridge(s) <sup>(1)(2)</sup>	4 plus	1 per structure (≤ 300')	4 plus	1 per structure (≤ 300')	2000
		2 per structure (301' – 500')		2 per structure (301' – 500')	

**TABLE 4.06-5B – TESTING REQUIREMENT FOR DENSITY LOTS**

**< 500 TONS**

<b>Lot Type</b>	<b>No. of Mat Cores</b>	<b>No. of Joint Cores</b>	<b>Lot Size (Tons)</b>
Lot Without Bridge <sup>(1)</sup>	3	3	1 per lift
Lot With Bridge(s) <sup>(1)(2)</sup>	3	3	1 per lift

Note (1): The number of “Required Paver Passes for Full Width” shall be used to determine the sub-lot sizes within the lot. The number of paver passes for full width is determined by the contractor.

Note (2): If a non-bridge mat or joint core location randomly falls on a structure, the core is to be obtained on the structure in addition to the core(s) required on the structure.

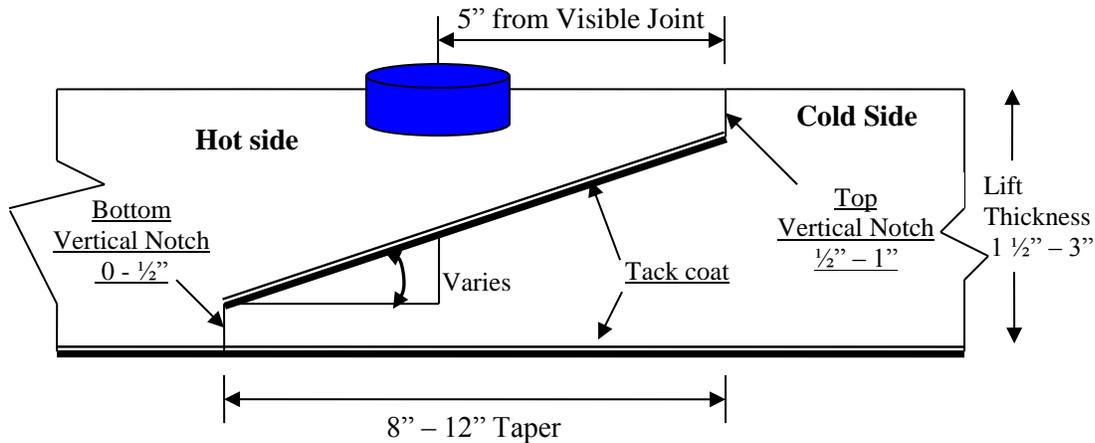
A density lot will be complete when the full designed paving width of the established lot length has been completed and shall include all longitudinal joints that exist between the curb lines regardless of date(s) paved. Quantity of material placed on structures less than or equal to 500 feet long is inclusive of the standard lot. Prior to paving, the total length of the project to be paved shall be split up into lots that contain approximately 2000 tons each. Areas such as highway ramps may be combined to create one lot. In general, combined areas should be set up to target a 2000 ton lot size. One adjustment will apply for each lot. The tons shall be determined using the yield calculation in Article 4.06.04. The last lot shall be the difference between the total payable tons for the project and the sum of the previous lots.

After the compaction process has been completed, the material shall be allowed to cool sufficiently to allow the cutting and removal of the core without damage. The Contractor shall core to a depth that allows extraction so that the uppermost layer being tested for density will not be affected.

A mat core shall not be taken any closer than one foot from the edge of a paver pass. If a random number locates a core less than one foot from any edge, locate the core so that the sample is one foot from the edge.

Joint cores must be taken so that the center of the core is 5 inches from the visible joint on the hot mat side. Refer to figure 4.06-5.

**Figure 4.06-5**



Cores may be obtained daily or weekly. All cores must be cut within 5 calendar days of placement. Any core that is damaged or obviously defective while being obtained will be replaced with a new core from a location within 2 feet measured in a longitudinal direction.

Core holes shall be filled immediately upon core extraction. Prior to being filled, the hole shall be prepared by removing any free water and applying tack coat using a brush or other means to uniformly cover the cut surface. The core hole shall be filled with a mixture containing the same nominal maximum aggregate size and compacted with a hand compactor or other mechanical means to the maximum compaction possible. The bituminous concrete mixture shall be compacted to  $\frac{1}{8}$  inch above the finished pavement prior to opening the roadway to traffic.

**11. Acceptance Inspection, Sampling and Testing:** Inspection, sampling, and testing to be used by the Engineer shall be performed at the minimum frequency specified in Section M.04 and stated herein.

Sampling for acceptance shall be established using ASTM D 3665, or a statistically based procedure of random sampling approved by the Engineer.

Plant Material Acceptance: The Contractor shall provide the required acceptance sampling, testing and inspection during all phases of the work in accordance with Section M.04. The Department will perform verification testing on the Contractor's acceptance test results. Should binder content or air void results exceed the specified tolerances in the Department's current QA Program for Materials, Acceptance and Assurance Testing Policies and Procedures, the Department will investigate to determine an assignable cause. Contractor's test results for a subject lot or sub lot may be replaced with verification's result for the purpose of assessing adjustments. The verification procedure is included in the Department's current QA Program for Materials.

Density Acceptance: The Engineer will perform all acceptance testing on the cores in accordance with AASHTO T 331(M).

English

**12. Density Dispute Resolution Process:** The Contractor and Engineer will work in partnership to avoid potential conflicts and to resolve any differences that may arise during quality control or acceptance testing for density. Both parties will review their sampling and testing procedures and results and share their findings. If the Contractor disputes the Engineer's test results, the Contractor must submit in writing a request to initiate the Dispute Resolution Process within 10 calendar days of the notification of the test results. No request for dispute resolution will be allowed unless the Contractor provides quality control results within the timeframe described in Sub article 4.06.03-9 supporting its position. Should the dispute not be resolved through evaluation of existing testing data or procedures, the Engineer may authorize the Contractor to obtain a new set of core samples per disputed lot. The core samples must be extracted no later than 30 calendar days from the date of Engineer's authorization. The number and type (mat, joint, or structure) of the cores taken for dispute resolution must reflect the number and type of the cores taken for acceptance. The location of each core shall be 36" from the original acceptance core location forward along a line parallel to the baseline that results in the same type (mat, joint, or structure) of core. All such core samples shall be extracted and filled using the procedure outlined in Article 4.06.03. The results from the dispute resolution cores shall be added to the results from the acceptance cores and averaged for determining the final in-place density value.

**13. Corrective Work Procedures:** Any portion of the completed pavement that does not meet the requirements of the specification shall be corrected at the expense of the Contractor. Any corrective courses placed as the final wearing surface shall not be less than 1½ inches in thickness after compaction.

If pavement placed by the Contractor does not meet the specifications, and the Engineer requires its replacement or correction, the Contractor shall:

- a) Propose a corrective procedure to the Engineer for review and approval prior to any corrective work commencing. The proposal shall include:
  - Limits of pavement to be replaced or corrected, indicating stationing or other landmarks that are readily distinguishable.
  - Proposed work schedule.
  - Construction method and sequence of operations.
  - Methods of maintenance and protection of traffic.
  - Material sources.
  - Names and telephone numbers of supervising personnel.
- b) Perform all corrective work in accordance with the Contract and the approved corrective procedure.

**14. Protection of the Work:** The Contractor shall protect all sections of the newly finished pavement from damage that may occur as a result of the Contractor's operations for the duration of the Project. Prior to the Engineer's authorization to open the pavement to traffic, the Contractor is responsible to protect the pavement from damage.

English

**15. Cut Bituminous Concrete Pavement:** Work under this item shall consist of making a straight-line cut in the bituminous concrete pavement to the lines delineated on the plans or as directed by the Engineer. The cut shall provide a straight, clean, vertical face with no cracking, tearing or breakage along the cut edge.

**4.06.04—Method of Measurement:**

**1. Bituminous Concrete Class ( ) or HMA S\* or PMA S\*:** The quantity of bituminous concrete measured for payment will be determined by the documented net weight in tons accepted by the Engineer in accordance with this specification and Section M.04.

**2. Adjustments:** Adjustments may be applied to bituminous concrete quantities and will be measured for payment using the following formulas:

**Yield Factor** for Adjustment Calculation = 0.0575 Tons/SY/inch

**Actual Area** = [(Measured Length (ft)) x (Avg. of width measurements (ft))]

**Actual Thickness (t)** = Total tons delivered / [Actual Area (SY) x 0.0575 Tons/SY/inch]

- a) Area: If the average width exceeds the allowable tolerance, an adjustment will be made using the following formula. The tolerance for width is equal to the specified thickness (in.) of the lift being placed.

**Tons Adjusted for Area (T<sub>A</sub>)** = [(L x W<sub>adj</sub>)/9] x (t) x 0.0575 Tons/SY/inch = (-) Tons

Where: L = Length (ft)

(t) = Actual thickness (inches)

W<sub>adj</sub> = (Designed width (ft) + tolerance /12) - Measured Width

- b) Thickness: If the actual thickness is less than the allowable tolerance, the Contractor shall submit a repair procedure to the Engineer for approval. If the actual thickness exceeds the allowable tolerance, an adjustment will be made using the following formula:

**Tons Adjusted for Thickness (T<sub>T</sub>)** = A x t<sub>adj</sub> x 0.0575 = (-) Tons

Where: A = Area = {[L x (Designed width + tolerance (lift thickness)/12)] / 9}

t<sub>adj</sub> = Adjusted thickness = [(Dt + tolerance) - Actual thickness]

Dt = Designed thickness (inches)

- c) Weight: If the quantity of bituminous concrete representing the mixture delivered to the project is in excess of the allowable gross vehicle weight (GVW) for each vehicle, an adjustment will be made using the following formula:

**Tons Adjusted for Weight (T<sub>w</sub>)** = GVW – DGW = (-) Tons

Where: DGW = Delivered gross weight as shown on the delivery ticket or measured on a certified scale.

- d) **Mixture Adjustment:** If the quantity of bituminous concrete representing the produced mixture exceeds one or more of the production tolerances for Marshall (Table 4.06-6) or Superpave mix designs (Table 4.06-7 and 4.06-8), an adjustment will be made using the following formulas. The Department's Division of Material Testing will calculate the daily adjustment values for  $T_{MD}$  and  $T_{SD}$ .

- (1) *Marshall Design*- The tolerances shown in Table 4.06-6 for gradation and binder content will be used to determine whether a mixture adjustment will apply. If the mixture does not meet the requirements of Section M.04, an adjustment will be computed using the following formula:

**Tons Adjusted for Marshall Design ( $T_{MD}$ ) =  $M \times 0.10$**

Where: M= Tons of bituminous concrete mixture exceeding the tolerances in Table 4.06-5.

**TABLE 4.06-6  
TOLERANCES FOR CONSECUTIVE TESTS (MARSHALL)**

Classes	Criteria	% Tolerances (+/-)
-	Binder	0.4
1, 2, 4, 5, 5A & 5B	#200	2.0
1, 2, 4	#50	4
1, 2, 5, 5A & 5B	#30	5
1, 2, 4, 5, 5A & 5B	#8	6
1, 2, 4, 5, 5A & 5B	#4	7
1, 2, 4, 5, 5A & 5B	$\frac{3}{8}$ & $\frac{1}{2}$ inch	8

- (2) *Superpave Design*- The adjustment values in Table 4.06-7 and 4.06-8 shall be calculated for each sub lot based on the Air Void and Liquid Binder Content test results for that sub lot. The total adjustment for each day's production (lot) will be computed using tables and the following formulas:

**Tons Adjusted for Superpave Design ( $T_{SD}$ ) =  $[(AdjAV_t + AdjPB_t) / 100] \times \text{Tons}$**

**Percent Adjustment for Air Voids =  $AdjAV_t = [AdjAV_1 + AdjAV_2 + AdjAV_i + \dots + AdjAV_n] / n$**

Where:  $AdjAV_t$  = Total percent air void adjustment value for the lot  
 $AdjAV_i$  = Adjustment value from Table 4.06-7 resulting from each sub lot or the average of the adjustment values resulting from multiple tests within a sub lot, as approved by the Engineer.

$n$  = number of sub lots based on Table M.04.03-1

**TABLE 4.06-7  
ADJUSTMENT VALUES FOR AIR VOIDS (SUPERPAVE)**

Adjustment Value ( $AdjAV_i$ ) (%)	S0.25, S0.375, S0.5, S1 Air Voids (AV)
+2.5	3.8 - 4.2
+3.125*(AV-3)	3.0 - 3.7
-3.125*(AV-5)	4.3 - 5.0
20*(AV-3)	2.3 - 2.9
-20*(AV-5)	5.1 - 5.7
-20.0	$\leq 2.2$ or $\geq 5.8$

Percent Adjustment for Liquid Binder =  $AdjPB_t = [(AdjPB_1 + AdjPB_2 + AdjPB_i + \dots + AdjPB_n)] / n$

Where:  $AdjPB_t$  = Total percent liquid binder adjustment value for the lot  
 $AdjPB_i$  = Adjustment value from Table 4.06-7 resulting from each sub lot  
 $n$  = number of binder tests in a production lot

**TABLE 4.06-8**

Adjustment Value ( $AdjAV_i$ ) (%)	<u>S0.25, S0.375, S0.5, S1</u> Pb (refer to Table M.04.03-5)
0.0	Equal to or above the min. liquid content
- 10.0	Below the min. liquid content

- e) Density Adjustment: The quantity of bituminous concrete measured for payment for a specified lift of pavement 1½ inches or greater may be adjusted for density. Separate density adjustments will be made for each lot and will not be combined to establish one density adjustment. If either the Mat or Joint adjustment value is “remove and replace”, the density lot shall be removed and replaced (curb to curb).

**Tons Adjusted for Density ( $T_D$ )** =  $[(PA_M \times .50) + (PA_J \times .50)] / 100$  X Density Lot Tons

Where:  $T_D$  = Total tons adjusted for density for each lot  
 $PA_M$  = Mat density percent adjustment from Table 4.06-9

PA<sub>J</sub> = Joint density percent adjustment from Table 4.06-10

**TABLE 4.06-9  
ADJUSTMENT VALUES FOR PAVEMENT MAT DENSITY**

<b>Average Core Result Percent Mat Density</b>	<b>Percent Adjustment (Bridge and Non-Bridge) (1,2)</b>
97.1 - 100	-1.667*(ACRPD-98.5)
94.5 – 97.0	+2.5
93.5 – 94.4	+2.5*(ACRPD-93.5)
92.0 – 93.4	0
90.0 – 91.9	-5*(92-ACRPD)
88.0 – 89.9	-10*(91-ACRPD)
87.0 – 87.9	-30
86.9 or less	Remove and Replace (curb to curb)

**TABLE 4.06-10  
ADJUSTMENT VALUES FOR PAVEMENT JOINT DENSITY**

<b>Average Core Result Percent Joint Density</b>	<b>Percent Adjustment (Bridge and Non-Bridge) (1,2)</b>
97.1 – 100	-1.667*(ACRPD-98.5)
93.5 – 97.0	+2.5
92.0 – 93.4	+1.667*(ACRPD-92)
91.0 – 91.9	0
89.0 – 90.9	-7.5*(91-ACRPD)
88.0 – 88.9	-15*(90-ACRPD)
87.0 – 87.9	-30
86.9 or less	Remove and Replace (curb to curb)

(1) ACRPD = Average Core Result Percent Density

(2) All Percent Adjustments to be rounded to the second decimal place. For example, 1.667 is to be rounded to 1.67.

**3. Transitions for Roadway Surface:** The installation of permanent transitions shall be measured under the appropriate item used in the formation of the transition.

The quantity of material used for the installation of temporary transitions shall be measured for payment under the appropriate item used in the formation of the transition. The installation and removal of a bond breaker, and the removal and disposal of any temporary transition formed by milling or with bituminous concrete pavement is not measured for payment.

**4. Cut Bituminous Concrete Pavement:** The quantity of bituminous concrete pavement cut will be measured in accordance with Article 2.02.04.

**5. Material for Tack Coat:** The quantity of tack coat will be measured for payment by the number of gallons furnished and applied on the Project and approved by the Engineer. No tack coat material shall be included that is placed in excess of the tolerance described in Article 4.06.03.

Method of Measurement:

- a. Container Method- Material furnished in a container will be measured to the nearest ½ gallon. The volume will be determined by either measuring the volume in the original container by a method approved by the Engineer or using a separate graduated container capable of measuring the volume to the nearest ½ gallon. The container in which the material is furnished must include the description of material, including lot number or batch number and manufacturer or product source.
- b. Truck Method- The Engineer will establish a weight per gallon of the bituminous material based on the specific gravity at 60°F for the material furnished. The number of gallons furnished will be determined by weighing the material on scales furnished by and at the expense of the Contractor.

**6. Material Transfer Vehicle (MTV) - The furnishing and use of a MTV will be measured separately for payment based on the actual number of surface course tons delivered to a paver using the MTV.**

**4.06.05—Basis of Payment:**

**1. Bituminous Concrete Class ( ), HMA S\* or PMA S\*:** The furnishing and placing of bituminous concrete will be paid for at the Contract unit price per ton for "Bituminous Concrete, Class ( )" or "HMA S\*" or "PMA S\*".

- All costs associated with providing illumination of the work area are included in the general cost of the work.
- All costs associated with constructing longitudinal joints are included in the general cost of the work.
- All costs associated with obtaining cores for core correlation and dispute resolution are included in the general cost of the work.

**2. Bituminous Concrete Adjustment Costs:** The adjustment will be calculated using the formulas shown below if all of the measured adjustments in Article 4.06.04 do not equal zero. A payment will be made for a positive adjustment. A deduction from monies due the Contractor will be made for a negative adjustment.

$$\text{Production Lot: } [T_T + T_A + T_W + (T_{MD} \text{ or } T_{SD})] \times \text{Unit Price} = \text{Est. (P)}$$

**Density Lot:  $T_D \times \text{Unit Price} = \text{Est. (D)}$**

Where: Unit Price = Contract unit price per ton per type of mixture

$T_*$  = Total tons of each adjustment calculated in Article 4.06.04

Est. ( ) = Pay Unit represented in dollars representing incentive or disincentive.

The estimated cost figure if included in the bid proposal or estimate is not to be altered in any manner by the bidder. If the bidder should alter the amount shown, the altered figure will be disregarded and the original cost figure will be used to determine the amount of the bid for the Contract.

**3. Transitions for Roadway Surface:** The installation of permanent transitions shall be paid under the appropriate item used in the formation of the transition. The quantity of material used for the installation of temporary transitions shall be paid under the appropriate pay item used in the formation of the transition. The installation and removal of a bond breaker, and the removal and disposal of any temporary transition formed by milling or with bituminous concrete pavement is included in the general cost of the work.

4. The cutting of bituminous concrete pavement will be paid in accordance with Article 2.02.05.

5. Material for tack coat will be paid for at the Contract unit price per gallon for "Material for Tack Coat".

6. The Material Transfer Vehicle (MTV) will be paid at the Contract unit price per ton for a "Material Transfer Vehicle".

<u>Pay Item*</u>	<u>Pay Unit*</u>
Bituminous Concrete, Class ( )	ton
HMA S*	ton
PMA S*	ton
Bituminous Concrete Adjustment Cost	est.
Material for Tack Coat	gal.
Material Transfer Vehicle	ton

\*For contracts administered by the State of Connecticut, Department of Administrative Services, the pay items and pay units are as shown in contract award price schedule.

## **SECTION 9.21 CONCRETE SIDEWALKS AND RAMPS**

Section 9.21 is being deleted in its entirety and replaced with the following:

### **9.21.01 – Description**

### **9.21.02 – Materials**

### **9.21.03 – Construction Methods**

### **9.21.04 – Method of Measurement**

### **9.21.05 – Basis of Payment**

**9.21.01—Description:** This item shall consist of concrete sidewalks and ramps constructed on a gravel or reclaimed miscellaneous aggregate base course in the locations and to the dimensions and details shown on the plans or as ordered and in accordance with these specifications.

**9.21.02—Materials:** Materials for this work shall conform to the requirements of Article M.03.01 for Class “F” Concrete.

Gravel or reclaimed miscellaneous aggregate for base shall conform to Article M.02.01 for granular fill.

Detectable warning strips shall be a prefabricated detectable warning tile chosen from the Department’s Qualified Products List for retrofit and/or cast in place applications.

### **9.21.03—Construction Methods:**

**1. Excavation:** Excavation, including removal of any existing sidewalk (bituminous or concrete) and curbing, shall be made to the required depths below the finished grade, as shown on the plans or as directed. All soft and yielding material shall be removed and replaced with suitable material.

When connecting new concrete sidewalk to a section of existing concrete sidewalk, the connection point shall be at the nearest joint in the existing sidewalk.

The Contractor shall establish the limits required to achieve grades for each ramp prior to removal of existing sidewalk and ramps. The Contractor shall document and notify the Engineer of any control points that may conflict with the design grades or configuration of ramps shown on the plans. Control points can be but are not limited to ROW, utility poles, drainage structures, buildings, fences, walls or other features found near the proposed ramp. When control points are encountered within the limits of the ramp, the Engineer will determine if an alternative ramp type is required or the ramp is to be constructed as shown on the plans.

**2. Gravel or Reclaimed Miscellaneous Aggregate Base:** The gravel or reclaimed miscellaneous aggregate base shall be placed in layers not over 6 inches in depth and to such a depth that after compaction it shall be at the specified depth below the finished grade of the walk. The base shall be wetted and rolled or tamped after the spreading of each layer.

**3. Forms:** Forms shall be of metal or wood, straight, free from warp and of sufficient strength to resist springing from the pressure of the concrete. If made of wood, they shall be of 2-inch surfaced plank except that at sharp curves thinner material may be used. If made of metal, they shall be of an approved section and have a flat surface on the top. Forms shall be of a depth equal to the depth of the sidewalk. Forms shall be securely staked, braced and held firmly to the required line and grade and shall be sufficiently tight to prevent leakage of mortar. All forms shall be cleaned and oiled or wetted before concrete is placed against them. Sheet metal templates 1/8 inch in thickness, of the full depth and width of the walk, shall be spaced at intervals of 12 feet or as directed. If the concrete is placed in alternate sections, these templates shall remain in place until concrete has been placed on both sides of the template. As soon as the concrete has obtained its initial set, the templates shall be removed.

**4. Concrete:** The concrete shall be proportioned, mixed, placed, etc., in accordance with the provisions of Section 6.01 for Class “F” Concrete. Concrete shall be cured in accordance with the provisions of Article 4.01.03 for Concrete Pavement.

**5. Finishing:** The surface of the concrete shall be finished with a wood float or by other approved means. The outside edges of the slab and all joints shall be edged with a 1/4-inch radius edging tool. Each slab shall be divided into two or more sections by forming dummy joints with a jointing tool as directed.

**6. Backfilling and Removal of Surplus Material:** The sides of the sidewalk shall be backfilled with suitable material thoroughly compacted and finished flush with the top of the sidewalk. All surplus material shall be removed and the site left in a neat and presentable condition to the satisfaction of the Engineer.

**7. Detectable Warning Strip:** The detectable warning strip for new construction shall be set directly in poured concrete and each tile shall be weighted down to prevent the tile from floating after placement in wet concrete in accordance with curing procedures. Install detectable warning strip, according to the plans and the Manufacturer's specifications, or as directed by the Engineer.

The detectable warning strip for retrofit construction shall be installed according to the plans in the direction of pedestrian route and contained wholly within painted crosswalk when present. Its installation shall conform to all Manufactures requirements.

**9.21.04—Method of Measurement:** This work will be measured for payment as follows:

**1. Concrete Sidewalk or Sidewalk Ramp:** This work will be measured by the actual number of square feet of completed and accepted concrete sidewalk or ramp.

**2. Excavation:** Excavation below the finished grade of the sidewalk or ramp, backfilling, and disposal of surplus material will not be measured for payment, but the cost shall be included in the price bid for the sidewalk or ramp. Excavation above the finished grade of the sidewalk or ramp will be measured and paid for in accordance with Section 2.02

**3. Gravel or Reclaimed Miscellaneous Aggregate Base:** This work will not be measured for payment, but the cost shall be considered as included in the price bid for the sidewalk or ramp.

**4. Detectable Warning Strip:** For new construction (cast in place), the detectable warning strip will be measured for payment by the actual number of each ramp where a detectable warning strip has been installed and accepted regardless of the number of tiles installed.

**5. Retrofit Detectable Warning Strip:** For retrofit construction (surface applied), the detectable warning strip will be measured for payment by the actual number of each ramp where a detectable warning strip has been installed and accepted regardless of the number of tiles installed.

**6. Construction Staking:** The establishment of control points and limits of grading will be measured in accordance with the item Construction Staking.

**9.21.05—Basis of Payment:** Construction of a concrete sidewalk or ramp will be paid for at the contract unit price per square foot for "Concrete Sidewalk," or "Concrete Sidewalk Ramp" complete in place, which price shall include all excavation as specified above, backfill, disposal of surplus material, curb removal and any monolithic or separately cast sidewalk curb when required for the sidewalk ramp as shown on the plans, gravel or reclaimed miscellaneous aggregate base, equipment, tools, materials and labor incidental thereto.

A new detectable warning strip will be paid for at the contract unit price for each ramp where the detectable warning strip has been installed complete in place. This price shall include all tiles, materials, equipment, tools and labor incidental thereto.

Retrofitting the existing concrete sidewalk with a detectable warning strip will be paid for at the contract unit price for each ramp where the retrofit detectable warning strip has been installed complete in place. This price will include all tiles, saw cutting concrete, adhesive, drilling holes for fasteners, materials, equipment, tools and labor incidental there to.

The establishment of control points and limits of grading will be paid for in accordance with the item Construction Staking.

Pay Item	Pay Unit
Concrete Sidewalk	s.f.
Concrete Sidewalk Ramp	s.f.
Detectable Warning Strip	Each
Retrofit Detectable Warning Strip	Each

## **SECTION M.04 BITUMINOUS CONCRETE**

Section M.04 is being deleted in its entirety and replaced with the following:

### **M.04.01—Bituminous Concrete Materials and Facilities**

### **M.04.02—Mix Design and Job Mix Formula (JMF)**

### **M.04.03—Production Requirements**

**M.04.01—Bituminous Concrete Materials and Facilities:** Each source of material, and facility or plant used to produce and test bituminous concrete must be qualified on an annual basis by the Engineer. Test Procedures and Specifications referenced herein are in accordance with the latest AASHTO and ASTM Standard Test Procedures and Specifications. Such references when noted with an (M) have been modified by the Engineer and are detailed in Table M.04.03-6.

The Contractor shall submit to the Engineer all sources of coarse aggregate, fine aggregate, mineral filler, PG binder, and if applicable any additives such as but not limited to anti-strip, warm mix, and polymer modifiers. The Contractor shall submit a Material Safety Data Sheet (MSDS) for each grade of binder, and additive to be used on the Project. The Contractor shall not change any material sources without prior approval of the Engineer.

An adequate quantity of each size aggregate, mineral filler, bitumen, and additives, shall be maintained at the bituminous concrete plant site at all times while the plant is in operation to ensure that the plant can consistently produce bituminous concrete mixtures that meet the job mix formula (JMF) as specified in Article M.04.02. The quantity of such material shall be reviewed by the Engineer on an individual plant basis and is dependent upon the plant's daily production capacity. A total quantity of any material on site that amounts to less than one day's production capacity may be cause for the job mix formula to be rejected.

#### **1. Coarse Aggregate:**

- a. **Requirements:** The coarse aggregate shall consist of clean, hard, tough, durable fragments of crushed stone or crushed gravel of uniform quality. Aggregates from multiple sources of supply must not be mixed or stored in the same stockpile.
- b. **Basis of Approval:** The request for approval of the source of supply shall include a washed sieve analysis in accordance with AASHTO T 27. The G<sub>sa</sub>, G<sub>sb</sub>, and P<sub>w<sub>a</sub></sub> shall be determined in accordance with AASHTO T 85. The coarse aggregate must not contain more than 1% crusher dust, sand, soft disintegrated pieces, mud, dirt, organic and other injurious materials. When tested for abrasion using AASHTO T 96, the aggregate loss must not exceed 40%. When tested for soundness using AASHTO T 104 with a magnesium sulfate solution, the coarse aggregate must not have a loss exceeding 10% at the end of 5 cycles.

For all bituminous mixtures, materials shall also meet the coarse aggregate angularity criteria as specified in Tables M.04.02-2 thru M.04.02-4 for blended aggregates retained

on the #4 sieve when tested according to ASTM D 5821. The amount of aggregate particles of the coarse aggregate blend retained on the #4 sieve that are flat or elongated shall be determined in accordance with ASTM D 4791 and shall not exceed 10% by weight when tested to a 3:1 ratio, as shown in Tables M.04.02-2 thru M.04.02-4.

**2. Fine Aggregate:**

**Requirements:** The fine aggregate from each source quarry/pit deposit shall consist of clean, hard, tough, rough-surfaced and angular grains of natural sand; manufactured sand prepared from washed stone screenings; stone screenings, slag or gravel; or combinations thereof, after mechanical screening or manufactured by a process approved by the Engineer. The Contractor is prohibited from mixing two or more sources of fine aggregate on the ground for the purpose of feeding into a plant.

- a. All fine aggregate shall meet the listed criteria shown in items #1 thru #7 of Table M.04.01-1. Table M.04.01-1 indicates the quality tests and criteria required for all fine aggregate sources. Individually approved sources of supply shall not be mixed or stored in the same stockpile. The fine aggregates must be free from injurious amounts of clay, loam, and other deleterious materials.

For Superpave mixtures, in addition to the above requirements, the fine aggregate angularity shall be determined by testing the materials passing the #8 sieve in accordance with AASHTO T 304, Method A. Qualification shall be based on the criteria listed in Tables M.04.02-2 thru M.04.02-4. The fine aggregate shall also be tested for clay content as a percentage contained in materials finer than the #8 sieve in accordance with AASHTO T 176.

**Table M.04.01-1: Fine Aggregate Criteria by Pit/Quarry Source**

Item	Title	AASHTO Protocol(s)	Criteria
1	Grading	T 27 & T 11	100% Passing 3/8 inch 95% Passing the #4 min.
2	Absorption	T 84	3% maximum
3	Plasticity limits	T 90	0 or not detectable
4	L.A. Wear	T 96	50% maximum(fine agg. particle size # 8 and above)
5	Soundness by Magnesium Sulfate	T 104	20% maximum @ 5 cycles
6	Clay Lumps and Friable Particles	T 112	3% maximum
7	Deleterious Material	As determined by the Engineer	Organic or inorganic calcite, hematite, shale, clay or clay lumps, friable materials, coal-lignite, shells, loam, mica, clinkers, or organic matter (wood, etc). -Shall not contain more than 3% by mass of any individual listed constituent and not more than 5% by mass in total of all listed constituents.
8	Petrographic Analysis	ASTM C 295	Terms defined in Section M.04.01-2c.

- b. Basis of Approval: A Quality Control Plan for Fine Aggregate (QCPFA) provided by the Contractor shall be submitted for review and approval for each new source documenting how conformance to Items 1 through 7 as shown in Table M.04.01-1 is monitored. The QCPFA must be resubmitted any time the process, location or manner of how the fine aggregate (FA) is manufactured changes, or as requested by the Engineer. The QCPFA must include the locations and manufacturing processing methods. The QCPFA for any source may be suspended by the Engineer due to the production of inconsistent mixtures.

The Contractor shall submit all test results to the Engineer for review. The Contractor shall also include a washed sieve analysis in accordance with AASHTO T 27/T 11. Any fine aggregate component or final combined product shall have 100% passing the 3/8 inch sieve and a minimum of 95% passing the # 4. The G<sub>sa</sub>, G<sub>sb</sub>, and P<sub>w<sub>a</sub></sub> shall be determined in accordance with AASHTO T 84.

The Contractor will be notified by the Engineer if any qualified source of supply fails any portion of Table M.04.01-1. One retest will be allowed for the Contractor to make corrections and/or changes to the process. If, upon retest, the material does not meet the requirements of items 1-7, additional testing will be required in accordance with item 8.

- c. The Contractor may provide a Petrographic analysis of the material performed by a third party acceptable to the Engineer at its' own expense. The Contractor shall submit the results of the analysis with recommended changes to the manufacturing process to the Engineer. The Contractor shall submit fine aggregate samples for testing by the Engineer after the recommended changes have been made.

The Contractor may request the use of such fine aggregate on select project(s) for certain applications of bituminous concrete pavement. Such material will be monitored for a period no less than 48 months, at no cost to the State. Terms of any evaluation and suitable application will be determined by the Engineer.

### **3. Mineral Filler:**

- a. Requirements: Mineral filler shall consist of finely divided mineral matter such as rock dust, including limestone dust, slag dust, hydrated lime, hydraulic cement, or other accepted mineral matter. At the time of use it shall be freely flowing and devoid of agglomerations. Mineral filler shall be introduced and controlled at all times during production in a manner acceptable to the Engineer.
- b. Basis of Approval: The request for approval of the source of supply shall include the location, manufacturing process, handling and storage methods for the material. Mineral filler shall conform to the requirements of AASHTO M-17

#### **4. Liquid Bituminous Materials:**

a. General:

- i. Liquid PG binders shall be uniformly mixed and blended and be free of contaminants such as fuel oils and other solvents. Binders shall be properly heated and stored to prevent damage or separation.
- ii. The blending at mixing plants of PG binder from different suppliers is strictly prohibited. Contractors who blend PG binders will be classified as a supplier and will be required to certify the binder in accordance with AASHTO R-26(M). The binder shall meet the requirements of AASHTO M-320(M) and AASHTO R-29(M). The Contractor shall submit a Certified Test Report and bill of lading representing each delivery in accordance with AASHTO R-26(M). The Certified Test Report must also indicate the binder specific gravity at 77°F; rotational viscosity at 275°F and 329°F and the mixing and compaction viscosity-temperature chart for each shipment.
- iii. The Contractor shall submit the name(s) of personnel responsible for receipt, inspection, and record keeping of PG binder materials. Contractor plant personnel shall document specific storage tank(s) where binder will be transferred and stored until used, and provide binder samples to the Engineer upon request. The person(s) shall assure that each shipment (tanker truck) is accompanied by a statement certifying that the transport vehicle was inspected before loading and was found acceptable for the material shipped and that the binder will be free of contamination from any residual material, along with two (2) copies of the bill of lading.
- iv. Basis of Approval: The request for approval of the source of supply shall list the location where the material will be manufactured, and the handling and storage methods, along with necessary certification in accordance with AASHTO R-26(M). Only suppliers/refineries that have an approved "Quality Control Plan for Performance Graded Binders" formatted in accordance with AASHTO R-26(M) will be allowed to supply PG binders to Department projects.

b. Neat Performance Grade (PG) Binder:

- i. PG binder shall be classified by the supplier as a "Neat" binder for each lot and be so labeled on each bill of lading. Neat PG binders shall be free from modification with: fillers, extenders, reinforcing agents, adhesion promoters, thermoplastic polymers, acid modification and other additives, and shall indicate such information on each bill of lading and certified test report.
- ii. The asphalt binder shall be Performance Grade PG 64-22.

c. Modified Performance Grade (PG) Binder

Unless otherwise noted, the asphalt binder shall be Performance Grade PG 76-22 asphalt modified with a Styrene-Butadiene-Styrene (SBS) polymer. The polymer modifier shall be added at either the refinery or terminal and delivered to the bituminous concrete production facility as homogenous blend. The stability of the modified binder shall be verified in accordance with ASTM D7173 using the Dynamic Shear Rheometer (DSR). The DSR  $G^*/\sin(\delta)$  results from the top and bottom sections of the ASTM D7173 test shall not differ by more than 10%. The results of ASTM D7173 shall be included on the Certified Test Report. The binder shall meet the requirements of AASHTO M-320(M) and AASHTO R-29(M).

d. Warm Mix Additive or Technology:

- i. The warm mix additive or technology must be listed on the NEAUPG Qualified Warm Mix Asphalt (WMA) Technologies List at the time of bid, which may be accessed online at [http://www.neaupg.uconn.edu/wma\\_info.html](http://www.neaupg.uconn.edu/wma_info.html).
- ii. The warm mix additive shall be blended with the asphalt binder in accordance with the manufacturer's recommendations.
- iii. The blended binder shall meet the requirements of AASHTO M-320(M) and AASHTO R-29(M) for the specified binder grade. The Contractor shall submit a Certified Test Report showing the results of the testing demonstrating the binder grade. In addition, it must include the grade of the virgin binder, the brand name of the warm mix additive, the manufacturer's suggested rate for the WMA additive, the water injection rate (when applicable) and the WMA Technology manufacturer's recommended mixing and compaction temperature ranges.
- iv. Cut-backs (medium cure type):
  - i. Requirements: The liquid petroleum materials shall be produced by fluxing an asphalt base with appropriate petroleum distillates to produce the grade specified.
  - ii. Basis of Approval: The request for approval of the source of supply shall be submitted at least seven days prior to its use listing the location where the materials will be produced, and manufacturing, processing, handling and storage methods. The Contractor shall submit a Certified Test Report in accordance with Section 1.06 and a Material Safety Data Sheet (MSDS) for the grade to be used on the Project. The liquid asphalt shall be MC-250 conforming to AASHTO M-82.

e. Emulsions

- i. Requirements: The emulsified asphalt shall be homogeneous and not be used if exposed to freezing temperatures.
- ii. Basis of Approval: The request for approval of the source of supply must include the location where the materials will be produced, and manufacturing, processing, handling and storage methods.
  1. Emulsified asphalts shall conform to the requirements of AASHTO M-140. Materials used for tack coat shall not be diluted and meet grade RS-1. When ambient temperatures are 80°F and rising, grade SS-1 or SS-1h may be substituted if accepted by the Engineer. Each shipment shall be accompanied with a Certified Test Report listing Saybolt viscosity, residue by evaporation, penetration of residue, and weight per gallon.
  2. Cationic emulsified asphalt shall conform to the requirements of AASHTO M-208(M). Materials used for tack coat shall not be diluted and meet grade CRS-1. The settlement and demulsibility test will not be performed unless deemed necessary by the Engineer. When ambient temperatures are 80°F and rising, grade CSS-1 or CSS-1h may be substituted if accepted by the Engineer. Each shipment shall be accompanied with a Certified Test Report listing Saybolt viscosity, residue by evaporation, penetration of residue, and weight per gallon.

**5. Reclaimed Asphalt Pavement (RAP):**

- a. Requirements: RAP shall consist of asphalt pavement constructed with asphalt and aggregate reclaimed by cold milling or other removal techniques approved by the Engineer. For bituminous concrete mixtures containing RAP, the Contractor shall submit a JMF in accordance with Article M.04.02 to the Engineer for review.
- b. Basis of Approval: The RAP material will be accepted on the basis of one of the following criteria:
  - i. When the source of all RAP material is from pavements previously constructed on Department projects, the Contractor shall provide a materials certificate listing the detailed locations and lengths of those pavements and that the RAP is only from those locations listed.
  - ii. When the RAP material source or quality is not known, the Contractor shall test the material and provide the following information along with a request for approval to the Engineer at least 30 calendar days prior to the start of the paving operation. The request shall include a material certificate stating that the RAP consists of aggregates that meet the specification requirements of sub articles M.04.01-1 through 3 and that the binder in the RAP is substantially free of solvents, tars and other contaminants. The Contractor is prohibited from using unapproved material on Department projects

and shall take necessary action to prevent contamination of approved RAP stockpiles. Stockpiles of unapproved material shall remain separate from all other RAP materials at all times. The request for approval shall include the following:

1. A 50-pound sample of the RAP to be incorporated into the recycled mixture.
2. A 25-pound sample of the extracted aggregate from the RAP.
3. A statement that RAP material has been crushed to 100% passing the ½ inch sieve and remains free from contaminants such as joint compound, wood, plastic, and metals.

**6. Crushed Recycled Container Glass (CRCG):**

- a. Requirements: The Contractor may propose to use clean and environmentally-acceptable CRCG in an amount not greater than 5% by weight of total aggregate.
- b. Basis of Approval: The Contractor shall submit to the Engineer a request to use CRCG. The request shall state that the CRCG contains no more than 1% by weight of contaminants such as paper, plastic and metal and conform to the following gradation:

<b>CRCG Grading Requirements</b>	
<u>Sieve Size</u>	<u>Percent Passing</u>
3/8-inch	100
No. 4	35-100
No. 200	0.0-10.0

**7. Joint Seal Material:**

Requirements: Joint seal material shall be a hot-poured rubber compound intended for use in sealing joints and cracks in bituminous concrete pavements. Joint seal material must meet the requirements of AASHTO M-324 – Type 2.

**8. Plant Requirements:**

- a. Mixing Plant and Machinery:

The mixing plant used in the preparation of the bituminous concrete shall comply with AASHTO M-156(M)/ASTM D 995 for a Batch Plant or a Drum Dryer Mixer Plant, and be approved by the Engineer.

- b. Storage Silos:

For all mixes, the Contractor may use silos for short-term storage of Superpave mixtures with prior notification and approval of the Engineer. A silo must have heated cones and an unheated silo cylinder if it does not contain a separate internal heating system. Prior approval must be obtained for storage times greater than those indicated. When multiple

silos are filled, the Contractor shall discharge one silo at a time. Simultaneous discharge of multiple silos is not permitted.

<u>Type of silo cylinder</u>	<u>Maximum storage time for all classes (hr)</u>	
	HMA	WMA/PMA
Open Surge	4	Mfg Recommendations
Unheated – Non-insulated	8	Mfg Recommendations
Unheated – Insulated	18	Mfg Recommendations
Heated – No inert gas	TBD by the Engineer	

- c. Documentation System: The mixing plant documentation system shall include equipment for accurately proportioning the components of the mixture by weight and in the proper order, controlling the cycle sequence and timing the mixing operations. Recording equipment shall monitor the batching sequence of each component of the mixture and produce a printed record of these operations on each delivery ticket, as specified herein. Material feed controls shall be automatically or manually adjustable to provide proportions within the tolerances listed below for any batch size.

An asterisk (\*) shall be automatically printed next to any individual batch weight(s) exceeding the tolerances in ASTM D 995 section 8.7.3. The entire batching and mixing interlock cut-off circuits shall interrupt and stop the automatic batching operations when an error exceeding the acceptable tolerance occurs in proportioning.

There must be provisions so that scales are not manually adjusted during the printing process. In addition, the system shall be interlocked to allow printing only when the scale has come to a complete rest. A unique printed character (m) shall automatically be printed on the truck and batch plant printout when the automatic batching sequence is interrupted or switched to auto-manual or full manual during proportioning. For each day's production, each project shall be provided a clear, legible copy of these recordings on each delivery ticket.

- d. Aggregates: The Contractor shall ensure that aggregate stockpiles are managed to provide uniform gradation and particle shape, prevent segregation and cross contamination in a manner acceptable to the Engineer. For drum plants only, the Contractor shall determine the percent moisture content at a minimum, prior to production and half way through production.
- e. Mixture: The dry and wet mix times shall be sufficient to provide proper coating (minimum 95% as determined by AASHTO T 195(M)) of all particles with bitumen and produce a uniform mixture.

The Contractor shall make necessary adjustments to ensure all types of bituminous concrete mixtures contain no more than 0.5% moisture throughout when tested in accordance with AASHTO T 329.

- f. RAP: The Contractor shall indicate the percent of RAP, the moisture content (as a minimum determined twice daily – prior to production and halfway through production), and the net dry weight of RAP added to the mixture on each truck ticket. For each day of production, the production shall conform to the job mix formula and RAP percentage and no change shall be made without the prior approval of the Engineer.
- g. Asphalt Binder: The last day of every month, a binder log shall be submitted when the monthly production for the Department exceeds 5000 tons. Blending of PG binders from different suppliers or grades at the bituminous concrete production facility is strictly prohibited.
- h. Warm mix additive: For mechanically foamed WMA, the maximum water injection rate shall not exceed 2.0% water by total weight of binder and the water injection rate shall be constantly monitored during production.
- i. Field Laboratory: The Contractor shall furnish the Engineer an acceptable field laboratory at the production facility to test bituminous concrete mixtures during production. The field laboratory shall have a minimum of 300 square feet, have a potable water source and drainage in accordance with the CT Department of Public Health Drinking Water Division, be equipped with all necessary testing equipment as well as with a PC, printer, and telephone with a dedicated hard-wired phone line. In addition, the PC shall have a high speed internet connection with a minimum upstream of 384 Kbps and a functioning web browser with unrestricted access to <https://ctmail.ct.gov>. This equipment shall be maintained in clean and good working order at all times and be made available for use by the Engineer.

The laboratory shall be equipped with a suitable heating system capable of maintaining a minimum temperature of 65°F. It shall be clean and free of all materials and equipment not associated with the laboratory. Windows shall be installed to provide sufficient light and ventilation. During summer months adequate cooling or ventilation must be provided so the indoor air temperature shall not exceed the ambient outdoor temperature. Light fixtures and outlets shall be installed at convenient locations, and a telephone shall be within audible range of the testing area. The laboratory shall be equipped with an adequate workbench that has a suitable length, width, and sampling tables, and be approved by the Engineer.

The field laboratory testing apparatus, supplies, and safety equipment shall be capable of performing all tests in their entirety that are referenced in AASHTO R 35(M), *Standard Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA)* and AASHTO M 323, *Standard Specification for Superpave Volumetric Mix Design*. In addition, the quantity of all equipment and supplies necessary to perform the tests must be sufficient to initiate and complete the number of tests identified in Table M.04.03-2 for the quantity of mixture produced at the facility on a daily basis. The Contractor shall ensure that the

Laboratory is adequately supplied at all times during the course of the project with all necessary testing materials and equipment.

The Contractor shall maintain a list of laboratory equipment used in the acceptance testing processes including but not limited to, balances, scales, manometer/vacuum gauge, thermometers, gyratory compactor, clearly showing calibration and/or inspection dates, in accordance with AASHTO R-18. The Contractor shall notify the Engineer if any modifications are made to the equipment within the field laboratory. The Contractor shall take immediate action to replace, repair, and/or recalibrate any piece of equipment that is out of calibration, malfunctioning, or not in operation.

#### **M.04.02—Mix Design and Job Mix Formula (JMF)**

##### **1. Marshall Method - Class 1, 2, 3, 4, 5, 5A, 5B and 12:**

- a. Requirements: When specified, the Marshall method shall be employed to develop a bituminous concrete mix design that includes a JMF consisting of target values for gradation and bitumen content for each class of bituminous concrete designated for the project in accordance with the latest Asphalt Institute's MS-2 manual. Each class of bituminous concrete must meet the requirements as shown in Table M.04.02-1.
- b. Basis of Approval: The Contractor shall submit to the Engineer a request for approval of the JMF annually in accordance with one of the methods described herein. Prior to the start of any paving operations, the JMF and production percentage of bitumen must be accepted by the Engineer, and the Contractor must demonstrate the ability to meet the accepted JMF and production percentage of bitumen for each class of mixture. Additionally, the fraction of material retained between any two consecutive sieves shall not be less than 4%.

The Engineer will test each class of mixture for compliance with the submitted JMF and Table M.04.02-1. The maximum theoretical density (Gmm) will be determined by AASHTO T 209(M). If the mixture does not meet the requirements, the JMF shall be adjusted within the ranges shown in Table M.04.02-1 until an acceptable mixture is produced. All equipment, tests and computations shall conform to the Marshall method in accordance with AASHTO T 245(M).

An accepted JMF from the previous operating season may be acceptable to the Engineer provided that there are no changes in the sources of supply for the coarse aggregate, fine aggregate, recycled material (if applicable) and the plant operation had been consistently producing acceptable mixture.

The Contractor shall not change sources of supply after a JMF has been accepted. Before a new source of supply for materials is used, a new JMF shall be submitted to the Engineer for approval.

- c. Marshall Mixture (Virgin): For bituminous concrete mixtures that contain no recycled material, the limits prescribed in Table M.04.02-1 govern. The Contractor shall submit to the Engineer for approval, a JMF with the individual fractions of the aggregate expressed as percentages of the total weight of the mix and the source(s) of all materials. The JMF shall indicate two bitumen contents; the JMF target percentage and a production percentage (actual amount added to mix) of bitumen for each mix class by total weight. For surface course Class 1, a 0.45 power gradation chart shall also be submitted on which is plotted the percentage passing each sieve. The JMF shall also indicate the target temperature of completed mixture as it is dumped from the mixer and tested in accordance with Article M.04.03.
- d. Marshall Mixtures with RAP: In addition to subarticles M.04.02 – 1a through c, RAP in bituminous concrete shall comply with requirements stated in Article M.04.01, and as stated herein. Upon approval of the Engineer, a maximum of 15% RAP may be used with no binder grade modification. RAP material shall not be used with any other recycling option.  
The Contractor may increase the RAP percentage in 5% increments up to a maximum of 30% provided a new JMF is accepted by the Engineer. The following information shall be included in the JMF submittal:
- Gradation and asphalt content of the RAP.
  - Percentage of RAP to be used.
  - Virgin aggregate source(s).
  - Total binder content based on total mixture weight.
  - Production pull percentage of added virgin binder based on total mixture weight.
  - Gradation of combined bituminous concrete mixture (including RAP).
  - Grade of virgin added, if greater than 15% of total mix weight.
- e. Marshall Mixture with CRCG: In addition to subarticle M.04.02 – 1a through c, for bituminous concrete that contains CRCG, the Contractor shall submit a materials certificate to the Engineer stating that the mixture and its components comply with requirements stated in subarticle M.04.01 - (6). Additionally, 1% hydrated lime, or other accepted non-stripping agent, shall be added to all mixtures containing CRCG. CRCG material shall not be used with any other recycling option.

## **2. Cold Patch Method - Class 5, 5A, 5B:**

- a. Requirements: This mixture must be capable of being stockpiled and workable at all times. A non-stripping agent accepted by the Engineer shall be used in accordance with manufacturer's recommendations. The Contractor shall take necessary steps to ensure that this mixture uses aggregate containing no more than 1% moisture and is not exposed to any rain, snow, or standing water for a period of 6 hours after being mixed. This mixture shall be mixed and stockpiled at the point of production on a paved surface at a height not greater than 4 feet during the first 48 hours prior to its use.

- i. Class 5A mixture shall have  $\frac{3}{8}$  to  $\frac{1}{2}$  inch polypropylene fibers that have been approved by the Engineer added at a rate of 6 pounds per ton of mixture.
  - ii. Class 5B mixture shall have  $\frac{1}{4}$  inch polyester fibers that have been approved by the Engineer added at the rate of 2  $\frac{1}{2}$  pounds per ton of mixture.
  - iii. Class 5 mixture shall not contain fibers.
- b. Basis of Approval: The aggregates, fibers and binder (MC-250) shall meet the requirements as specified in sub articles M.04.01-1 through 4 and in Table M.04.02-1. The use of recycled material is not permitted with these classes of bituminous concrete. Mixtures not conforming to the binder content as shown in Table M.04.02-1 shall be subject to rejection. There is a two test minimum per day of production. Mixtures not conforming to the gradation as shown in Table M.04.02-1 shall be subject to payment adjustment as specified in Section 4.06.

**TABLE M.04.02 – 1 MASTER RANGES FOR MARSHALL BITUMINOUS-CONCRETE MIXTURES**

**Notes:** (a) 75 blow (Marshall Criteria). (b) 3-6% when used for a roadway wearing surface. (c) For divided highways with 4 or more lanes, a stability of 1500 lbs is required. (d) Contains an accepted non-stripping compound. (e) To help prevent stripping, the mixed material will be stockpiled on a paved surface and at a height not greater than 4 feet during the first 48 hours. (f) As determined by AASHTO T 245(M). (g) The percent passing the #200 sieve shall not exceed the percentage of bituminous asphalt binder determined by AASHTO T 164 or AASHTO T 308(M). (h) Mixture with 5% or more aggregate retained on 3/4" sieve. (i) Mixtures finer than condition (h) above. (j) Class 5 mixture shall contain no fibers. Class 5A mixture shall have 3/8 to 1/2 inch polypropylene fibers that have been previously accepted by the Engineer added at a minimum rate of 6 pounds per ton of mixture. Class 5B mixture shall have 1/4 inch polyester fibers that have been previously accepted by the Engineer added at the minimum rate of 2 1/2 pounds per ton of mixture

CLASS	1	2	3	4	12	5 (e)(j)	5A (e)(j)	5B (e)(j)	JMF % Tol. (±)
Grade of PG Binder content %	PG 64-22 5.0 – 6.5	PG 64-22 5.0 – 8.0	PG 64-22 6.5 - 9.0	PG 64-22 4.0 - 6.0	PG 64-22 7.5 - 10.0	MC-250 (d) 6.0 - 7.5	MC-250 (d) 6.0 - 7.5	MC-250 (d) 6.0 - 7.5	0.4
Sieve Size	Percent Passing (%)								
# 200	3.0 – 8.0 (g)	3.0 – 8.0 (g)	3.0 – 8.0 (g)	0.0 – 5.0 (g)	3.0 – 10.0 (g)	0.0 - 2.5	0.0- 2.5	0.0 - 2.5	2.0
# 50	6 – 26	8 – 26	10 - 30	5 - 18	10 - 40				4
# 30	10 - 32	16 - 36	20 - 40		20 - 60	2 - 15	2 – 15	2 - 15	5
# 8	28 - 50	40 - 64	40 - 70	20 - 40	60 - 95	10 - 45	10 – 45	10 - 45	6
# 4	40 - 65	55 - 80	65 - 87	30 - 55	80 - 95	40 - 100	40 – 100	40 - 100	7
1/4"									
3/8 "	60 - 82	90 - 100	95 - 100	42 - 66	98 - 100	100	100	100	8
1/2 "	70 - 100	100	100		100				8
3/4"	90 - 100			60 - 80					8
1"	100								
2"				100					
<b>Additionally, the fraction of material retained between any two consecutive sieves shall not be less than 4%</b>									
<b>Mixture Temperature</b>									
Binder	325°F maximum					140-185° F			
Aggregate	280-350° F					100-175° F			
Mixtures	265-325° F				275-325°F	120-175° F			25 °F
<b>Mixture Properties</b>									
VOIDS - %	3.0 – 6.0 (a)	2.0 – 5.0 (b)	0 – 4.0		0 - 5.0 (a)				
Stability (f) lbs. min.	1200 (c)	1000	1000		1000				
FLOW (f) in.	.08 - .15	.08 - .15	.08 - .18		.08 - .15				
VMA % - min.	15(h) :16 (i)								

### 3. Superpave Design Method – S0.25, S0.375, S0.5, and S1

- a. Requirements: The Contractor or its representative shall design and submit Superpave mix designs annually for approval. The design laboratory developing the mixes shall be approved by the Engineer. The mix design shall be based on the specified Equivalent Single-Axle Loads (ESAL). Each bituminous concrete mix type must meet the requirements shown in Tables M.04.02-2 thru Table M.04.02-5 and in accordance with AASHTO M 323(M) and AASHTO R 35(M). The mix design shall include the nominal maximum aggregate size and a JMF consisting of target values for gradation and bitumen content for each bituminous concrete mix type designated for the project.

The contractor shall provide test results with supporting documentation from an AASHTO Materials Reference Laboratory (AMRL) with the use of NETTCP Certified Technicians for the following tests;

1. Aggregate consensus properties for each type & level, as specified in Table M.04.02-3. In addition the G<sub>sa</sub>, G<sub>sb</sub>, Pw<sub>a</sub> shall also be provided for each component aggregate.
2. New mixes shall be tested in accordance with AASHTO T 283(M) *Standard Method of Test for Resistance of Compacted Hot-Mix Asphalt (HMA) to Moisture-Induced Damage*, (TSR). The compacted specimens may be fabricated at a bituminous concrete facility and then tested at an AMRL accredited facility.

The AASHTO T 283(M) test results, specimens, and corresponding JMF sheet (Form MAT-429s) shall be submitted by the Contractor for review.

The Contractor shall supply the Engineer with 1 gallon of the specified PG binder and 1 gallon of the same PG binder with the warm mix additive blended into it. The MSDS for the WMA additive shall be included with every submittal.

In addition, minimum binder content values apply to all types of bituminous concrete mixtures, as stated in Table M.04.02-5. For mixtures containing RAP, the virgin production and the anticipated proportion of binder contributed by the RAP cannot be less than the total permitted binder content value for that type nor the JMF minimum binder content.

- i. Superpave Mixture (virgin): For bituminous concrete mixtures that contain no recycled material, the limits prescribed in Tables M.04.02-2 thru Table M.04.02-5 apply. The Contractor shall submit a JMF, on a form provided by the Engineer, with the individual fractions of the aggregate expressed as percentages of the total weight of the mix and the source(s) of all materials to the Engineer for approval. The JMF shall indicate the corrected target binder content and applicable binder correction factor (ignition oven or extractor) for each mix type by total weight of mix. The mineral filler (dust) shall be defined as that portion of blended mix that

passes the #200 sieve by weight when tested in accordance with AASHTO T 30(M). The dust-to-effective asphalt (D/Pbe) ratio shall be between 0.6 and 1.2 by weight. The dry/wet mix times and hot bin proportions (batch plants only) for each type shall be included in the JMF.

The percentage of aggregate passing each sieve shall be plotted on a 0.45 power gradation chart and shall be submitted for all bituminous concrete mixtures. This chart shall delineate the percentage of material passing each test sieve size as defined by the JMF. The percentage of aggregate passing each standard sieve shall fall within the specified control points, but outside the restricted zone limits as shown in Tables M.04.02-2 thru Table M.04.02-5. Mixes with documented performance history which pass through the restricted zone may be permitted for use as long as all other physical and volumetric criteria meets specifications as specified in Tables M.04.02-2 thru Table M.04.02-5 and with prior approval from the Engineer. A change in the JMF requires that a new chart be submitted.

- ii. Superpave Mixtures with RAP: Use of approved RAP may be allowed with the following conditions:
  - RAP amounts up to 15% may be used with no binder grade modification.
  - RAP amounts up to 20% may be used provided a new JMF is approved by the Engineer. The JMF submittal shall include the grade of virgin binder added and test results that show the combined binder (recovered binder from the RAP, virgin binder at the mix design proportions and warm mix asphalt additive if used) meets the requirements of the specified binder grade.

Unless approved by the Engineer, RAP material shall not be used with any other recycling option.

- b. Basis of Approval: On an annual basis, the Contractor shall submit to the Engineer any bituminous concrete mix design, and JMF anticipated for use on Department projects. Prior to the start of any paving operations, the mix design and JMF must be approved by the Engineer. Bituminous concrete mixture supplied to the project without an approved mix design and JMF will be rejected. The following information must be included in the mix design submittal:
  - a. Gradation, specific gravities and asphalt content of the RAP,
  - b. Source of RAP and percentage to be used.
  - c. Warm mix Technology and manufacturer's recommended additive rate and tolerances, mixing and compaction temperature ranges for the mix with and without the warm-mix technology incorporated.
  - d. Result of TSR testing, and if applicable Anti-strip manufacturer, and dosage rate.
  - e. Target Temperature at plant discharge.

Note – Testing to be performed shall be done in accordance with section M.04.03.

The JMF shall be accepted if the Plant mixture and materials meet all criteria as specified in Tables M.04.02-2 thru Table M.04.02-5. If the mixture does not meet the requirements, the contractor shall adjust the JMF within the ranges shown in Tables M.04.02-2 thru Table M.04.02-5 until an acceptable mixture is produced. All equipment, tests, and computations shall conform to the latest AASHTO R-35(M) and AASHTO M-323(M).

Any JMF, once approved, shall only be acceptable for use when it is produced by the designated plant, it utilizes the same component aggregates and binder source, and it continues to meet all criteria as specified herein, and component aggregates are maintained within the tolerances shown in Table M.04.02-2.

The Contractor shall not change any component source of supply including consensus properties after a JMF has been accepted. Before a new source of materials is used, a revised JMF shall be submitted to the Engineer for approval. Any approved JMF applies only to the plant for which it was submitted. Only one mix with one JMF will be approved for production at any one time. Switching between approved JMF mixes with different component percentages or sources of supply is prohibited.

Superpave mixture with CRCG: In addition to subarticles M.04.02 – 3 a through c, for bituminous concrete mixtures that contain CRCG, the Contractor shall submit a materials certificate to the Engineer stating that the CRCG complies with requirements stated in Article M.04.01, as applicable. Additionally, 1% hydrated lime, or other accepted non-stripping agent, shall be added to all mixtures containing CRCG. CRCG material shall not be used with any other recycling option.

- c. Mix Status: Each facility will have each type of bituminous concrete mixture evaluated based on the previous year of production, for the next construction paving season, as determined by the Engineer. Based on the rating a type of mixture receives it will determine whether the mixture can be produced without the completion of a PPT. Ratings will be provided to each bituminous concrete producer annually prior to the beginning of the paving season.

The rating criteria are based on compliance with Air Voids and Voids in Mineral Aggregate (VMA) as indicated in Table M.04.03-3: *Superpave Master Range for Bituminous Concrete Mixture Production*, and are as follows:

Criteria A: Based on Air Voids. Percentage of acceptance results with passing air voids.

Criteria B: Based on Air Voids and VMA. The percentage of acceptance results with passing VMA, and the percentage of acceptance results with passing air voids, will be averaged.

The final rating assigned will be the lower of the rating obtained with Criteria A or Criteria B.

Ratings are defined as:

“A” – Approved:

A rating of “A” is assigned to each mixture type from a production facility with a current rating of 70% passing or greater.

“PPT” – Pre-Production Trial:

Rating assigned to each mixture type from a production facility when:

1. there are no passing acceptance production results submitted to the Department from the previous year;
2. there is a source change in one or more aggregate components from the JMF on record by more than 10% by weight;
3. there is a change in RAP percentage ,
4. the mixture has a rating of less than 70% from the previous season;
5. a new JMF not previously submitted.

Bituminous concrete mixtures rated with a “PPT” cannot be shipped or used on Department projects. A passing “PPT” test shall be performed with NETTCP certified personnel on that type of mixture by the bituminous concrete producer and meet all specifications (Table M.04.02-2 Table M.04.02-5) before production shipment may be resumed.

Contractors that have mix types rated a “PPT” may use one of the following methods to change the rating to an “A.”

Option A: Schedule a day when a Department inspector can be at the facility to witness a passing “PPT” test or,

Option B: When the Contractor or their representative performs a “PPT” test without being witnessed by an inspector, the Contractor shall submit the test results and a split sample including 2 gyratory molds, 5,000 grams of boxed bituminous concrete for binder and gradation determination, and 5,000 grams of cooled loose bituminous concrete for Gmm determination for verification testing and approval. Passing verifications will designate the bituminous concrete type to be on an “A” status. Failing verifications will require the contractor to submit additional trials.

Option C: When the Contractor or their representative performs a “PPT” test without being witnessed by a Department inspector, the Engineer may verify the mix in the Contractor’s laboratory. Passing verifications will designate the bituminous concrete type to be an “A” status. Failing verifications will require the Contractor to submit additional trials.

When Option (A) is used and the “PPT” test meets all specifications, the “PPT” test is considered a passing test and the rating for that mix is changed to “A”. When the “PPT” test is not witnessed, the “PPT” Option (B) or (C) procedure must be followed. If the “PPT” Option (B) procedure is followed, the mixtures along with the test results must be delivered to the Materials Testing Lab. The test results must meet the “C” tolerances established by the Engineer. The tolerance Table is included in the Department’s current QA Program for Materials, Acceptance and Assurance Testing Policies and Procedures.

“U” – No Acceptable Mix Design on File:

Rating assigned to a type of mixture that does not have a JMF submitted, or the JMF submitted has not been approved, or is incomplete. A mix design or JMF must be submitted annually seven (7) days prior in order to obtain an “A,” or “PPT” status for that mix. A “U” will be used only to designate the mix status until the mix design has been approved, and is accompanied with all supporting data as specified. Bituminous concrete mixtures rated with a “U” cannot be used on Department projects.

**TABLE M.04.02- 2: SUPERPAVE MASTER RANGE FOR BITUMINOUS CONCRETE MIXTURE DESIGN CRITERIA**

Notes: (1) Minimum Pb as specified in Table M.04.02-5. (2) Voids in Mineral Aggregates shall be computed as specified herein. (3) Control point range is also defined as the master range for that mix. (4) Dust is considered to be the percent of materials passing the #200 sieve. (5) For WMA, lower minimum aggregate temperature will require Engineer's approval. (6) For WMA and PMA, the mix temperature shall meet manufacturer's recommendations.

Sieve	S0.25				S0.375				S0.5				S1			
	CONTROL POINTS <sup>(3)</sup>		RESTRICTED ZONE		CONTROL POINTS <sup>(3)</sup>		RESTRICTED ZONE		CONTROL POINTS <sup>(3)</sup>		RESTRICTED ZONE		CONTROL POINTS <sup>(3)</sup>		RESTRICTED ZONE	
inches	Min (%)	Max (%)	Max (%)	Min (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)	Min (%)	Max (%)
2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.5	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-
1.0	-	-	-	-	-	-	-	-	-	-	-	-	90	100	-	-
3/4	-	-	-	-	-	-	-	-	100	-	-	-	-	90	-	-
1/2	100	-	-	-	100	-	-	-	90	100	-	-	-	-	-	-
3/8	97	100	-	-	90	100	-	-	-	90	-	-	-	-	-	-
#4	-	90	-	-	-	90	-	-	-	-	-	-	-	-	39.5	39.5
#8	32	67	47.2	47.2	32	67	47.2	47.2	28	58	39.1	39.1	19	45	26.8	30.8
#16	-	-	31.6	37.6	-	-	31.6	37.6	-	-	25.6	31.6	-	-	18.1	24.1
#30	-	-	23.5	27.5	-	-	23.5	27.5	-	-	19.1	23.1	-	-	13.6	17.6
#50	-	-	18.7	18.7	-	-	18.7	18.7	-	-	15.5	15.5	-	-	11.4	11.4
#100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
#200	2.0	10.0	-	-	2.0	10.0	-	-	2.0	10.0	-	-	1.0	7.0	-	-
Pb <sup>(1)</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VMA <sup>(2)</sup> (%)	16.0 ± 1				16.0 ± 1				15.0 ± 1				13.0 ± 1			
VA (%)	4.0 ± 1				4.0 ± 1				4.0 ± 1				4.0 ± 1			
Gse	JMF value				JMF value				JMF value				JMF value			
Gmm	JMF ± 0.030				JMF ± 0.030				JMF ± 0.030				JMF ± 0.030			
Dust/Pbe <sup>(4)</sup>	0.6 – 1.2				0.6 – 1.2				0.6 – 1.2				0.6 – 1.2			
Agg. Temp <sup>(5)</sup>	280 – 350F				280 – 350F				280 – 350F				280 – 350F			
Mix Temp <sup>(6)</sup>	265 – 325 F				265 – 325 F				265 – 325 F				265 – 325 F			
Design TSR	> 80%				> 80%				> 80%				> 80%			
T-283 Stripping	Minimal, as determined by the Engineer															

**TABLE M.04.02-3**

**SUPERPAVE MASTER RANGE FOR CONSENSUS PROPERTIES OF COMBINED AGGREGATE STRUCTURES**

<b>Notes:</b> (1) If less than 25 % of a given layer is within 4 inches of the anticipated top surface, the layer may be considered to be below 4 inches for mixture design purposes.					
Traffic Level	Design ESALs (80 kN)	Coarse Aggregate Angularity <sup>(1)</sup> ASTM D 5821	Fine Aggregate Angularity <sup>(7)</sup> AASHTO T 304	Flat or Elongated Particles ASTM D 4791	Sand Equivalent AASHTO T 176
-----	(million)			> # 4	-----
1*	< 0.3	55/- -	40	10	40
2	0.3 to < 3.0	75/- -	40	10	40
3	≥ 3.0	95/90	45	10	45
	Design ESALs are the anticipated project traffic level expected on the design lane, projected over a 20 year period, regardless of the actual expected design life of the roadway.	Criteria presented as minimum values. 95/90 denotes that a minimum of 95% of the coarse aggregate, by mass, shall have one fractured face and that a minimum of 90% shall have two fractured faces.	Criteria presented as minimum percent air voids in loosely compacted fine aggregate passing the #8 sieve.	Criteria presented as maximum Percent by mass of flat or elongated particles of materials retained on the #4 sieve, determined at 3:1 ratio.	Criteria presented as minimum values for fine aggregate passing the #8 sieve.

\* NOTE: Level 1 for use by Towns and Municipalities ONLY.

**TABLE M.04.02- 4: SUPERPAVE MASTER RANGE FOR TRAFFIC LEVELS AND DESIGN VOLUMETRIC PROPERTIES.**

Traffic Level	Design ESALs	Number of Gyration by Superpave Gyrotory Compactor			Percent Density of Gmm from HMA/WMA specimen			Voids Filled with Asphalt (VFA) Based on Nominal mix size – inch			
		(million)	Nini	Ndes	Nmax	Nini	Ndes	Nmax	0.25	0.375	0.5
1*	< 0.3	6	50	75	≤ 91.5	96.0	≤ 98.0	70 - 80	70 - 80	70 - 80	67 - 80
2	0.3 to < 3.0	7	75	115	≤ 90.5	96.0	≤ 98.0	65 - 78	65 - 78	65 - 78	65 - 78
3	≥ 3.0	8	100	160	≤ 90.0	96.0	≤ 98.0	73 - 76	73 - 76	65 - 75	65 - 75

\* NOTE: Level 1 for use by Towns and Municipalities ONLY.

**TABLE M.04.02– 5: SUPERPAVE MINIMUM BINDER CONTENT  
BY MIX TYPE & LEVEL.**

Mix Type	Level	Binder Content Minimum <sup>(1)</sup>
S0.25	1*	5.6
S0.25	2	5.5
S0.25	3	5.4
S0.375	1*	5.6
S0.375	2	5.5
S0.375	3	5.4
S0.5	1*	5.0
S0.5	2	4.9
S0.5	3	4.8
S1	1*	4.6
S1	2	4.5
S1	3	4.4

\* NOTE: Level 1 for use by Towns and Municipalities ONLY.

**M.04.03— Production Requirements:**

**1. Quality Control Plan and Processes:** The Contractor shall submit a Quality Control Plan (QCP) for bituminous concrete production specifically for the plant producing the bituminous concrete mixture for review and approval of the Engineer on an annual basis.

The QCP shall describe the organization and procedures which the Contractor shall use to administer quality control. The QCP shall include the procedures used to control the production process, to determine when immediate changes to the processes are needed, and to implement the required changes. The QCP must detail the inspection, sampling and testing protocols to be used, and the frequency for each.

Control Chart(s) shall be developed and maintained for critical aspect(s) of the production process as determined by the Contractor. The control chart(s) shall identify the material property, applicable upper and lower control limits, and be updated with current test data. The control chart(s) shall be used as part of the quality control system to document variability of the bituminous concrete production process. The control chart(s) shall be submitted to the Engineer upon request.

The QCP shall also include the name and qualifications of a Quality Control Manager. The Quality Control Manager shall be responsible for the administration of the QCP, including compliance with the plan and any plan modifications. All daily QC sampling, inspection and test reports shall be reviewed by the Quality Control Manager and be submitted to the Engineer upon request.

The QCP shall also include the name and qualifications of any outside testing laboratory performing any QC functions on behalf of the Contractor. The QCP must also include a list of sampling & testing methods and frequencies used during production, and the names of all Quality Control personnel and their duties.

Approval of the QCP does not imply any warranty by the Engineer that adherence to the plan will result in production of bituminous concrete that complies with these specifications. The Contractor shall submit any changes to the QCP as work progresses.

**2. Acceptance Sampling & Testing Methods:** Acceptance samples of mixtures shall be obtained from the hauling vehicles and tested by the Contractor at the facility during each day's production.

The hauling vehicle from which samples are obtained shall be selected using stratified – random sampling based on the total estimated tons of production in accordance with ASTM D 3665, except that the first test shall be randomly taken from the first 151 tons or as directed by the Engineer.

The number of sub lots and tests required per sub lot is based on the total estimated tons of production per day as indicated in Table M.04.03-1. Quantities of the same type/level mix per plant may be combined daily for multiple state projects to determine the number of sub lots. The payment adjustment for air voids and liquid binder will be calculated per sub lot as described in Section 4.06.

An acceptance test shall not be performed within 150 tons of production from a previous acceptance test unless approved by the Engineer. Quality Control tests are not subject to this restriction. Unless otherwise tested, a minimum of one (1) acceptance test shall be performed for every four days of production at a facility for each type/level mix (days of production may or may not be consecutive days).

The Contractor shall submit all acceptance tests results to the Engineer within 24 hours or prior to the next day's production. All acceptance test specimens and supporting documentation must be retained by the Contractor. Verification testing will be performed by the Engineer on the retained specimens in accordance with the Department's QA Program for Materials.

Should the Department be unable to verify the Contractor's acceptance test result(s) due to a failure of the Contractor to retain acceptance test specimens or supporting documentation, the Contractor shall review its quality control plan, determine the cause of the nonconformance and respond in writing within 24 hours to the Engineer describing the corrective action taken at the plant. In addition the Contractor must provide supporting documentation or test results to validate the subject acceptance test result(s). The Engineer may invalidate any positive adjustments for material corresponding to the acceptance test(s). Failure of the Contractor to adequately address quality control issues at a facility may result in suspension of production for Department projects at that facility.

Contractor personnel performing acceptance sampling and testing must be present at the facility prior to, and during production, and be certified as a NETTCP HMA Plant Technician or Interim HMA Plant Technician and be in good standing. Production of material for use on State projects must be suspended by the Contractor if such personnel are not present.

Technicians found by the Engineer to be non-compliant with NETTCP or Department policies may be removed by the Engineer from participating in the acceptance testing process for Department projects until their actions can be reviewed.

Anytime during production that testing equipment becomes inoperable, production can continue for a maximum of 1 hour. The Contractor shall obtain box sample(s) in accordance with Table M.04.03-1 to satisfy the daily acceptance testing requirement for the quantity shipped to the project. The box sample(s) shall be tested once the equipment issue has been resolved to the satisfaction of the Engineer. Production beyond 1 hour may be considered by the Engineer. Production will not be permitted beyond that day until the subject equipment issue has been resolved.

**Table M.04.03 – 1: Acceptance Testing Frequency per Type/Level/Plant**

Daily quantity produced in tons (lot)	Number of Sub Lots/Tests
0 to 150	0, Unless requested by the Engineer
151 to 600	1
601 to 1,200	2
1,201 to 1,800	3
1,801 or greater	1 per 600 tons or portions thereof

**i. Marshall Mix Acceptance Sampling and Testing Procedures:** When the Marshall mix design is specified, the following acceptance procedures and AASHTO test methods shall be used:

**Table M.04.03 – 2: Marshall Acceptance Test Procedures**

Protocol	Reference	Description
1	AASHTO T 30(M)	Mechanical Analysis of Extracted Aggregate
2	AASHTO T 40(M)	Sampling Bituminous Materials
3	AASHTO T 308(M)	Binder content by Ignition Oven method (adjusted for aggregate correction factor)
4	AASHTO T 245(M)	Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
5	AASHTO T 209(M)	Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
6	AASHTO T 269(M)	Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
7	AASHTO T 329	Moisture Content of Hot-Mix Asphalt (HMA) by Oven Method

- a. Cessation of Supply: Marshall Mix Production shall cease for the Project from any facility that consistently fails to produce mixture that meets the JMF and volumetric properties. The criteria for ceasing the supply of a class of mixture from any plant are as follows:
- i. Off-Test Status: The results of AASHTO T 164 or AASHTO T 308(M) and T 30(M) will be used to determine if the mixture is within the tolerances shown in Table M.04.02-1. The Contractor will be notified that a plant is "off test" for a class of mixture when the test results indicate that any single value for bitumen content or gradation are not within the tolerances shown in Table M.04.02-1 for that class of mixture.
  - ii. When multiple plants and silos are located at one site, mixture supplied to one project is considered as coming from one source for the purpose of applying the "off test" adjusted payment.
  - iii. If a test indicates that the bitumen content or gradation are outside the tolerances, the Contractor may make a single JMF change on classes 1, 2, 3, 4 and 12 as allowed by the Engineer prior to any additional testing. A JMF change shall include the date and

- name of the Engineer that allowed it. Consecutive test results outside the requirements of Table M.04.02-1 JMF tolerances may result in rejection of the mixture.
- iv. The Engineer may cease supply of mixture from the plant when the test results from three non-consecutive samples of a class of mixture are not within the JMF tolerances or the test results from two non-consecutive samples not within the master range indicated in Table M.04.02-1 during any one production period, due to inconsistent production.
  - v. Any modification to the JMF shall not exceed 50% of the JMF tolerances indicated in Table M.04.02-1 for any given component of the mixture without approval of the Engineer. When such an adjustment is made to the bitumen, the corresponding production percentage of bitumen shall be revised accordingly.
- b. Adjustments for Off Test Mixture under Cessation of Supply: The bituminous concrete plant shall cease supplying to the project:
- i. When the test results from three consecutive samples are “off test” and not within the JMF tolerances or,
  - ii. The test results from two consecutive samples are “off test” and not within the ranges indicated in Table M.04.02 – 1 or,
  - iii. When the percent of material passing the minus #200 sieve material exceeds the percent of extracted bitumen content for three consecutive samples during any production period of the values stated in Table M.04.02-1:
    - a. The quantity of mixtures shipped to the project determined to be “off test” and outside the tolerances will be tabulated by the Engineer and will be adjusted in accordance with Section 4.06.
    - b. Following cessation, a trial production period will be required at the plant for that class of mixture. Use of that class of mixture from that plant will be prohibited on the Project until the plant has demonstrated the ability to consistently produce acceptable mixture.
    - c. When the Engineer has accepted the mixtures from the trial production period, the use of that mixture on the Project may resume.

**ii. Superpave Mix Acceptance Sampling and Testing Procedures:** When the Superpave mix design is specified, the following acceptance and AASHTO test procedures shall be used:

**Table M.04.03– 3: Superpave Acceptance Testing Procedures**

<b>Protocol</b>	<b>Reference</b>	<b>Description</b>
1	AASHTO T 168(M)	Sampling of bituminous concrete
2	AASHTO T 308(M)	Binder content by Ignition Oven method (adjusted for aggregate correction factor)
3	AASHTO T 30(M)	Gradation of extracted aggregate for bituminous concrete mixture
4	AASHTO T 312(M)	<sup>(1)</sup> Superpave Gyratory molds compacted to $N_{des}$
5	AASHTO T 166(M)	<sup>(2)</sup> Bulk specific gravity of bituminous concrete
6	AASHTO R 35(M)	<sup>(2)</sup> Air voids, VMA
7	AASHTO T 209(M)	Maximum specific gravity of bituminous concrete (average of two tests)
8	AASHTO T 329	Moisture content of Production bituminous concrete

The Contractor shall perform moisture susceptibility (TSR) testing annually for all design levels of HMA-, WMA-, and PMA- S0.5 plant-produced mixtures, in accordance with the latest version of AASHTO T 283(M).

If any material source changes from the previous year, or during the production season, a mix design TSR as well as a production TSR is required for the new mixture. The AASHTO T 283(M) test shall be performed at an AASHTO Materials Reference Laboratory (AMRL) by NETTCP Certified Technicians. The test results and specimens shall be submitted to the Engineer for review. This shall be completed within 30 days from the start of production. Superpave mixtures that require anti-strip additives (either liquid or mineral) shall continue to meet all requirements specified herein for binder and bituminous concrete. The Contractor shall submit the name, manufacturer, percent used, and MSDS sheet for the anti-strip additive (if applicable) to the Engineer. In addition, compaction of samples shall be accomplished utilizing an accepted Superpave Gyratory Compactor (SGC), supplied by the Contractor. The SGC shall be located at the facility supplying mixture to the project.

a. Determination of Off-Test Status:

- i. Off Test Status: Superpave mixes shall be considered “*off test*” when any Control Point Sieve, VA, VMA, and Gmm values are outside of the limits specified in Table M.04.03-3 and the computed binder content (Pb) established by AASHTO T308(M) or as documented on the vehicle delivery ticket is below the minimum binder content stated in sub article M.04.03-5. Note that further testing of samples or portions of samples not initially tested for this purpose cannot be used to change the status.

- ii. Any time the bituminous concrete mixture is considered Off-test:
1. The Contractor shall notify the Engineer (and project staff) when the plant is "off test" for a type of mixture. When multiple plants and silos are located at one site, mixture supplied to one project is considered as coming from one source for the purpose of applying the "off test" determination.
  2. The Contractor must take immediate actions to correct the deficiency, minimize "off test" production to the project, and obtain an additional Process Control (PC) test after any corrective action to verify production is in conformance to the specifications. A PC test will not be used for acceptance and is solely for the use of the Contractor in its quality control process.
- b. Cessation of Supply for Superpave Mixtures with no Payment Adjustment: Production of bituminous concrete shall cease for the Project from any plant that consistently fails to produce mixture that meets the JMF and volumetric properties. The quantity of Superpave mixtures shipped to the project that is "off-test" will not be adjusted for deficient mixtures.

A Contractor shall cease to supply mixture from a plant when:

1. Bituminous concrete mixture is "off test" on three (3) consecutive tests for VMA or Gmm, regardless of date of production due to inconsistency (i.e., small production requires 1 test per day for multiple days).
2. Bituminous concrete mixture is "off test" on two (2) consecutive tests for the Control Point sieves in one day's production.

Following cessation, the Contractor shall immediately make necessary material or process corrections and run a Pre-Production Trial (PPT) for that type of mixture. Use of that type of mixture from that plant will be prohibited on the Project until the Contractor has demonstrated the ability to produce acceptable mixture from that facility. When the Contractor has a passing test and has received approval from the Engineer, the use of that mixture to the Project may resume.

- c. Cessation of Supply for Superpave Mixtures with Payment Adjustment: Production of bituminous concrete shall cease for the Project from any plant that consistently fails to produce mixture that meets the Superpave minimum binder content by mix type and level listed in Table M.04.02-5. The quantity of Superpave mixtures shipped to the project that is "off-test" will be adjusted for deficient mixtures in accordance with Section 4.06.

A Contractor shall cease to supply mixture from a plant when the binder content (Pb) is below the requirements of Table M.04.03-5 on the ignition oven test result after two (2) consecutive tests, regardless of the date of production.

Following cessation, the Contractor shall immediately make necessary material or process corrections and run a Pre-Production Trial (PPT) for that type of mixture. Use of that type of mixture from that plant will be prohibited on the Project until the Contractor has demonstrated the ability to produce acceptable mixture from that facility. When the Contractor has a passing test and has received approval from the Engineer, the use of that mixture to the Project may resume.

- d. JMF Changes for Superpave Mixture Production: It is understood that a JMF change is effective from the time it was submitted forward and is not retroactive to the previous test or tests. JMF changes are permitted to allow for trends in aggregate and mix properties but every effort shall be employed by the Contractor to minimize this to ensure a uniform and dense pavement.

JMF changes to the  $G_{mm}$  or mix Absorption Correction Factor ( $A_{cf}$ ) are only permitted prior to or after a production shift for all bituminous-concrete types of mixtures and only when they:

- i. Are requested in writing and pre-approved by the Engineer;
- ii. Are based on a minimum of a two test trend;
- iii. Are documented with a promptly submitted revised JMF on form provided by the Engineer.
- iv. A revised JMF submittal shall include the date and name of the Engineer that allowed it.

**TABLE M.04.03– 3: SUPERPAVE MASTER RANGE FOR BITUMINOUS CONCRETE MIXTURE PRODUCTION**

<b>Notes:</b> (1) 300°F minimum after October 15. (2) Minimum Pb as specified in Table M.04.03-5 (3) Control point range is also defined as the master range for that mix. (4) JMF tolerances shall be defined as the limits for production compliance. VA & Pb payment is subject to adjustments, as defined in sub-article 4.06.04 - 2. (5) For WMA, lower minimum aggregate temperature will require Engineer's approval. (6) For WMA and/or polymer modified asphalt, the mix temperature shall meet manufacturer's recommendations. In addition, for WMA, the maximum mix temperature shall not exceed 325°F once the WMA technology is incorporated.									
	<b>S0.25</b>		<b>S0.375</b>		<b>S0.5</b>		<b>S1</b>		<b>Tolerances</b>
Sieve	CONTROL POINTS <sup>(4)</sup>		CONTROL POINTS <sup>(4)</sup>		CONTROL POINTS <sup>(4)</sup>		CONTROL POINTS <sup>(4)</sup>		<b>JMF Limits <sup>(4)</sup></b>
inches	Min(%)	Max(%)	Min(%)	Max(%)	Min(%)	Max(%)	Min(%)	Max(%)	±Tol
2.0	-	-	-	-	-	-	-	-	
1.5	-	-	-	-	-	-	100	-	
1.0	-	-	-	-	-	-	90	100	
3/4	-	-	-	-	100	-	-	90	
1/2	100	-	100	-	90	100	-	-	
3/8	97	100	90	100	-	90	-	-	
#4	-	90	-	90	-	-	-	-	
#8	32	67	32	67	28	58	19	45	
#16	-	-	-	-	-	-	-	-	
#200	2.0	10.0	2.0	10.0	2.0	10.0	1.0	7.0	
Pb <sup>(2)</sup>	-	-	-	-	-	-	-	-	note (2)
VMA (%)	16.0		16.0		15.0		13.0		1.0
VA (%)	4.0		4.0		4.0		4.0		1.0
Gmm	JMF value		JMF value		JMF value		JMF value		0.030
Agg. Temp <sup>(5)</sup>	280 – 350F		280 – 350F		280 – 350F		280 – 350F		
Mix Temp <sup>(6)</sup>	265 – 325 F <sup>(1)</sup>		265 – 325 F <sup>(1)</sup>		265 – 325 F <sup>(1)</sup>		265 – 325 F <sup>(1)</sup>		
Prod. TSR	N/A		N/A		≥80%		N/A		
T-283 Stripping	N/A		N/A		Minimal as determined by the Engineer		N/A		

**TABLE M.04.03– 4: SUPERPAVE MASTER RANGE FOR TRAFFIC LEVELS AND DESIGN VOLUMETRIC PROPERTIES.**

Traffic Level	Design ESALs	Number of Gyration by Superpave Gyrotory Compactor	
	(million)	Nini	Ndes
1*	< 0.3	6	50
2	0.3 to < 3.0	7	75
3	≥3.0	8	100

\* NOTE: Level 1 for use by Towns and Municipalities ONLY.

**TABLE M.04.03– 5: SUPERPAVE MINIMUM BINDER CONTENT BY MIX TYPE & LEVEL.**

Mix Type	Level	Binder Content Minimum <sup>(1)</sup>
S0.25	1*	5.6
S0.25	2	5.5
S0.25	3	5.4
S0.375	1*	5.6
S0.375	2	5.5
S0.375	3	5.4
S0.5	1*	5.0
S0.5	2	4.9
S0.5	3	4.8
S1	1*	4.6
S1	2	4.5
S1	3	4.4

\* NOTE: Level 1 for use by Towns and Municipalities ONLY.

**Table M.04.03-6:  
Modifications to Standard AASHTO and ASTM Test Specifications and Procedures.**

<b>AASHTO Standard Specification</b>	
<b>Reference</b>	<b>Modification</b>
<b>M 320</b>	<p>1. Mass change for PG 64-22 shall be a maximum loss of 0.5% when tested in accordance with AASHTO T 240.</p> <p>2. The two bottles used for the mass change determination may be re-heated and used for further testing.</p>
<b>AASHTO Standard Methods of Test</b>	
<b>Reference</b>	<b>Modification</b>
<b>T 27</b>	Section 7.7 Samples are not washed
<b>T 30</b>	Section 6.2 thru 6.5 Samples are not routinely washed
<b>T 168</b>	<p>Samples are taken at one point in the pile. All types of bituminous concrete except Class 4 are scooped from the sample container instead of remixing and quartering. (Method verified by laboratory study).</p> <p>Samples from a hauling vehicle are taken from only one point instead of three as specified.</p> <p>Selection of Samples: Sampling is equally important as the testing, and the sampler shall use every precaution to obtain samples that are truly representative of the bituminous mixture.</p> <p>Box Samples: In order to enhance the rate of processing samples taken in the field by construction or maintenance personnel the samples will be tested in the order received and data processed to be determine conformance to material specifications and to prioritize inspections by laboratory personnel.</p>
<b>T 195</b>	Section 4.3 only one truck load of mixture is sampled. Samples are taken from opposite sides of the load.
<b>T 209</b>	<p>Article 9.5.1 Bowl is suspended 2 minutes prior to reading rather than 10 minutes. This makes no significant difference in results.</p> <p>Section 7.2 The average of two bowls is used proportionally in order to satisfy minimum mass requirements.</p> <p>8.3 Omit Pycnometer method.</p>
<b>T 245</b>	<p>Article 3.3.2 A compacting temperature of 140 to 146°C (284 to 295°F) is used</p> <p>Article 3.5.2 Seventy-five (75) blows per side are used on Classes 1 and 12, per ConnDOT design requirements</p> <p>Section 3.1 for production testing: one specimen is molded for each extraction test for production over 275 metric tons/day (300 tons/day). Other mixtures: two specimens per extraction test.</p>
<b>T 283</b>	When foaming technology is used, the material used for the fabrication of the specimens shall be cooled to room temperature, and then reheated to the manufactures recommended compaction temperature prior to fabrication of the

	specimens.
<b>T 308</b>	<p>In addition to the standard testing procedure, the Department has adopted a procedure that addresses a correction factor that is calculated using the composite aggregate percentages (Composite Aggregate Correction Factor Method (CACF)).</p> <p>The aggregate is burned in compliance with the standard AASHTO procedure Method A exclusively. All modifications are listed for this method only.</p> <p>A2.2 and A2.3 Omit</p> <p>A2.4 Omit. Replace with: Determine an aggregate gradation for each aggregate component “blank” in accordance with T30.</p> <p>A2.5 Omit. Replace with: The individual aggregate samples are to be dried in an oven at a maximum temperature of <math>148 \pm 5^{\circ}\text{C}</math> (<math>300 \pm 9^{\circ}\text{F}</math>) to a constant weight. RAP samples are to be oven dried at a maximum temperature of <math>110 \pm 5^{\circ}\text{C}</math> (<math>230 \pm 9^{\circ}\text{F}</math>) to a constant weight. RAP samples will be burned for total binder content only and not to arrive at a correction factor for a mixture.</p> <p>A2.6 and A2.7 and A2.8 Omit.</p> <p>A2.8.1 Omit Note 2</p> <p>A2.9 Omit. Replace with: Perform a gradation analysis on the residual aggregate in accordance with T30 and compare it to the gradation performed prior to burning.</p> <p>A2.9.1 and A2.9.2 Omit</p> <p>The correction factors for each size aggregate are provided by the Contractor to the Engineer prior to the Annual Plant Inspection. The Engineer may verify the correction factors. The Composite Aggregate Correction Factor (CACF) for any mixture may be calculated by summing the result of the correction factor for each individual aggregate multiplied by the percentage of that aggregate in the overall mixture.</p> <p>(Note: All correction factors must be re-calculated every time the percentage of any aggregate changes within the mixture.)</p> <p>If the average corrected Pb content from the ignition oven differs by 0.3% or more from the average bituminous concrete facility production weigh ticket in five (5) consecutive tests regardless of the production date (moving average), the Contractor shall immediately investigate, determine an assignable cause and correct the issue. When two consecutive moving average differences are 0.3% or more, the Engineer may require a new correction factor calculation for all the aggregate components in the mix.</p> <p>In addition to the standard testing procedure, the Department has adopted a procedure that addresses the time involved between sampling the hot-mix asphalt specimen and the beginning of the test.</p> <p>6.3 Omit. Replace with: The test specimen must be ready to be placed in an approved ignition furnace for testing within ten minutes of being obtained from the hauling vehicle and the test shall start immediately after.</p>

T 331	6.1 Cores are dried to a constant mass prior to testing using a core-dry machine.
<b>AASHTO Standard Recommended Practices</b>	
<b>Reference</b>	<b>Modification</b>
R 35	<p><b><u>Volumetric Calculations of VMA and Correction Factor</u></b>  VMA<sub>a</sub> - Voids in Mineral Aggregate from (V<sub>a</sub> + V<sub>b</sub>) the mix:</p> <p>A. VMA calculated from the mix shall be determined in accordance with <i>Formula 5.16.1A</i>. It can be correlated that the VMA calculated from AASHTO R-35 is equivalent to VMA<sub>a</sub> when the P<sub>b</sub> × (100-P<sub>b</sub>) / 100 is known and substituted for A<sub>cf</sub>, as shown in <i>Formula 5.16.1A (ii)</i>. Test results from VMA<sub>a</sub> shall therefore be required to meet all contract specifications. Values of VMA<sub>a</sub> that are out of specifications during production may be cause for the contractor to determine assignable reason, take corrective action, and modify the Job Mix Formula (JMF), as needed. Continued VMA<sub>a</sub> data that is out of specifications may be cause for the Engineer to order cessation of supply.</p> <p><i>Formula 5.16.1A</i>. Determining the VMA of bituminous concrete by the mix or air voids &amp; effective binder method:</p> $VMA_a = V_a + \left[ \frac{(Gmb_d \times (Pb_t - A_{cf}))}{G_b} \right]$ <p>Where: VMA<sub>a</sub> = VMA calculated from plant production mix( V<sub>a</sub> + V<sub>b</sub>)  Gmb<sub>d</sub> = Bulk specific gravity as determined by AASHTO T 166(M)  Pb<sub>t</sub> = Total Binder Content (corrected) by AASHTO T 308(M)  A<sub>cf</sub> = Absorption correction factor provided by Contractor (refer to B. i and ii)</p> <p>B. Determining the bituminous concrete mix binder correction factor for each class by use of percent absorption of water by AASHTO T 84/85, AASHTO M 323 and D<sub>f</sub> method. This value shall be performed by the Contractor during the mix design only and submitted as a JMF value. Two methods for determining the A<sub>cf</sub> are shown, although method (i) will be the desired method to be used. Both methods are equivalent when the G<sub>sa</sub>, G<sub>sb</sub> and P<sub>wa</sub> are recent and valid for the mix.</p> <p>i. <math>A_{cf} = D_f \times P_{wa} \times (100 - P_{b_t}) / 100</math>  ii. <math>A_{cf} = (P_{b_a} \text{ from annual JMF submittal}) \times (100 - P_{b_t}) / 100</math></p> <p>Where: D<sub>f</sub> = as determined by Formula 5.16.1B.  P<sub>wa</sub> = as determined by AASHTO T 84/85  P<sub>b<sub>a</sub></sub> = as determined by AASHTO M 323 (from annual JMF submittal)  D<sub>f</sub> (Density Factor): The Contractor shall calculate the bituminous concrete</p>

	<p>mix design <math>D_f</math> (derived from formula XI.2 APPENDIX XI of AASHTO R 35) for each class of material, in accordance with <i>Formula 5.16.1B</i>.</p> <p><i>Formula 5.16.1B.</i> Determining the Density Factor (<math>D_f</math>) of mix design bituminous concrete:</p> $D_f = \left( \frac{G_{se} - G_{sb}}{G_{sa} - G_{sb}} \right)$ <p>Where:  <math>D_f</math> = Density Factor or multiplier determined by AASHTO R-35(M)  <math>G_{se}</math> = Effective Specific Gravity determined by AASHTO M-323 at plant  <math>G_{sa}</math> = Apparent Specific Gravity determined by AASHTO T 84/85 of mix design  <math>G_{sb}</math> = Bulk Specific Gravity determined by AASHTO T 84/85 of mix design</p>
<p><b>R 26</b></p>	<p>Quality Control Plans must be formatted in accordance with AASHTO R 26, certifying suppliers of performance-graded asphalt binders, Section 9.0, Suppliers Quality Control Plan, and “NEAUPG Model PGAB QC Plan.”</p> <ol style="list-style-type: none"> <li>1. The Department requires that all laboratory technician(s) responsible for testing PG-binders be certified or Interim Qualified by the New England Transportation Technician Certification Program (NETTCP) as a PG Asphalt Binder Lab Technician.</li> <li>2. Sampling of asphalt binders should be done under the supervision of qualified technician. NETCP “Manual of Practice,” Chapter 2 Page 2-4 (Key Issues 1-8).</li> <li>3. A copy of the Manual of Practice for testing asphalt binders in accordance with the Superpave PG Grading system shall be in the testing laboratory.</li> <li>4. All laboratories testing binders for the Department are required to be accredited by the AASHTO Materials Reference Laboratory (AMRL).</li> <li>5. Sources interested in being approved to supply PG-binders to the Department by use of an “in-line blending system,” must record properties of blended material, and additives used.</li> <li>6. Each source of supply of PG-binder must indicate that the binders contain no additives used to modify or enhance their performance properties. Binders that are manufactured using additives, modifiers, extenders etc., shall disclose the type of additive, percentage and any handling specifications/limitations required.</li> </ol> <p>Suppliers shall provide AASHTO M-320 Table 2 testing at a minimum of once per month on one sample of material. Each supplier shall rotate the PG grade each month (including polymer-modified asphalt (PMA)), so that data can be collected for all the grades produced.</p>

## **ON-THE-JOB TRAINING (OJT) WORKFORCE DEVELOPMENT PILOT**

### **Description**

To provide construction industry related job opportunities to minorities, women and economically disadvantaged individuals; and to increase the likelihood of a diverse and inclusive workforce on Connecticut Department of Transportation (ConnDOT) projects.

All contractors (existing and newcomers) will be automatically placed in the Workforce Development Pilot. Standard OJT requirements typically associated with individual projects will no longer be applied at the project level for new projects. Instead, these requirements will be applicable on an annual basis for each contractor performing work on ConnDOT projects.

The OJT Workforce Development Pilot will allow a contractor to train employees on Federal, State and privately funded projects located in Connecticut. However, contractors should give priority to training employees on ConnDOT Federal Aid funded projects.

### **Funding**

The Department will establish an OJT fund annually from which contractors may bill the Department directly for eligible trainee hours. The funds for payment of trainee hours on federal aid projects will be allocated from the ½ of 1% provided for OJT funding, and will be based on hours trained, not to exceed a maximum of \$25,000.00 per year; per contractor.

### **Minorities and Women**

Developing, training and upgrading of minorities, women and economically disadvantaged individuals toward journeyman level status is the primary objective of this special training provision. Accordingly, the Contractor shall make every effort to enroll minority, women and economically disadvantaged individuals as trainees to the extent that such persons are available within a reasonable area of recruitment. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training whether a member of a minority group or not.

### **Assigning Training Goals**

The Department, through the OJT Program Coordinator, will assign training goals for a calendar year based on the contractor's past two year's activities and the contractor's anticipated upcoming year's activity with the Department. At the beginning of each year, all contractors eligible will be contacted by the Department to determine the number of trainees that will be assigned for the upcoming calendar year. At that time, the Contractor shall enter into an agreement with the Department to provide a self-imposed on-the-job training program for the calendar year. This agreement will include a specific number of annual training goals agreed to by both parties. The number of training assignments may range from one (1) to six (6) per

contractor per calendar year. Each January, a summary of the trainees required and the OJT Workforce Development Pilot package will be sent to participating contractors. The number of trainees assigned to each contractor in the summary will increase proportionately not to exceed 6, as shown in the following table. This package will also be provided to contractors as they become newly eligible for the OJT Workforce Development Pilot throughout the remainder of the year. Projects awarded after September 30 will be included in the following year's Program.

The dollar thresholds for training assignments are as follows:

\$4.5 – 8 million=	1 trainee
\$ 9 – 15 million=	2 trainees
\$16 – 23 million=	3 trainees
\$24 – 30 million=	4 trainees
\$31 – 40 million=	5 trainees
\$41 – and above=	6 trainees

**Training Classifications**

Preference shall be given to providing training in the following skilled work classifications. However, the classifications established are not all-inclusive:

Equipment Operators	Electricians
Laborers	Painters
Carpenters	Iron / Reinforcing Steel Workers
Concrete Finishers	Mechanics
Pipe Layers	Welders

The Department has on file common training classifications and their respective training requirements; that may be used by the contractors. Contractors shall submit new classifications for specific job functions that their employees are performing. The Department will review and recommend for acceptance the new classifications proposed by contractors, if applicable. New classifications shall meet the following requirements:

Proposed training classifications are reasonable and realistic based on the job skill classification needs, and the number of training hours specified in the training classification is consistent with common practices and provides enough time for the trainee to obtain journeyman level status.

Where feasible, 25% percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. The number of trainees shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment.

No employee shall be employed as a trainee in any classification in which they have successfully completed a training course leading to journeyman level status or in which they have been employed as a journeyman.

## **Records and Reports**

The Contractor shall maintain enrollment in the program and submit all required reports documenting company compliance under these contract requirements. These documents and any other information shall be submitted to the OJT Program Coordinator as requested.

Upon the trainee's completion and graduation from the program, the Contractor shall provide each trainee with a certification Certificate showing the type and length of training satisfactorily completed.

## **Trainee Interviews**

In order to determine the continued effectiveness of the OJT Program in Connecticut, the department will periodically conduct personal interviews with current trainees and may survey recent graduates of the program. This enables the OJT Program Coordinator to modify and improve the program as necessary. Trainee interviews are generally conducted at the job site to ensure that the trainees' work and training is consistent with the approved training program.

## **Trainee Wages**

Contractors shall compensate trainees on a graduating pay scale based upon a percentage of the prevailing minimum journeyman wages (Davis-Bacon Act). Minimum pay shall be as follows:

60 percent	of the journeyman wage for the first half of the training period
75 percent	of the journeyman wage for the third quarter of the training period
90 percent	of the journeyman wage for the last quarter of the training period

*In no case, will the trainee be paid less than the prevailing rate for general laborer as shown in the contract wage decision (must be approved by the Department of Labor).*

## **Achieving or Failing to Meet Training Goals**

The Contractor will be credited for each trainee currently enrolled or who becomes enrolled in the approved training program and providing they receive the required training under the specific training program. Trainees will be allowed to be transferred between projects if required by the Contractor's schedule and workload. The OJT Program Coordinator must be notified of transfers within five (5) days of the transfer or reassignments by email ([Phylisha.Coles@ct.gov](mailto:Phylisha.Coles@ct.gov)).

Where a contractor does not or cannot achieve its annual training goal with female or minority trainees, they must produce adequate Good Faith Efforts documentation. Good Faith Efforts are those designed to achieve equal opportunity through positive, aggressive, and continuous result-oriented measures. 23 CFR § 230.409(g) (4). Contractors should request minorities and females from unions when minorities and females are underrepresented in the contractor's workforce.

Whenever a contractor requests ConnDOT approval of someone other than a minority or female, the contractor must submit documented evidence of its Good Faith Efforts to fill that position with a minority or female. When a non-minority male is accepted, a contractor must continue to attempt to meet its remaining annual training goals with females and minorities.

Where a contractor has neither attained its goal nor submitted adequate Good Faith Efforts documentation, ConnDOT will issue a letter of non-compliance. Within thirty (30) days of receiving the letter of non-compliance, the contractor must submit a written Corrective Action Plan (CAP) outlining the steps that it will take to remedy the non-compliance. The CAP must be approved by ConnDOT. Failure to comply with the CAP may result in your firm being found non-responsive for future projects.

### **Measurement and Payment**

Optional reimbursement will be made to the contractor for providing the required training under this special provision on ConnDOT Federal6Aid funded projects only.

Contractor will be reimbursed at \$0.80 for each hour of training given to an employee in accordance with an approved training or apprenticeship program. This reimbursement will be made even though the Contractor receives additional training program funds from other sources, provided such other source does not specifically prohibit the contractor from receiving other reimbursement.

Reimbursement for training is made annually or upon the trainees completion and not on a monthly basis. No payment shall be made to the Contractor if either the failure to provide the required training, or the failure to hire the trainee as a journeyman, is caused by the Contractor.

Program reimbursements will be made directly to the prime contractor on an annual basis. To request reimbursement, prime contractors must complete the Voucher for OJT Workforce Development Pilot Hourly Reimbursement for each trainee in the OJT Program. This form is included in the OJT Workforce Development Pilot package and is available on the Department's web site at:

[www.ct.gov/dot](http://www.ct.gov/dot)

The completed form must be submitted to the Office of Contract Compliance for approval. The form is due on the 15<sup>th</sup> day of January for each trainee currently enrolled and for hours worked on ConnDOT Federal6Aid funded projects only.

## **SMALL CONTRACTOR AND SMALL CONTRACTOR MINORITY BUSINESS ENTERPRISES (SET-ASIDE)**

March, 2001

NOTE: Certain of the requirements and procedures stated in this "Special Provision" are applicable prior to the execution of the Contract.

### **I. GENERAL**

- A. The Contractor shall cooperate with the Connecticut Department of Transportation (CONNDOT) in implementing the required contract obligations concerning "Small Contractor" and "Small Contractor Minority Business Enterprise" use on this Contract in accordance with Section 4a-60g of the Connecticut General Statutes as revised. References, throughout this "Special Provision", to "Small Contractors" are also implied references to "Small Contractor Minority Business Enterprises" as both relate to Section IIA of these provisions. The Contractor shall also cooperate with CONNDOT in reviewing the Contractor's activities relating to this provision. This "Special Provision" is in addition to all other equal opportunity employment requirements of this Contract.
- B. For the purpose of this "Special Provision", the "Small Contractor(s)" and "Minority Business Enterprise(s)" named to satisfy the set-aside requirement must be certified by the Department of Administrative Services, Business Connections/ Set-Aside Unit [(860) 713-5236 [www.das.state.ct.us/busopp.htm](http://www.das.state.ct.us/busopp.htm)] as a "Small Contractor" and "Minority Business Enterprises" as defined by Section 4a-60g Subsections (1) and (3) of the Connecticut General Statutes as revised and is subject to approval by CONNDOT to do the work for which it is nominated pursuant to the criteria stipulated in Section IIC-3.
- C. Contractors who allow work which they have designated for "Small Contractor" participation in the pre-award submission required under Section IIC to be performed by other than the approved "Small Contractor" organization and prior to concurrence by CONNDOT, will not be paid for the value of the work performed by organizations other than the "Small Contractor" designated.
- D. If the Contractor is unable to achieve the specified contract goals for "Small Contractor" participation, the Contractor shall submit written documentation to CONNDOT's Manager of Construction Operations indicating his/her good faith efforts to satisfy goal requirements. Documentation is to include but not be limited to the following:

1. A detailed statement of the efforts made to select additional subcontract opportunities for work to be performed by each "Small Contractor" in order to increase the likelihood of achieving the stated goal.
  2. A detailed statement, including documentation of the efforts made to contact and solicit contracts with each "Small Contractor", including the names, addresses, dates and telephone numbers of each "Small Contractor" contacted, and a description of the information provided to each "Small Contractor" regarding the scope of services and anticipated time schedule of items proposed to be subcontracted and the nature of response from firms contacted.
  3. For each "Small Contractor" that placed a subcontract quotation which the Contractor considered not to be acceptable, provide a detailed statement of the reasons for this conclusion.
  4. Documents to support contacts made with CONNDOT requesting assistance in satisfying the contract specified or adjusted "Small Contractor" dollar requirements.
  5. Document other special efforts undertaken by the Contractor to meet the defined goal.
- E. Failure of the Contractor to have at least the specified dollar amount of this contract performed by "Small Contractor" as required in Section IIA of this "Special Provision" will result in the reduction in contract payment to the Contractor by an amount equivalent to that determined by subtracting from the specific dollar amount required in Section IIA, the dollar payments for the work actually performed by each "Small Contractor". The deficiency in "Small Contractor" achievement, will therefore, be deducted from the final contract payment. However, in instances where the Contractor can adequately document or substantiate its good faith efforts made to meet the specified or adjusted dollar amount to the satisfaction of CONNDOT, no reduction in payments will be imposed.
- F. All records must be retained for a period of three (3) years following completion of the contract and shall be available at reasonable times and places for inspection by authorized representatives of CONNDOT.
- G. Nothing contained herein, is intended to relieve any contractor or subcontractor or material supplier or manufacturer from compliance with all applicable Federal and State legislation or provisions concerning equal employment opportunity, affirmative action, nondiscrimination and related subjects during the term of this Contract.

## II. SPECIFIC REQUIREMENTS

In order to increase the participation of "Small Contractors", CONNDOT requires the following:

- A. Not less than 7.0 (%) percent of the **final** value of this Contract shall be subcontracted to and performed by, and/or supplied by, manufactured by and paid to "Small Contractors" and/or "Small Contractors Minority Business Enterprises".

*If the above percentage is zero (0%) AND an asterisk (\*) has been entered in the adjacent brackets [     ], this Contract is 100% solely set-aside for participation by "Small Contractors" and/or "Small Contractors Minority Business Enterprises".*

- B. The Contractor shall assure that each "Small Contractor" will have an equitable opportunity to compete under this "Special Provision", particularly by arranging solicitations, time for the preparation of Quotes, Scope of Work, and Delivery Schedules so as to facilitate the participation of each "Small Contractor".
- C. The Contractor shall provide to CONNDOT's Manager of Contracts within Seven (7) days after the bid opening the following items:
1. An affidavit (Exhibit I) completed by each named "Small Contractor" subcontractor listing a description of the work and indicating the dollar amount of all contract(s) and/or subcontract(s) that have been awarded to him/her for the current State Fiscal Year (July 1 - June 30) does not exceed the Fiscal Year limit of \$10,000,000.00.
  2. A certification of work to be subcontracted (Exhibit II) signed by both the Contractor and the "Small Contractor" listing the work items and the dollar value of the items that the nominated "Small Contractor" is to perform on the project to achieve the minimum percentage indicated in Section IIA above.
  3. A certification of past experience (Exhibit III) indicating the scope of work the nominated "Small Contractor" has performed on all projects, public and private, for the past two (2) years.
  4. In instances where a change from the originally approved named "Small Contractor" (see Section IB) is proposed, the Contractor is required to submit, in a reasonable and expeditious manner, a revised submission, comprised of the documentation required in Section IIC, Paragraphs 1, 2 and 3 and Section E together with documentation to substantiate and

justify the change, (i.e., documentation to provide a basis for the change) to CONNDOT's Manager of Construction Operations for its review and approval prior to the implementation of the change. The Contractor must demonstrate that the originally named "Small Contractor" is unable to perform in conformity to specifications, or unwilling to perform, or is in default of its contract, or is overextended on other jobs. The Contractor's ability to negotiate a more advantageous contract with another "Small Contractor" is not a valid basis for change. Documentation shall include a letter of release from the originally named "Small Contractor" indicating the reason(s) for the release.

- D. After the Contractor signs the Contract, the Contractor will be required to meet with CONNDOT's Manager of Construction Operations or his/her designee to review the following:
1. What is expected with respect to the "Small Contractor" set aside requirements.
  2. Failure to comply with and meet the requirement can and will result in monetary deductions from payment.
  3. Each quarter after the start of the "Small Contractor" the Contractor shall submit a report to CONNDOT's Manager of Construction Operations indicating the work done by, and the dollars paid to each "Small Contractor" to date.
  4. What is required when a request to sublet to a "Small Contractor" is submitted.
- E. The Contractor shall submit to CONNDOT's Manager of Construction Operations all requests for subcontractor approvals on standard forms provided by the Department.

If the request for approval is for a "Small Contractor" subcontractor for the purpose of meeting the contract required "Small Contractor" percentage stipulated in Section IIA, a copy of the legal contract between the Contractor and the "Small Contractor" subcontractor must also be submitted at the same time. Any subsequent amendments or modifications of the contract between the Contractor and the "Small Contractor" subcontractor must also be submitted to CONNDOT's Manager of Construction Operations with an explanation of the change(s). The contract must show items of work to be performed, unit prices and, if a partial item, the work involved by both parties.

In addition, the following documents are to be attached:

- (1) A statement explaining any method or arrangement for renting equipment. If rental is from a Contractor, a copy of Rental Agreement must be submitted.
- (2) A statement addressing any special arrangements for manpower.
- (3) A statement addressing who will purchase material.

F. Contractors subcontracting with a "Small Contractor" to perform work or services as required by this "Special Provision" shall not terminate such firms without advising CONNDOT, in writing, and providing adequate documentation to substantiate the reasons for termination if the designated "Small Contractor" firm has not started or completed the work or the services for which it has been contracted to perform.

G. Material Suppliers or Manufacturers

If the Contractor elects to utilize a "Small Contractor" supplier or manufacturer to satisfy a portion or all of the specified dollar requirements, the Contractor must provide the Department with:

1. An executed Affidavit Small Contractor (Set-Aside) Connecticut Department of Transportation Affidavit Supplier or Manufacturer (sample attached), and
2. Substantiation of payments made to the supplier or manufacturer for materials used on the project.

Brokers and packagers shall not be regarded as material Suppliers or manufacturer.

H. Non-Manufacturing or Non-Supplier "Small Contractor" Credit

Contractors may count towards its "Small Contractor" goals the following expenditures with "Small Contractor" firms that are not manufacturers or suppliers:

1. Reasonable fees or commissions charged for providing a bona fide service such as professional, technical, consultant or managerial services and assistance in the procurement of essential personnel, facilities, equipment, material or supplies necessary for the performance of the contract provided that the fee or commission is determined by the Department of Transportation to be reasonable and consistent with fees customarily allowed for similar services.

2. The fees charged for delivery of materials and supplies required on a job site (but not the cost of the materials and supplies themselves) when the hauler, trucker, or delivery service is not also the manufacturer of or a regular dealer in the materials and supplies, provided that the fee is determined by the Department of Transportation to be reasonable and not excessive as compared with fees customarily allowed for similar services.
3. The fees or commissions charged for providing any bonds or insurance specifically required for the performance of the Contract, provided that the fee or commission is determined by the Department of Transportation to be reasonable and not excessive as compared with fees customarily allowed for similar services.

### III. **BROKERING**

For the purpose of this "Special Provision", a "Broker" is one who acts as an agent for others in negotiating contracts, purchases, sales, etc., in return for a fee or commission. Brokering of work by a "Small Contractor" is not allowed and is a contract violation.

### IV. **PRE-AWARD WAIVERS:**

If the Contractor's submission of the "Small Contractor" listing, as required by Section IIC indicates that it is unable, by subcontracting to obtain commitments which at least equal the amount required by Section IIA, it may request, in writing, a waiver of up to 50% of the amount required by Section IIA. To obtain such a waiver, the Contractor must submit a completed "Application for Waiver of Small Contractor Minority Business Enterprise Goals" to CONNDOT's Manager of Contracts which must also contain the following documentation:

1. Information described in Section ID.
2. For each "Small Contractor" contacted but unavailable, a statement from each "Small Contractor" confirming its unavailability.

Upon receipt of the submission requesting a waiver, the CONNDOT's Manager of Contracts shall submit the documentation to the Director of the Office of Contract Compliance who shall review it for completeness. After completion of the Director of Contract Compliance's review, she/he should write a narrative of his/her findings of the application for a waiver, which is to include his/her recommendation. The Director of Contract Compliance shall submit the written narrative to the Chairperson of the DBE Screening Committee at least five (5) working days before the scheduled meeting. The Contractor shall be invited to attend the meeting and present his/her position. The DBE Screening Committee shall render a decision on the waiver request within five (5)

working days after the meeting. The DBE Screening Committee's decision shall be final. Waiver applications are available from the CONNDOT Manager of Contracts.

SMALL CONTRACTOR/\*MINORITY BUSINESS ENTERPRISE
(\* Delete if not Applicable)
SET-ASIDE PROGRAM
(QUALIFICATION AFFIDAVIT)

PROJECT(s) \_\_\_\_\_
(INCLUDING TOWN & DESCRIPTION)

STATE OF \_\_\_\_\_ CONNECTICUT \_\_\_\_\_

COUNTY OF \_\_\_\_\_

I \_\_\_\_\_, ACTING IN BEHALF

OF \_\_\_\_\_, DO HEREBY CERTIFY

PERSON FIRM OR ORGANIZATION

AND AFFIRM THAT THE INFORMATION SET FORTH BELOW IS TRUE AND ACCURATE TO THE BEST OF MY KNOWLEDGE. AS OF THIS DATE \_\_\_\_\_ THE LIST OF SMALL CONTRACTOR SET-ASIDE PROGRAM - CONTRACTS AND/OR SUBCONTRACTS AWARDED DURING THE CURRENT FISCAL YEAR ( JULY 1 - JUNE 30) 20 \_\_\_\_\_ IS AS FOLLOWS:

Table with 5 columns: Col. 1 TOWN AND PROJECT NUMBER, Col. 2 STATE AGENCY WHICH AWARDED CONTRACT, Col. 3 CONTRACT AMOUNT AWARDED UNDER THIS PROGRAM, Col. 4 AMOUNT OF WORK SUBCONTRACTED FROM OTHER FIRMS UNDER THIS PROGRAM, Col. 5 TOTAL AMOUNT OF ALL WORK UNDER THIS PROGRAM Col. 3 Plus Col. 4. Includes a 'TOTALS' row at the bottom.

NAME OF PERSON, FIRM OR ORGANIZATION

(FIRM SEAL)

SIGNATURE & TITLE OF OFFICIAL

SWORN TO AND SUBSCRIBED BEFORE ME BY \_\_\_\_\_

WHO IS PERSONALLY KNOWN TO ME, THIS \_\_\_\_\_ DAY OF \_\_\_\_\_, 20 \_\_\_\_\_

(NOTARY PUBLIC)

MY COMMISSION EXPIRES \_\_\_\_\_ SEAL

PLEASE NOTE THAT ALL THE WORK AWARDED OR SUBCONTRACTED TO YOUR FIRM UNDER THE SET-ASIDE PROGRAM IN A FISCAL YEAR (JULY 1-JUNE 30) INCLUDING THIS PROJECT, CANNOT BE MORE THAN \$10,000,000.00



EXHIBIT III CERTIFICATION  
PAST CONSTRUCTION EXPERIENCE

Mar. 01

SMALL CONTRACTOR / \* MINORITY BUSINESS ENTERPRISES \* Delete if not applicable

PLEASE LIST ALL CONSTRUCTION PROJECTS YOUR ORGANIZATION HAS WORKED ON IN THE PAST TWO FISCAL YEARS

PROJECT LOCATION NUMBER AND DESCRIPTION APPLICABLE	CONTRACT AMOUNT	IF WORK PERFORMED AS PRIME GIVE OWNERS NAME IF WORK PERFORMED AS SUBCONTRACTOR GIVE CONTRACTORS NAME	START DATE	ACTUAL OR ESTIMATED COMPLETION DATE	NAME AND PHONE OF OWNER OR PRIME CONTRACTOR AS

SIGNED BY: \_\_\_\_\_  
 SMALL BUSINESS CONTRACTOR  
 \*MINORITY BUSINESS ENTERPRISES  
 D.O.T. PROJECT NO. \_\_\_\_\_  
 \* Delete if not applicable

MARCH, 2001

**SMALL CONTRACTOR/SMALL CONTRACTOR MINORITY BUSINESS ENTERPRISE  
(MBE) (SET-ASIDE) CONNECTICUT DEPARTMENT OF TRANSPORTATION  
AFFIDAVIT – SUPPLIER OR MANUFACTURER**

This affidavit must be completed by the State Contractor's designated Small Contractor/ Small Contractor Minority Business Enterprise (MBE), notarized and attached to the contractor's request to utilize a Small Contractor/Small Contractor Minority Business Enterprise (MBE) supplier or manufacturer as a credit towards its Small Contractor/Small Contractor Minority Business Enterprise (MBE) contract requirement; failure to do so will result in not receiving credit towards the contract Small Contractor/Small Contractor Minority Business Enterprise (MBE) requirement.

State Project No. \_\_\_\_\_  
Federal Aid Project No. \_\_\_\_\_  
Description of Project \_\_\_\_\_

I, \_\_\_\_\_, acting in behalf of \_\_\_\_\_  
(Name of person signing Affidavit) (Small Contractor/Small Contractor MBE contractor person,  
\_\_\_\_\_ of which I am the \_\_\_\_\_ affirm that \_\_\_\_\_  
firm, association or certify and corporation) (Title of Person) (Small  
Contractor/Small Contractor MBE person, firm, association or corporation)  
\_\_\_\_\_ is a certified Small Contractor/Small  
Contractor Minority Business Enterprise, as defined by Section 4a-60g of the Connecticut General  
Statutes, as revised.

I further certify and affirm that \_\_\_\_\_  
(Small Contractor/Small Contractor MBE person, firm, association or corporation)  
will assume the actual and contractual responsibility for the provision of the materials and/or supplies  
sought by \_\_\_\_\_. If a manufacturer, I produce goods from raw  
(State Contractor)  
materials or substantially alter them before resale, or if a supplier, I perform a commercially useful  
function in the supply process.

I understand that false statements made herein are punishable at Law (Sec. 53a-157, CGS, as revised).

\_\_\_\_\_  
(Name of Small Contractor/Small Contractor MBE person, firm, association or corporation)

\_\_\_\_\_  
(Signature and Title of Official making the Affidavit)

Subscribed and sworn to before me, the \_\_\_\_\_ day of \_\_\_\_\_ 200\_\_\_\_\_.

\_\_\_\_\_  
Notary Public (Commissioner of the Superior Court)

My Commission Expires \_\_\_\_\_

**CERTIFICATE OF CORPORATION**

I, \_\_\_\_\_, certify that I am the \_\_\_\_\_  
(Official) of the Corporation named in the foregoing instrument; that I have been duly authorized to affix  
the seal of the Corporation to such papers as require the seal; that \_\_\_\_\_, who  
signed said instrument on behalf of the Corporation, was then \_\_\_\_\_ of  
said corporation; that said instrument was duly signed for and in behalf of said Corporation by authority  
of its governing body and is within the scope of its corporation powers.

\_\_\_\_\_  
(Signature of Person Certifying)

\_\_\_\_\_  
(Date)

(Corporate Seal)

## **ITEM #0100500A – CONSTRUCTION COMMUNICATION EQUIPMENT**

**Description:** Under this item, the Contractor shall provide authorized communication equipment for use by the inspection personnel. This item shall include all necessary equipment, accessories, material and labor and maintenance to make the system operational, including Bluetooth. Provisions shall also be made to maintain all provided communication equipment and any additional communication equipment assigned to the project, as directed by the Engineer.

**Materials:** The equipment for this item shall conform to the following: Wireless communications capable of communicating digitally between units. In addition, the equipment shall have the ability to send and receive Text and Numeric messaging, voice mail, caller ID, and call waiting.

The Engineer will provide the Contractor with the quantities of the communication equipment needed.

**Construction Methods:** The Contractor, upon receipt of the specifications from the Engineer, shall submit three (3) proposals for each item specified.

The three proposals may be for either rental or purchase, of new or reconditioned equipment. The Engineer will inform the Contractor of his selection. Once approved, the contractor shall order the equipment, and have it installed and operating within fifteen (15) working days.

All equipment and associated materials shall remain the property of the State upon completion of the project.

**Method of Measurement:** The measurement for payment of Construction Communication Equipment will be provided for under Article 1.09.04 Extra and Cost Plus work.

The sum of money shown on the estimate and in the itemized proposal as “Estimated Cost” for this work will be considered the bid price even though payment will be made only for actual cost of equipment, material, service contracts, accessories and labor. The estimated cost figure is not to be altered in any manner by the bidder. If the bidder alters the amount shown, the altered figures will be disregarded, and the original price will be used to determine the total bid for the contract.

**Basis of Payment:** The item “Construction Communication Equipment” will be paid as cost plus work in accordance with Article 1.09.04 (b) Specialized Work.

Payment will include all authorized materials, equipment, labor, service charges and maintenance incidental thereto.

<b><u>Pay Item</u></b>	<b><u>Pay Unit</u></b>
Construction Communication Equipment	EST

ITEM #0100500A

## **ITEM #0202479A – REMOVAL OF HMA WEARING SURFACE**

**Description:** Work under this item shall consist of the complete removal and disposal of the existing HMA wearing surface, deck expansion joint system, membrane waterproofing and bond breaker covering the reinforced concrete bridge deck as shown on the plans, as ordered by the Engineer and in accordance with these specifications. The work shall also include performing an exploration of pavement thickness and joint location near the gutterline before removal of HMA begins.

**Construction Methods:** Prior to removal of HMA wearing surface and any deck expansion joint system and material, the Contractor shall locate the centerline of joint by excavating wearing surface near the gutterline to expose the joint. Contractor shall then determine limits of removal of wearing surface relative to the joint opening as noted on the plans. The Contractor shall remove the HMA wearing surface, deck expansion joint system, membrane waterproofing and bond breaker using means acceptable to the Engineer to completely expose the underlying concrete deck, without damaging the deck, roadway materials, and structures which are to remain intact.

Acceptable mechanical method for removal of HMA surface on a structure can be one of the following:

**Micro-milling** - Micro-milling equipment shall consist of Cold Plane or Rotomill Grinders using carbide cutting tools in a rotary drum. The equipment shall provide a tool spacing of not more than  $\frac{3}{16}$  inch, capable of leaving a smooth, uniform pattern of striations with a maximum forward speed of 45 feet/minute.

**Fine Milling** – Fine milling equipment shall consist of Cold Plane or Rotomill Grinders using carbide cutting tool in a rotary drum. The equipment shall provide a tool spacing of not more than  $\frac{5}{16}$  inch, capable of leaving a smooth, uniform pattern of striations with a maximum forward speed of 45 feet/minute.

Alternate methods may be submitted to the Engineer for review and acceptance. Demonstration of the alternate removal method shall be performed prior to consideration.

All particles and aggregate adhering to the exposed concrete that could, in the Engineer's opinion, cause failure of/or puncture the new membrane shall be removed. The existing HMA wearing surface, membrane waterproofing, and bond breaker that are removed shall be disposed of offsite by the Contractor unless otherwise noted in the contract documents or as directed by the Engineer.

Prior to removal of HMA wearing surface the Contractor shall conduct a survey. A minimum of four (4) representative depth measurements shall be taken per span for a span up to 100 feet in length to predetermine the overlay thickness. An additional measurement shall be taken for each 25 feet in span length. If depth of overlay varies across the structure, it shall be clearly marked

to aid in the removal operation. Survey locations shall be filled with bituminous material if milling operation is not scheduled within five (5) days or at the direction of the Engineer.

The existing HMA wearing surface joint system and membrane waterproofing shall be removed in its entirety to the limits shown on the plans. The removal operations shall not begin until the Contractor is prepared to perform the permanent patching and/or repair to the underlying concrete within five (5) working days. If this in conflict with "Prosecution and Progress", "Maintenance and Protection of Traffic", or other contract requirements, the more stringent specification shall apply.

Protection shall be provided around existing catch basin inlets, bridge scuppers, manholes, utility valve boxes, median barriers, parapets, and other roadway structures. Any damage to such structures as a result of removal operations is the Contractor's responsibility and shall be repaired at the Contractor's expense.

A uniform textured riding surface shall be provided and maintained. The surface shall be free from gouges, longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, improper use of equipment, poor workmanship, or inadequate survey. Any unsatisfactory surfaces caused by the removal operations are the Contractor's responsibility and shall be corrected at the Contractor's expense and to the satisfaction of the Engineer prior to opening the surface to traffic.

Any raised structures shall be clearly marked by high visibility paint and delineated with traffic control devices, as directed by the Engineer. Installation of traffic control devices will be included under the costs for "Maintenance and Protection of Traffic"; payment for the devices will be under their applicable items.

No vertical faces, transverse or longitudinal, shall be left exposed to traffic. If any vertical face is formed in an area exposed to traffic a temporary paved transition will be established according to the requirements shown on the plans. If the milling machine is used to form a temporary transition, the length of the temporary transition shall conform to, Section 4.06 – Bituminous Concrete, "Transitions for Roadway Surface", the requirements shown on the plans, or as directed by the Engineer. At all permanent limits of removal, a clean vertical face shall be established prior to paving by saw cutting.

The sweeper shall be equipped with a water tank and be capable of removing the millings and loose debris from the surface. Other sweeping equipment may be provided in lieu of the sweeper where acceptable by the Engineer.

**Method of Measurement:** This work will be measured for payment by the number of square yards of HMA wearing surface and joint system removed to expose the underlying concrete deck. No area deductions will be made for minor unmilled areas such as scuppers, joints, and any similar structures. The work necessary for the exploration at the gutterline should be included in the general cost of the work and will not be measured separately for payment.

**Basis of Payment:** This work will be paid for at the contract unit price per square yard for "Removal of HMA Wearing Surface", complete and accepted, which price shall include the removal of deck expansion joint system, membrane waterproofing and bond breaker, and all equipment, tools and labor.

Pay Item	Pay Unit
<b>Removal of HMA Wearing Surface</b>	<b>S.Y.</b>

**ITEM #0401152A – CONCRETE PAVEMENT REPLACEMENT FOR ROADWAY (FULL-DEPTH)**

**Article 4.01.01 - Description:**

*Delete the entire article and add the following:*

This work shall consist of replacing full-depth concrete pavement at locations as designated by the Engineer.

**Article 4.01.02 - Materials:**

*After the last sentence add the following:*

Mix I: The Contractor shall design and submit a Portland cement concrete mix to the Engineer for approval. Mix I shall be used only when the ambient air temperature is 65 degrees F or higher, and where there is unlimited cure time.

Mix II: The Contractor shall design and submit a high-early strength Portland cement concrete mix to the Engineer for approval. Mix II shall be used only when the ambient air temperature is 65 degrees F or higher, and where there is restricted cure time.

Mix III: The Contractor shall submit a proprietary, rapid-setting concrete mix or Mix IV to the Engineer for approval. These mixes are to be used when the ambient air temperature at the time of placement falls between the range of 30 to 65 degrees F.

Mix IV: The Contractor shall design and submit a high-early, cold weather concrete mix to the Engineer for approval. The aggregate sizes shall be designed by the Contractor so as to function properly given the job conditions. This mix shall be used in conjunction with the requirements as detailed under Section 19, "Cold Weather Concreting," of the Construction Methods detailed herein. Prior to approval, the Contractor shall demonstrate his ability to successfully utilize this mix.

**Additional Materials:**

Insulating material will conform to the requirements of ASTM C578.

Expansion joint material will conform to AASHTO M153, Type 2.

**Article 4.01.03 - Construction Methods:**

*Delete Subarticle F-2 and H-1; add the following:*

Construction Methods not specifically covered in this specification shall conform to 4.01.03:

## 1. COMPOSITION:

The Contractor shall submit a mix design to the Engineer for each of the mixes listed below. The mix design calculations shall include certified test results documenting the strength requirements relative to temperature restrictions for the available cure time.

**These designs must be submitted at least 30 days prior to the start of the contract.**

Mix I will be composed of Portland cement, fine and coarse aggregate, water, and approved concrete admixtures.

Mix II will be composed of Portland cement, fine and coarse aggregate, water and approved concrete admixtures. Accelerators will be non-chloride, and will conform to AASHTO M-194. Accelerators shall be used in strict accordance with the manufacturer's recommendations and procedures. Precautions shall be taken to ensure compatibility of the air-entraining and non-chloride accelerating admixtures. High range water reducing agents (superplasticizers) may be used in the mix design if approved by the Engineer. The maximum allowable slump will be increased to 7 inches when superplasticizers are used, provided that the water-cement ratio is not exceeded and the mix does not exhibit segregation. The specified air content will be  $6-1/2 \pm 1-1/2$  percent when superplasticizers are included in the mix. The superplasticizers shall be added on-site to avoid rapid slump loss. Slump measurements shall be taken before and after the addition of the superplasticizer. Additional superplasticizer may be added to the mix with approval of the Engineer.

Mix III will strictly follow the manufacturer's recommendations with regard to the composition of the concrete mix. The mix will contain an air-entraining agent, and the percentages of entrained air will be maintained at  $6-1/2 \pm 1-1/2$  percent. The percentage of required entrained air in the mix may be reduced by the Engineer, providing that the product manufacturer can demonstrate that the durability of the material is satisfactory when the amount of entrained air is reduced. The Contractor shall submit substantive testing documentation, which verifies the above requirement, to the Engineer for approval.

Mix IV will be of the same composition as Mix II, with the following additional requirements:

1. Only Type III Portland cement will be utilized in the mix, with its minimum content being 850 pounds per cubic yard of concrete.
2. The temperature of the concrete, as delivered, will be within the range of 70 to 95 degrees F.

Mixes II, III, and IV will develop a minimum compressive strength of 1,800 psi in a maximum period of 6 hours. This is the minimum strength necessary to open to traffic.

## **2. INSPECTION OF THE CONCRETE SLABS:**

Before any existing concrete is removed, the Engineer shall perform an inspection of the concrete slabs and designate areas where concrete removal is required. The lateral limits of each area to be removed and replaced shall be marked with paint by the Engineer. In no case will the minimum length of the patch be less than 6 feet, or less than 12 feet in width.

## **3. SAWING OF THE CONCRETE PAVEMENT:**

The existing pavement to be removed shall be sawed full-depth along the transverse and longitudinal boundaries designated by the Engineer.

The equipment will be capable of sawing neat vertical faces along the patch boundaries. Saw cuts with a toothed wheel saw blade shall **ONLY** be permitted inside the patch boundaries to facilitate the concrete removal operation. In this case, however, a minimum 3-inch clearance must be maintained between the internal cuts and the boundaries of the patch. If the Contractor oversaws with a toothed wheel into the adjacent concrete slabs, then the Contractor shall replace said slabs at no cost to the State.

Oversawing into the adjacent slabs or shoulders to ensure that full-depth cuts have been achieved in the corners shall be minimized. All oversawed areas shall be thoroughly cleaned and filled with approved crack sealant.

The sawing operation may be performed in advance of the concrete-removal operation. However, it will be limited to a distance not to exceed the amount of patching that can be completed during the next five (5) working days. This distance shall be determined by the Engineer, based on past performance of the Contractor.

## **4. REMOVAL OF DETERIORATED CONCRETE:**

Concrete slab removal will be limited to the amount of pavement that can be removed and replaced during the allowable working period. All deteriorated concrete shall be removed within the limits marked by paint or where designated by the Engineer.

The concrete slabs shall be lifted out by means of chains, lift-pins, or other approved devices. In-place breaking of concrete shall not be permitted. During the removal operation, utmost care shall be exercised to minimize disturbance and damage to the subbase, adjacent pavement, or bituminous shoulder. Any areas damaged during either the concrete sawing or removal operations shall be repaired by extending the patch boundary. These repairs shall be made under the direction of the Engineer, at no cost to the State.

## **5. BITUMINOUS CONCRETE REMOVAL:**

Where existing bituminous material is to be replaced with concrete, the adjacent concrete pavement shall be cut full-depth and removed. Utmost care shall be exercised to minimize

disturbance and damage to the subbase, adjacent pavement, or bituminous shoulder. Adjacent concrete edges shall be cleaned and exhibit a vertical face. Unacceptable concrete surfaces shall be re-cut as directed by the Engineer.

## **6. SUBBASE/SUBGRADE PREPARATION:**

After the concrete has been removed, all disturbed or loose subbase/subgrade material shall be carefully removed. Protection of the subbase/subgrade following the concrete removal shall be the responsibility of the Contractor and no additional payment will be allowed for repairs of the subbase/subgrade not so protected.

When, in the opinion of the Engineer, the subbase/subgrade is in a saturated condition or not suitable for concrete placement, the Contractor shall be required to excavate an additional depth as designated by the Engineer. Subbase replacement material shall meet the requirements for graded aggregate subbase in accordance with M.02. Construction methods for this material shall be in accordance with 2.12.03. The Engineer may also require that the Contractor install underdrains in accordance with 7.51.

## **7. HOLE DRILLING REQUIREMENTS:**

The face of the existing pavement shall be drilled for insertion of the deformed epoxy coated steel bars at locations shown on the contract drawings. The use of hand held drills shall not be permitted. The holes shall be drilled with a drilling machine meeting the following requirements:

- a. The machine will produce holes such that each individual dowel's longitudinal axis is aligned parallel to the longitudinal axis of the pavement slabs.
- b. The forward and reverse travel of the drills will be controlled by mechanically applied pressure. The drills will be equipped with tungsten carbide bits. Drill guide bushings will be required to prevent eccentricity of the drilled holes.
- c. The drill and the pressure mechanism will be matched to drill the holes for the dowels in 30 seconds or less.
- d. The drills, pressure mechanisms, guide bushings, centralizer collars, and drill feeds will be gang mounted and will consist of not less than three (3) independently powered and driven drills. The drill feeds will be constructed such that all drill bits will be parallel to one another. Each drill bit will pass through a centralizer collar which will be replaced as wear demands. The driven drill bits will impart a pressure against the face of the concrete not to exceed 40 psi.

The drilling machine should be mounted on a tractor or other suitable piece of equipment so that it can be easily transported and quickly positioned at each repair location. The drilling machine shall be approved by the Engineer prior to actual use.

When in the opinion of the Engineer drill wear is such that the hole diameter exceeds the diameter of the deformed bar by 1/4 of an inch, the Contractor shall replace the drill bits and/or guides. The holes and face of the existing concrete shall be cleaned with compressed air after drilling is complete.

## **8. DOWEL BAR INSTALLATION:**

Dowel bars will be number 10 deformed epoxy coated steel bars and will be used in all fixed transverse joints. All dowel bars will be 18 inches in length, and embedded a distance of 9 inches into the adjacent slabs.

Chemical anchor material will be used to secure the dowel bars in place as shown on the contract drawings. Chemical anchor material shall be placed by using a flexible long-nose tube that injects the material into the back of the hole in accordance with the manufacturer's recommendations.

**Under no circumstances will the practice of dipping the dowel bars in the chemical anchorage material be permitted.**

The bar shall be inserted into the hole while being rotated at least one complete revolution so that the material in the bottom of the hole is forced up and around the bar. A retention disk shall be placed on the leading end of the bar before it is inserted into the hole so that as the bar is inserted and rotated, only the excess chemical anchorage material is allowed to escape. The space around the bar shall be completely filled with chemical anchorage material and shall be free of voids.

Retention disks will be polymeric material or aluminum with a non-reactive flexible gasket material and shall be approved for use by the Engineer. The design and installation of the retention disk will be such that there will be no metal to metal contact between the retention disk and the deformed bars.

## **9. FORMS FOR SLAB REPLACEMENTS ADJACENT TO SHOULDER:**

Forms shall be utilized on the bituminous shoulder side of the patch. In order to accommodate the side forms, the Contractor shall saw cut full-depth and excavate 6 inches beyond the lateral width of the form into the adjacent shoulder. Forms shall extend longitudinally along the existing shoulder pavement a minimum of 1 foot beyond the transverse limits of the patch. The forms shall be secured to prevent movement during concrete placement. After the removal of the form, the excavated portion of the shoulder shall be replaced with bituminous concrete designated on the project, in accordance with Section 4.06 and shall be true to the line and grade of the new patch and existing shoulder.

## **10. POLYETHYLENE SHEET:**

A 4 mil thick polyethylene sheet, whose all around dimensions are 3 inches less than those of the repair area, shall be secured to the subbase prior to placement of the concrete.

## 11. CONCRETE PLACEMENT:

It shall be the responsibility of the Contractor to arrange the construction schedule so that the required operations are performed without causing a delay in work.

Concrete placement operations for Mixes I and II may commence only when the air temperature is in the range of 65 to 95 degrees F and when the anticipated minimum and maximum temperatures for the 48 hours immediately after placement of concrete will be within the range of 40 to 95 degrees F.

When the air temperature is below 65 degrees F, or when the anticipated temperature is expected to fall below 40 degrees F within 48 hours of the concrete placement, **ONLY** Mixes III or IV will be used.

Placement of concrete shall not be permitted if the air temperature is, or can be expected to lie outside the range specified for that particular mix design. The anticipated minimum and maximum temperatures will be based upon national weather service reports which the Contractor shall obtain on a daily basis. All temperatures shall be measured in the shade.

Concrete shall not be placed when it is raining or when rain is forecast within two hours of placement.

Vibration shall be used to thoroughly consolidate the concrete throughout the entire patch area. Approved spud-type vibrators whose head diameters will not be less than two (2) inches shall be used to consolidate the concrete. Vibrators will be capable of transmitting 10,000 to 15,000 vibrations per minute. The vibrators will be held vertically and vibration will be done full-depth over the entire area in a uniform pattern. Utmost care shall be exercised to ensure that the concrete around the dowel bars and slab edges has been properly consolidated.

## 12. JOINTS:

When an existing transverse contraction or expansion joint falls within the limits of a patch, the contraction or expansion joint shall be replaced with a joint of the same type, along the same plane as the adjacent transverse joint, as shown on the contract drawings. **Payment for the expansion or contraction joints will be included in the cost of the work.**

Finished joints will not deviate more than 1/4 inch in the horizontal alignment.

Transverse contraction joints will consist of planes of weakness created by forming or cutting grooves in the surface of the pavement. Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. The tool or device shall remain in-place until the concrete has attained its initial set and shall then be removed without disturbing the adjacent concrete, unless the device is designed to remain in the joint.

Sawed contraction joints shall be created by sawing grooves in the surface of the pavements of the dimensions shown on the plans with an approved concrete saw.

Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit sawing without excessive raveling, usually 4 to 24 hours. All joints shall be sawed before uncontrolled shrinkage cracking takes place.

The expansion joint material shall conform to AASHTO M153, Type 2.

### **13. FINISHING:**

After the concrete has been placed to a level slightly above the existing concrete pavement surface, a vibrating plate or screed shall be drawn over the surface at a uniform speed, without stopping, in order to strike-off the patch surface even with the adjacent concrete surface. The patch shall then be floated to a smooth finish. The type of screed or plate shall be approved by the Engineer.

The addition of water to facilitate the finishing of the patch surface shall **NOT** be permitted. Finishing operations shall be completed before initial set takes place. Patches less than 10 feet in length shall be screeded parallel to the centerline. Patches greater than 10 feet in length shall be screeded perpendicular to the centerline.

The surface of the patch will not vary more than 1/4 inch in a distance of 10 feet when a 10-foot-long straightedge is placed on the surface at any angle. Sags or depressions in the surface of the patch area that exceed the 1/4-inch tolerance shall be repaired at the expense of the Contractor. Upward deviations in the hardened patch surface shall be ground down or replaced, at the expense of the Contractor, by approved machinery as directed by the Engineer.

### **14. CURING:**

As soon as initial set of the concrete has occurred in Mixes I and II, curing mediums shall be applied. Initial set is defined as having occurred when no cement paste is lifted from the repair when the surface is lightly rubbed with the fingers of one's hand.

**Mix I Curing:** Liquid curing compound, conforming to 4.01.03-F7a, shall be used. When the ambient temperature is anticipated to fall below 50 degrees F, insulation curing material, as described below, shall be utilized.

**Mix II Curing:** Liquid curing compound, conforming to 4.01.03-F7a, shall be used. In addition, a sheet of 4 mil polyethylene shall be placed over the repair area, in conjunction with insulating curing material. This material will be a minimum of 2 inch thick closed cell extruded polystyrene insulation board that conforms to the requirements of ASTM C578. It will have a minimum certified R value of ten (10). The insulating material shall extend at least 12 inches beyond the limits of the repair area, and shall be kept in intimate contact with the pavement surrounding the patch area to prevent wind intrusion beneath. It shall be weighted down with sand bags weighing a

minimum of 15 pounds each. The sand bags shall be placed a minimum of two (2) feet on center around the patch area.

**Mix III Curing:** Curing shall be in accordance with the manufacturer's recommendations.

**Mix IV Curing:** The curing methods for this mix shall be the same as those requirements for Mix II, with the exception that liquid curing compound shall not be used. Any variations to this prescribed method of curing shall be approved in writing by the Engineer prior to its use.

## **15. INSPECTION:**

Any pavement defects or shrinkage cracks resulting from improper placement or curing methods shall be repaired, or the patch replaced by the Contractor at no cost to the State.

## **16. TESTING:**

The Contractor shall make test cylinders under the supervision of the representative of the Department. The dimensions, type of cylinder mold and number of cylinders shall be specified by the Engineer.

A portable compression testing machine shall be provided by the Contractor and available on site for cylinder testing. All testing and equipment will conform to ASTM C39. NOTE: This compression machine must be calibrated in accordance with the provisions of Section 5, ASTM C39.

## **17. TIME SCHEDULE:**

Traffic will be allowed on areas of the roadway where the Contractor has placed and finished the full-depth patches (with bituminous cover if required), after the attainment of 1,800 psi compressive strength.

If the concrete has not attained the above compressive strength requirements within 6 hours, the Contractor shall remove and replace the concrete patch, including any additional saw cutting, drilling and bar installation at his own expense during the next working day.

If the Contractor does not complete replacement operations within the given traffic lane closure time period, then he shall provide at his own expense, a full-depth bituminous concrete patch, or a temporary concrete platform, to allow full traffic operations over these areas. Steel plates may be used in lieu of bituminous concrete to span excavations that are 10 feet or less in length and if vehicle speed limits are not to exceed 25 miles per hour. These plates shall be secured to the existing slabs to prevent movement, as directed by the Engineer. Bituminous concrete shall be placed to provide a taper onto and off of the steel plates.

The plate, platform or bituminous patch shall be removed and all work shall be completed on the patch during the next scheduled work period. Installation and removal shall be done as directed by and to the satisfaction of the Engineer.

#### **18. TEMPORARY CONCRETE PLATFORMS:**

Temporary Concrete Platforms may be used to allow full traffic operations (as outlined above), or to enhance the production schedule.

#### **19. COLD WEATHER CONCRETING:**

When Mix IV is utilized for cold weather concreting as described herein, the following additional requirements will apply:

- a. The polyethylene sheeting referred to under Section 10 will be eliminated.
- b. During cold weather, only those chemical anchoring materials whose cure time is not affected by cold temperatures will be used.
- c. Just prior to the placement of the Mix IV concrete, the subbase and surrounding patch interfaces shall be thoroughly wetted with hot water having a minimum temperature of 175 degrees F. This wetting shall continue until these interfaces are substantially heated, but in no case shall the residual ponding of water be allowed to occur within the patch area. The method of wetting the patch area shall be approved by the Engineer prior to its use.

Immediately after the wetting operation is concluded, the Mix IV concrete shall be placed into the patch area. Due to the fact that rapid wetting, material placement, consolidation and finishing are paramount to the success of this operation, the failure of the Contractor to follow the prescribed, approved methods shall be grounds for the rejection of those materials in place.

#### **Article 4.01.04 - Method of Measurement:**

*Delete the entire article and substitute the following:*

This work shall be measured for payment by the actual number of cubic yards of concrete placed in acceptable patches.

Expansion and contraction joints shall not be measured for payment.

Removal of unsuitable subbase material shall be measured on the basis of cubic yards of material excavated, as directed by the Engineer.

Replacement of unsuitable subbase material shall be measured on the basis of cubic yards of subbase material placed and accepted by the Engineer.

Subgrade drains shall be measured on the basis of lineal feet of underdrain installed as directed by the Engineer.

Patching of the shoulder pavement that was removed to install the side forms shall be measured on the basis of the number of tons of bituminous concrete material placed, compacted and accepted by the Engineer.

If the existing roadway is composite pavement (bituminous over concrete), replacement of the bituminous directly above the new concrete patch shall be measured on the basis of the number of tons of bituminous concrete material placed, compacted and accepted by the Engineer. Material for Tack Coat shall be measured as outlined in 4.06.04-7.

**Article 4.01.05 - Basis of Payment:**

*Delete the entire article and substitute the following:*

This work shall be paid for at the contract unit price per cubic yard of "Concrete Pavement Replacement for Roadway (Full-Depth)," complete in place. This price will include removal and disposal of all materials including but not limited to deteriorated concrete, bituminous pavement, steel reinforcement, and transverse joints. The price will also include any required sawing of concrete and bituminous pavement, preparation of the patch area, furnishing, placement, finishing and curing of the concrete, subbase preparation, all drilling, furnishing and installation of the dowel bars, retention disks, steel reinforcement, Transverse Expansion Joints, Transverse Contraction Joints, insulating material, 4 mil polyethylene sheets, chemical anchoring material, and all tools and materials incidental thereto. The cost of furnishing, installing, and removal of the Temporary Concrete Platforms will also be included.

No direct payment will be made for the concrete testing equipment, the instruction in its use, in-situ testing, the concrete in or curing of the required cylinders as specified hereinbefore, but the cost of this work will be considered included in the general cost of the work.

Removal of unsuitable subbase material will be paid for at the contract unit price per cubic yard for "Earth Excavation."

Replacement of unsuitable subbase material will be paid for at the contract unit price per cubic yard for "Subbase."

Installation of subgrade drains will be paid for at the contract unit price per lineal foot for "Underdrain."

Patching of the shoulder to facilitate placement of the side forms will be paid for at the contract unit price per ton for bituminous concrete designated on the project.

If the existing roadway is composite pavement (bituminous over concrete), replacement of the bituminous directly above the new concrete patch will be paid for at the contract unit price per ton

for bituminous concrete designated on the project. Material for tack coat will be paid for at the contract unit price per gallon for "Material for Tack Coat."

## **ITEM #0406125A – BITUMINOUS CONCRETE SURFACE PATCH**

1. **Description:** This work shall consist of milling and patching an existing deteriorated bituminous concrete pavement surface. A milling machine shall be used to remove the existing pavement to a depth of 1.5 to 2.5 inches. The milled surface shall be swept and then be blown clean with compressed air. Tack coat is to be applied to the milled surface and any vertical or semi-vertical walls formed by the milling. The milled out area shall then be filled and compacted with HMA S0.375.
2. **Materials:** Materials for this work shall consist of the following:
  - 2.1 Hot-mix Asphalt (specifically HMA S0.375) conforming to the requirements of Sections 4.06 and M.04 of the Standard Specifications. An equivalent PMA may be used conforming to the requirements of Sections 4.06 and M.04 of the Standard Specifications.
  - 2.2 Tack coat conforming to the material requirements for tack coat in Sections 4.06 and M.04 of the Standard Specifications.
3. **Equipment:** Equipment for this work shall include, but is not limited to, the following:
  - 3.1 Milling machine – A milling machine designed and built for milling flexible pavements. It shall be self propelled with sufficient power, traction, and stability to maintain depth and slope and shall be capable of removing the existing HMA pavement.
 

The milling machine shall be equipped with a built-in automatic grade averaging control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results. The longitudinal controls shall be capable of operating from any longitudinal grade reference, including string line, contact ski (30 feet minimum), non-contact ski (20 feet minimum), or mobile string line (30 feet minimum). The transverse controls shall have an automatic system for controlling cross-slope at a given rate. The Engineer may waive the requirement for automatic grade or slope controls where the situation warrants such action.

The rotary drum of the machine shall utilize carbide tip tools spaced not more than 5/8 inches apart. The forward speed of the milling machine shall be limited to no more than 45 feet/minute. The tools on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture.

The Contractor may request to perform a test strip to demonstrate that the same surface tolerance can be attained at an increased forward speed. The test strip shall be a maximum length of 500 feet and shall have the same criteria for surface tolerance as noted in this specification. The final decision for implementing the increased forward speed will be at the discretion of the Engineer.

The machine shall be equipped with an integral pickup and conveying device to immediately remove material being milled from the surface of the roadway and discharge the millings into a truck, all in one operation. The machine shall also be equipped with a means of effectively limiting the amount of dust escaping from the milling and removal operation. When milling smaller areas or areas where it is impractical to use the above described equipment, the use of a lesser equipped milling machine may be permitted when approved by the Engineer.

In addition to meeting those requirements, the milling machine shall be capable of removing the existing pavement to a minimum width of 20 inches in any direction. This makes the minimum achievable patch size - 20 inches by 20 inches, or 0.30 square yards.

- 3.2 Sweeper – The sweeper shall be equipped with a water tank and be capable of removing the millings and loose debris from the surface. Other sweeping equipment may be provided in lieu of the sweeper where acceptable by the Engineer.
- 3.3 Air compressor – The unit shall consist of an air compressor capable of producing 100 psi, oil free, compressed air for blowing the milled pavement surface clean.
- 3.4 Hot air lance – The unit shall be designed for cleaning and drying the pavement surface. It shall consist of an air compressor capable of delivering 100 psi, oil free heated air. The compressed air emitted from the tip of the lance shall be flame free and be capable of achieving a temperature of at least 1500°F.
- 3.5 Paving and compaction equipment – All equipment used to place and compact the hot mix asphalt required for this work shall meet the requirements of Section 4.06 of the Standard Specifications. Due to the nature of this work, it is expected that much of the placement of hot mix asphalt will require hand work or a mixture of equipment and hand work methods and tools to achieve the required results. The same consideration is to be given to compaction of the hot mix asphalt. Smaller type compaction equipment, including vibratory plate compactors, shall be allowed to achieve the required results. At all times the Contractor is required to meet the density and compaction and all other requirements specified in Sections 4.06 and M.04 of the Standard Specifications.

#### **4. Construction Methods:**

##### **4.1 Demarcation of Areas to be Patched:**

- 4.1.1 Areas to be patched under this item shall consist of pavement surfaces in which the existing surface lift of pavement is raveling, disintegrating, or delaminated from the lift of pavement directly beneath it. Under this specification a “lift” of pavement is defined as an individual layer of bituminous concrete that was placed and compacted previously with one placement pass of a paver or other asphalt pavement placement device or method. “Surface lift” is defined as the last individual layer of bituminous concrete placed and compacted that currently serves as the driving surface of the roadway. This could include a milled surface. These definitions apply to previously placed “surface lifts” of pavement that were between 1 inch and 2.5 inches thick.

4.1.2 All areas in which the surface lift of pavement displays raveling, disintegration, or delamination from the underlying lift of pavement, of such a severity, that it will not likely support traffic loadings, or remain sound and in-tact, for an additional 2 years, shall be marked out by the Engineer for removal. The minimum width of any given area shall be 20 inches. All areas to be patched shall completely encompass the entire raveled, disintegrated, or delaminated area and extend at least 6 inches beyond into the surrounding pavement.

4.2 Patch Preparation and Construction:

4.2.1 Utilizing the specified milling machine, mill the demarcated areas to a depth that completely removes the surface lift of pavement. The minimum depth shall be 1.5 inches and the maximum depth shall not exceed 2.5 inches.

4.2.2 As specified in the requirements for milling, the milled surface shall be swept clean (by hand if necessary.) Once all millings are practicably removed by sweeping, the milled areas shall be allowed to dry if necessary. Any moisture in or on the milled areas must be allowed to evaporate or be removed with the assistance of a hot air lance as specified above. Once the milled area is deemed dry by the Engineer it shall be blown with compressed or hot lance air, as specified above, so that no debris or dust is present on or within the milled area.

4.2.3 Once deemed clean by the Engineer, the milled area, including the sides/walls of the milled area, shall receive an application of tack coat as specified above and in Section 4.06 of the Standard Specifications.

4.2.4 After the tack coat has had sufficient time to cure or break, HMA S0.375 shall be placed and compacted to the requirements above and in Section 4.06 of the Standard Specification. It shall be compacted to match the elevation of the surrounding pavement surface.

**5. Method of measurement:** This work shall be measured by the total area, in square yards, of “Bituminous Concrete Surface Patch.”

**6. Basis of Payment:** This work will be paid for at the contract unit price per square yard of “Bituminous Concrete Surface Patch.” The price shall include milling, pavement excavation and removal, cleaning of the milled area, tack coat application to the milled surface area, and placement and compaction of HMA S0.375. All other miscellaneous tools, materials, and equipment needed to complete the work shall also be included in the cost of the work.

Pay Item  
0406125A, Bituminous Concrete Surface Patch

Pay Unit  
S.Y.

## **ITEM #0406180A – HOT-MIX ASPHALT SMOOTHNESS ADJUSTMENT (ESTIMATED COST)**

### **Description**

The Engineer shall evaluate the final pavement surface for smoothness (rideability) as stated herein. This is a bonus/penalty item which shall be applied to the surface lift only. This item shall apply to projects requiring a minimum of two (2) lifts of bituminous concrete (Hot-Mix Asphalt (HMA), Polymer-Modified Asphalt (PMA), or Warm-Mix Asphalt (WMA)) in which the combined total compacted depth of bituminous concrete placed is 3 inches or greater and the surface lift is at least 1.5 inches thick. All provisions and requirements of Section 4.06 Bituminous Concrete apply, unless specifically stated otherwise within this item.

### **Definitions:**

**Lift:** A single bituminous-concrete mixture placed at a defined thickness in a single paver pass.

**Surface Lift:** The uppermost lift of bituminous-concrete paving.

**Roadway segment:** A segment of highway designated to receive pavement rehabilitation that includes paving at least two lifts, the combined thickness of which is 3 inches or greater. A roadway segment contains one or two directions of travel, through lanes in each direction, and any additional shoulder area, paved median area, ramp(s), and/or auxiliary lanes designated to receive paving.

**Lane:** An area of pavement designated to carry traffic in a given direction.

**Measured Lane:** A lane subject to a hot-mix asphalt pavement smoothness adjustment as indicated in this item. Ramps, shoulders, and certain other features are excluded from the adjustment as described below.

**Tenth Mile Segment:** The subset of a measured lane which will be evaluated for smoothness and used as the basis for payments. Each measured lane shall be divided into tenth (0.1) mile segments. Some tenth mile segments may be less than a full tenth (0.1) mile because they are terminated by a boundary such as the end of the lane or a bridge without an asphaltic plug joint. Bonuses/penalties shall be based on the smoothness and tonnage of the surface lift of each tenth mile segment.

**Lift Pay Thickness (inches):** The thickness that the plans specify for the surface lift of the measured lane.

**Tenth Mile Segment Pay Area (square yards):** The area of the travelway of a tenth mile segment as determined from the plans. If striping exists, it would be the area bounded by the lane striping and beginning and ending termini of the tenth mile segment. Where a segment's travelway width varies (for example, where a low speed lane narrows as it begins or terminates), the Pay Area shall reflect the actual travelway area.

**ARAN:** Automatic Road Analyzer. A vehicle operated by the State that collects and analyzes road data. It provides IRI data every 5 meters for both the right and left wheelpaths.

**IRI (inches/mile):** International Roughness Index, developed by the World Bank to quantify roughness.

**ProVAL:** Free FHWA sponsored software that is used to analyze road roughness.

**Average IRI (AIRI or MRI)** (inches/mile): The average of the right and left wheelpath IRIs for a tenth mile (528 foot) segment as computed by analyzing ARAN data with ProVAL software, selecting Ride Quality Analysis, selecting MRI as the Ride Quality Index, and selecting to apply a 250 mm filter. The MRI shall be rounded to the nearest whole tenth of an inch per mile. Fractional parts of 0.05 and up shall be rounded up, less than 0.05 shall be rounded down. For example, 50.05 is rounded to 50.1; 80.049 is rounded to 80.0.

**Hot-Mix Asphalt:** Whenever reference is made to Hot-Mix Asphalt (HMA), the reference shall apply to HMA, PMA, and WMA.

This item shall be applied separately to each roadway segment which is included in this Contract and designated to be measured for a Hot-Mix Asphalt smoothness adjustment as indicated in this item. The calculations for smoothness (as represented by ProVAL MRI) and cost adjustments shall be done separately for each tenth mile segment in each measured lane.

### **Evaluation Methods**

**Trial Evaluation** - Prior to the placement of the surface lift of pavement, the Engineer shall furnish the Contractor with IRI values for tenth mile (0.1mile) segments for the right and left wheelpaths that result from the Engineer's evaluation of the material placed to date. The actual time of the "trial" evaluation shall be coordinated between the Engineer and the Contractor. The "trial" evaluation shall be limited to one (1) test lane in each direction of travel. Final evaluations for payment shall measure all lanes of interest (as described below) in each direction of travel. The trial IRI values will serve as a guide to the Contractor in evaluating the level of conformance with the smoothness specification.

**Data Collection and IRI Computation** – All final pavement surfaces in lanes that extend for more than 0.4 miles (2,112 feet) shall be evaluated, including climbing lanes and acceleration lanes. The final pavement surface shall be evaluated for smoothness using the State's ARAN vehicle. ARAN vehicles contain sensors that measure vertical accelerations and roughness and software that simulates the traversing of a so-called "quarter car" over the adjusted profile. The software calculates an IRI value as defined by the World Bank for each lane of travel over the project. The ARAN is a Class II device as defined by the World Bank. The IRI represents the vertical (upward and downward) displacement that a passenger would experience traveling at 48 MPH in a standard vehicle over the profile established by the device. A zero IRI value would indicate a perfectly smooth pavement surface, while increasing IRI values would correspond to an increasingly rough pavement surface. The ARAN has the capability to measure the longitudinal profile in each (right and left) wheelpath simultaneously. If the ARAN vehicles are unavailable, the Engineer may substitute another suitable method of obtaining IRI values with a World Bank Class II profiler that allows calculation of smoothness adjustments as indicated in this item.

ProVAL shall be used to calculate an MRI value for each tenth mile segment. The ProVAL MRI is the average of the right and left wheelpath IRIs.

The evaluation shall be subject to the following:

1. Only mainline travel lanes shall be evaluated. This shall include climbing lanes, operational lanes, and turning roadways that are 0.4 miles (2,112 feet) or greater in length.
2. Data collection shall start approximately 100 feet prior to, and end approximately 100 feet after the transverse construction joints at the project limits. The pay area shall be limited to the limits of the paving as defined by the transverse construction joints at the start and end of the project.
3. Construction joints inside the project shall not be excluded from the area measured for smoothness.
4. Smoothness data and payment adjustments shall not be computed for the following project sections:
  - Ramps
  - Climbing lanes, operational lanes, acceleration lanes, deceleration lanes, and turning roadways less than 0.4 miles (2,112 feet) in length
  - Shoulders and gore areas
  - Pavement on horizontal curves which have a 900 foot or less centerline radius of curvature, and pavement within the super-elevation transition of these curves
5. Bridge decks shall be included if they are paved as part of the project, have two lifts totaling 3 inches of HMA, and have an asphaltic plug or similar product for bridge joints. Structures with exposed concrete, elastomeric concrete or steel joint systems shall be excluded.
6. Transition sections of varying thickness of pavement (created by milling or paving) leading into or away from pavement changes such as bridge decks or underpasses shall be excluded if the deck or underpass is excluded. A length of 50 feet on either end of a transition shall be excluded from measurement of IRI, but not from payment of an adjustment. The 50 foot length shall have the same adjustment percentage as the immediately adjacent tenth mile section.
7. If a deck or underpass is excluded and there is no transition section adjoining it, then a length of 50 feet before and after the deck or underpass shall be excluded for measurement, but included for payment similar to 6. above.
8. Tonnages for payment shall be calculated based on the theoretical volume of HMA as determined by the typical sections and distances measured by the ARAN van and assuming a density of 0.0575 tons per SY per inch of HMA thickness. For example, if the typical section calls for 2 inches HMA in the top course and a lane width of 12 feet,

the tonnage for a tenth mile section would be calculated:  $\text{Tons} = 12\text{ft} \times 528\text{ft} / 9 \times 2\text{inch} \times 0.0575 = 81.0 \text{ tons}$

9. Data shall be collected within 30 days of the completion of the entire surface lift of pavement, or within 30 days of the completion of any corrective work on the pavement. The Contractor, at its own expense, will be allowed to correct any areas prior to the collection of data. The Contractor shall notify the Engineer in writing of its intent to do so along with a proposed schedule for corrective work that includes an anticipated date that data collection can be performed. The completion of the entire final lift of pavement and/or any corrective work includes, but is not limited to, all associated work such as pavement markings, sawing and sealing of joints, and installation of bridge asphaltic plug joints.

To minimize the number of times the ARAN van is needed, all final surface lift paving in both directions of travel must be completed before calling on the ARAN van to measure the smoothness. However, if final surface lift paving extends beyond a single paving season, then the ARAN van shall be used to measure the final surface lifts completed each paving season.

10. No testing shall be conducted during rain or under other conditions deemed unacceptable by the Engineer. During testing, the roadway must be free of moisture and other deleterious materials which might affect the evaluation. Any work associated with preparing the roadway for the evaluation (for example, sweeping), shall not be measured for payment.
11. The option to apply the 250 mm filter, which represents the footprint length of a typical tire, shall be selected.
12. Measurements and locations are understood to have an accuracy limited to what can be attained by reviewing data and photos collected by the ARAN van. The state shall not be required to conduct surveys in addition to the ARAN van measurements. Since various factors affect the accuracy the van can attain, including but not limited to:
  - The van records certain data only once every 5 meters.
  - The distance measured by the van can vary because of vehicle wander within the lane and temperature changes affecting tire pressure.
  - The exact location of transitions and joints may be difficult to ascertain from the ARAN photos.

It is to be understood by all parties that measurements are approximate.

**Method of Measurement:**

Rideability Adjustments (RA) for pavement smoothness shall be applied to all HMA in the surface lift of all measured lanes in both directions. It shall be computed and paid (or penalty assessed) for each tenth mile segment.

**Bituminous Concrete Class ( ) or HMA S\* Quantity --** The quantity of bituminous concrete measured for the RA for each tenth mile segment shall be determined by using the equation below:

$$\begin{matrix} \text{Segment Tons} & = & \text{Lift Pay Thickness} & \times & \text{Tenth Mile Segment Pay Area} & \times & 0.0575 \\ \text{(tons)} & & \text{(inches)} & & \text{(SY)} & & \end{matrix}$$

**Rideability Adjustment (RA) Percent (%)**

The RA bonus/penalty percentage for each tenth mile segment shall be determined based on its AIRI. Each tenth mile segment AIRI shall be classified into one of the five AIRI ranges shown in Table 1 and the applicable pay factor value for the segment derived.

**Table 1 Rideability Pay Factor Schedule**

<b>AIRI (ProVAL MRI) (inches per mile)</b>	<b>Pay Factor (%)</b>	
Less than 50	+10	Bonus
50 to 60	+(60 – AIRI)	Bonus
60 to 80	0	0
80 to 120	1.25 x (80 – AIRI)	Penalty
over 120	- 50	Penalty

### Basis of Payment

Bonuses/Penalties shall be computed for each tenth mile segment. For each segment, the HMA Pay Factor and tonnage of the surface lift shall be determined as described above. The Pay Factor shall be rounded to the nearest tenth of a percent. For example, a Pay Factor of 7.72% rounds to 7.7%; -12.49% rounds to -12.5%). The adjustment to the cost shall be determined by the formula:

$$\text{Smoothness Adjustment} = \text{Segment Tons} \times \text{Pay Factor} / 100 \times \text{HMA Unit Cost}$$

For example, suppose a 1.06 mile measured lane with a surface lift thickness of 2 inches has eleven segments with their lengths, average travelway widths, and AIRI values as shown in Table 2 below. Assuming a unit cost for HMA of \$85 per ton, the smoothness adjustments for each segment would be as shown in Table 2.

**Table 2 HMA Smoothness Adjustment Example Calculations**

Segment	Length (miles)	Average Width (ft)	Area (SY)	Lift Pay Thickness (inch)	HMA Tons (Area x thickness x 0.0575)	AIRI (MRI) (in/mile)	Pay Factor (%)	Adjust (\$) (Tons x Pay Factor /100 x Unit cost)
1	0.1	4	235	2	26.99	72	0	0
2	0.1	9	528	2	60.72	50	10	516
3	0.1	12	704	2	80.96	40	10	688
4	0.1	12	704	2	80.96	90	-12.5	-860
5	0.1	12	704	2	80.96	100	-25	-1720
6	0.1	12	704	2	80.96	50	10	688
7	0.1	12	704	2	80.96	77	0	0
8	0.1	12	704	2	80.96	55	5	344
9	0.1	12	704	2	80.96	55	5	344
10	0.1	8	469	2	53.97	51	9	413
11	0.06	4	141	2	16.19	62	0	0
							Total:	413

For the surface lift in this measured lane, there would be a \$413 bonus.

Adjustments for smoothness shall not be made for those areas that the Engineer determines to be defective and require the removal and replacement of the HMA.

The sum of money shown on the estimate, and in the itemized proposal as "Estimated Cost", for this item will be considered the bid price although payment will be made as described above. The estimated cost figure is not to be altered in any manner by the bidder. If the bidder should alter the amount shown, the altered figure will be disregarded and the original cost figure will be used to determine the amount of the bid for the Contract.

## **ITEM #0406191A – PRE-OVERLAY CRACK FILLING (GREATER THAN 1.25 INCHES)**

**Description:** This work consists of treating cracks and joints in existing pavement by cleaning them and applying asphalt-aggregate filler on cracks and joints over 1.25 inches wide prior to the application of a surface treatment. It shall be constructed in accordance with these specifications and in close conformity with the lines, grades, thickness, and typical cross section shown on the plans or established by the Engineer. If the Contract includes milling of the pavement surface, application of any filler material is to be conducted after the milling is completed and the milled surface has been cleaned as required in the Contract.

### **Definitions and Use of Terminology:**

- (1) **Longitudinal Paving Joints:** Joints formed along the direction of travel between adjacent paving passes on the surface lift of a bituminous-concrete pavement structure.
- (2) **Longitudinal Joint-Reflection Cracks in Composite Pavement:** Longitudinal cracks formed atop the longitudinal joint in a Portland-cement-concrete pavement underlying the bituminous-concrete surface.
- (3) **Longitudinal Cracks:** Cracks, the endpoints of which are more distant in the direction of roadway travel than across the width of the pavement.
- (4) **Transverse Cracks:** Cracks, the endpoints of which are at least as distant across the width of the pavement as they are along the direction of travel.
- (5) **Crack Width Measurement Location:** Crack width measurement is to be conducted flush with the pavement surface.
- (6) **Asphalt-Aggregate Filler:** A hot-mix asphalt material with small maximum aggregate size suitable for use in filling cracks and joints greater than 1.25 inches.

For purposes of this document, the use of the term/word “crack,” including all work specified for “cracks” herein, shall also apply to “raveled longitudinal joints” and “raveled transverse joints,” unless otherwise specified.

**Materials:** Unless otherwise stated, all Material Certifications, Certified Test Reports, General Certifications, and Material Safety Data Sheets required prior to the start of the work, shall be submitted to the Engineer no later than 14 days prior to the start of the work. These minimum time submission requirements may be shortened with approval from the Engineer. All submissions not conforming to this specification shall be reason for the Engineer to stop the work until such time that all proper submission requirements are met. All correspondence, with regard to material requirements, shall be performed in writing between the Engineer and the Contractor.

- (1) **Asphalt-Aggregate Filler:** All Asphalt-Aggregate Filler used for filling cracks or joints shall be composed of hot-mix asphalt (HMA) conforming to the requirements of Section M.04 of the Standard Specifications. Furthermore, the selected HMA material shall be HMA S0.25 (Superpave Design Level 2).

**Equipment:** Unless otherwise specified, the Engineer reserves the right to inspect all equipment listed below to be used in performing the work at least 5 days prior to starting the work. As requested by the Engineer, the Contractor shall make the equipment available on site to the Engineer for inspection at least 5 days prior to starting the work. The Engineer may waive or shorten this requirement. Work shall not commence until the Engineer has inspected and approved all equipment for use. All correspondence, with regard to equipment requirements and inspection, shall be performed in writing between the Engineer and the Contractor.

The equipment used by the contractor shall include, but be not limited to, one or more of the following:

- (1) **Hot Air Lance:** The unit shall be designed for cleaning and drying the pavement surface cracks. Minimum compressed air capacity shall be 100 psi. The compressed air emitted from the tip of the lance shall be flame free and be capable of achieving a temperature of at least 1500°F.
- (2) **Asphalt Storage Hot Box:** The unit shall be heated and designed to store and maintain the “Asphalt Aggregate Filler” at a constant temperature between 275°F and 315°F. Alternate methods/devices that insure delivery of the mix to the temperatures required can be approved by the Engineer. The Contractor may submit a proposal to the Engineer for approval at least 5 days before beginning the work.
- (3) **Hand Tamper(s):** Two types of hand tampers are required.
1. A hand operated tamping tool shall be made from 1 inch ( $\pm$  0.25 inches) steel tubing, 1 inch ( $\pm$  0.25 inch) solid steel stock, or a combination of the two. The tubing or stock can be round or square and should be cut and manufactured to create a 4 to 6 foot handle and 3 to 4 inch piece of tubing or stock attached perpendicular to the end of the handle. The 3 to 4 inch piece of tubing or solid stock shall be used to ram and compact the Asphalt Aggregate Filler into the crack.
  2. The second hand operated tamping tool shall consist of a 4 to 6 foot handle fastened to a flat steel or iron plate measuring at least 4 inches wide by 4 inches long. It must weigh at least 2 pounds. This tamper is to be used to finish tamping the surface of the Asphalt Aggregate Filler so that it becomes flush with the surrounding pavement surface.

**Construction Methods:** The joint and crack filling operation shall proceed in accordance with the requirements of the “Maintenance and Protection of Traffic” and “Prosecution and Progress” specifications.

**(1) Weather Requirements:** Work will not be performed unless the pavement is dry. No frost, snow, ice, standing water, or visible moisture or dampness may be present on the roadway surface or within the cracks. No work shall be done if the ambient temperature is below 40° F during the field application operations.

**(2) Cracks and Joints Width Determination:** All crack and joint width determinations shall be made by measuring the pavement crack or joint width flush at the surface of the pavement to be filled. A straightedge shall be used whenever necessary to establish the location or limits of the “flush” surface of the pavement.

**Note:** The width determinations made to identify joints and cracks to be filled may not be the same as the finished width after placement of the filler material. The width measured before placement of any filler that is to be used to determine the appropriate widths of cracks and joints to be filled.

**(3) Cracks and Joints to be Filled:** The width and depth requirements for cracks and joints to be filled are not the same. The requirements for cracks and joints are stated below.

Filling Scenarios		
Type	Description	Action
Crack	Between 1.25 inches up to 4.00 inches in width	Fill entire crack, as long as part of it is wider than 1.25 inches
Crack	Entire length of crack is less than 1.25 inches wide	Repair with item #0406195A
Crack	Over half of crack less than 4.00 inches wide	Fill entire length that is less than 4.00 inches wide and over 1.25 inches.
Crack	Part over 4.00 inches wide	Do not fill that part. Repair by another method
Crack	Part under 1.25 inches wide	Do not fill that part. Repair by item # 0406195A
Crack	Over half of crack is greater than 4.00 inches wide	Do not fill. Repair by another method
Raveled Joint	Less than 0.5 inches deep	Do nothing
Raveled Joint	Less than 1 foot of continuous length	Do nothing
Raveled Joint	Over 3.00 inches wide	Fill entire joint.
Raveled Joint	Depth is between 0.5 inches and ½ thickness of surface lift and width is less than 3.00 inches	Repair with item #0406195A
Raveled Joint	Depth is greater than ½ thickness of	Treat it like a crack.

	surface lift	Take the action specified for a crack of similar dimensions.
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**(4) Crack and Joint Preparation:** Pavement surface cracks and joints to be filled shall be treated with a hot-air lance prior to application of the crack fill material. Two passes, minimum, shall be made with the hot-air lance. The hot air lance operation shall proceed at a rate no greater than 120 feet per minute. There shall be no more than 10 minutes time lapse between the second hot-air lance treatment and the material application. Should this time be exceeded the Contractor shall make an additional pass(es) with the hot air lance. The use of the hot air lance is not intended to heat the crack or joint. It is to be used to blow all debris from the crack or joint to a depth of at least 1.25 inches and to remove any latent moisture or dampness from inside the crack or joint until the inside of the crack or joint is completely dry in the opinion of the Engineer. “Moisture” does not include standing water. The hot air lance is not to be used to “boil off” or blow standing water from the bottom of a crack or joint. If standing water is present in the bottom of any crack or joint, the filling operation shall be postponed until such time that the standing water evaporates naturally. The Contractor may be allowed to use compressed, oil-free, air (not heated) to blow standing water from a crack or joint to help accelerate the natural evaporation of any standing water. If this is done, the crack or joint must be allowed to dry naturally until all standing water is visibly gone. Then the hot air lance can be used. If a crack is already completely dry, in the opinion of the Engineer, the hot air lance should be operated at its lowest temperature possible.

In the event that cracks or joints are packed tightly with debris, dirt, vegetation, or other material except previously placed sealant or filler, the Contractor shall use a vertically mounted power driven wire brush to remove debris and vegetation and burnish the sides of the crack to a depth of at least 1.25 inches. Cracks or joints treated with the wire power brush shall subsequently be treated with a hot air lance as described in this section. The conjunction of the use of the wire power brush and the hot-air lance treatment shall result in the complete removal of all material in the crack or joint (except previously placed sealant or filler) to a depth of at least 1.25 inches such that the sides of the crack are completely free and clean of any debris and moisture as described in this section.

A filling barrier will not be allowed for cracks

**(5) Crack Filling:** Cracks over 1.25 inches in width shall receive an application of tack coat meeting the requirements of Section 4.06 and M.04 of the Standard Specifications. They shall then be filled with Asphalt Aggregate Filler and thoroughly compacted and tamped utilizing the hand tools described above. For any given length or section area of joint or crack, the Asphalt Aggregate Filler shall be rammed at least 3 times with the hand tamping tool manufactured from 1 inch steel tubing or stock. The area shall be finished with at least 3 tappings of the second hand tool weighing at least 2 pounds. The Asphalt Aggregate Filler

shall be compacted to match the elevation of the pavement surface to the satisfaction of the Engineer.

- (6) Protection of Filled Cracks and Joints:** No traffic shall be permitted on the pavement until the crack fill material is set, whereas the crack fill material does not track and is not subject to deformation or pull-out by traffic. If the work under this item is being performed prior to placing a hot mix overlay or other surface treatment, a detackifier or blotting agent will not be allowed. If work under this item is not followed by placement of an overlay of any kind, a detackifier can be used. If a detackifier and/or blotting agent is used it shall be recommended by the supplier of the crack filling material and shall be used as recommended by the supplier, except that no paper, cotton, or other organic materials shall be allowed for either blotting or detackifying. Information on the type and usage of a detackifier and/or blotting agent shall be presented to the Engineer prior to its use. Any acceptance of the detackifier and/or blotting agent shall be granted by the Engineer in writing.
- (7) Surplus Treatment Material:** Treatment material remaining in the hot box at the close of the daily work session shall be discarded. At no time shall treatment material be re-heated for use in subsequent crack filling applications unless permitted by the Engineer following a review of field operation circumstances.
- (8) Debris Removal:** All debris generated from the operations described above shall be removed from the roadway by the Contractor and disposed in accordance with State of Connecticut law.
- (9) Pavement Markings:** If applicable, the Contractor shall replace any existing pavement markings obliterated by the crack and joint treatment work. Existing pavement markings obliterated by the crack and joint treatment work must be replaced with temporary pavement markings before the roadway is opened to traffic. The Contractor shall be responsible for maintaining any temporary pavement markings placed until the Contract is completed. All costs associated with the replacement of existing pavement markings with temporary pavement markings will be borne by the Contractor.
- (10) Required Project Documentation:** Provide the Engineer, on a daily basis, a report with the following information:
1. Control section, job number, and route number.
  2. Date, air temperature (°F), a.m. and p.m. weather.
  3. Beginning and ending locations for the day, including lane(s) and direction.
  4. Quantity of materials used for the day (Example Pounds, if paid for by the pound. Square yards, if paid for by the square yard).
  5. Traffic control typically used includes number of traffic control moves, and checks on the traffic control conducted.
  6. Unique or different situations on the project.

7. Contractor's signature.

**(11) Elapsed Time Required before Placement of an Overlay or Surface Treatment:** All crack filling material placed must be in-place for a minimum of twelve (12) hours prior to placing any type of overlay or surface treatment

**Acceptance of Work:** When work is complete on the project or on a project location, if multiple locations are included in the project, an inspection of the work shall be scheduled with the Engineer. Prior to placement of a hot-mix overlay or other surface treatment, the Engineer will note all deficiencies including areas exhibiting adhesion failure, cohesion failure, tracking of sealant material, missed cracks or joints, raveling or dislodgement of any Asphalt Aggregate Filler, over filling, and/or other factors that show the work is not acceptable. Work identified by the Engineer as not acceptable shall be re-done at the Contractor's expense. The Contractor shall notify the Engineer upon completion of required corrective work or upon completion of work on the project location if corrective work is not required.

**Method of Measurement:** Material used to fill cracks greater than 1.25 inches shall be measured by the linear foot. On a daily basis the Engineer shall measure and record the number of linear feet of "Pre-Overlay Crack Filling (greater than 1.25 inches)" placed. All work shall be measured as indicated in the Contract plans and documents and as adjusted, verified, and accepted by the Engineer.

**Basis of Payment:** The accepted quantity of Pre-Overlay Crack Filling (greater than 1.25 inches) shall be paid for at the contract unit price per linear foot, respectively. The prices shall include all materials, equipment, tools, and labor incidental thereto. No payment will be issued to the contractor prior to document submittals required.

**Pay Item**

0406191A – Pre-Overlay Crack Filling (greater than 1.25 inches)

**Pay Unit**

L.F.

## **ITEM #0406194A – JOINT AND CRACK SEALING OF BITUMINOUS CONCRETE PAVEMENT**

**1. Description:** This work consists of furnishing and applying a hot-applied rubberized crack sealant on joints, cracks, along boundaries of paved areas or other surfaces as indicated in the Plans or other Contract documents. It shall be constructed in accordance with these specifications and in close conformity with the lines, grades, thickness, and typical cross section shown on the plans or established by the Engineer. Joint and Crack Sealing may be used in conjunction with other joint and crack treatments including (but not limited to) joint and crack filling and joint or crack repair, in which case the relative sequence of crack treatments will be prescribed in the plans, a Notice to Contractor, or other Contract Documents.

### 1.1 Definitions:

**Crack:** Any location designated on the plans to receive joint and crack sealing. For the remainder of this document, crack can apply to the vertical face of a sawcut pavement surface, a joint, a crack, or the boundary between two pavement sections or at the edge of pavement next to curbing, a parapet, catch basin, or other structure. The actual area designated to receive joint and crack sealing will be noted on the Plans or other contract documents.

**Maximum Sealing Width:** The maximum width of crack or joint to be included in the work of sealing joints and cracks under this item. The Maximum Sealing Width is NOT the width of the sealant once applied to the surface, but rather the width of a crack or joint prior to sealant application.

**Crack width measurement location:** Crack width measurement is to be conducted flush with the pavement surface.

**2. Materials:** The hot-applied crack sealing material shall be composed of a hot-applied, rubberized asphalt meeting AASHTO M-324 Type 2 requirements. The contractor must submit to the Engineer all Material Safety Data Sheet documents from the material manufacturer prior to the commencement of work. During work progress, the contractor must submit to the Engineer the manufacturer's certificate of testing for compliance to AASHTO M-324 Type 2 requirements for each batch or lot of material utilized on the contract.

The contractor must submit to the Engineer all Material Safety Data Sheet documents from the material manufacturer(s) prior to the commencement of work. During work progress, the contractor must submit to the Engineer the manufacturer's certificate of testing for compliance to applicable specifications for each batch or lot of material utilized on the contract.

**3. Equipment:** The equipment used by the contractor shall include, but be not limited to, one or more of each of the following:

- (1) Melter Applicator: The unit shall consist of a boiler kettle equipped with pressure pump, hose, and applicator wand; the boiler kettle may be a combination melter and pressurized applicator of a double-boiler type with space between the inner and outer

shells filled with heat transfer oil. Heat transfer oil shall have a flash point of not less than 600°F. The kettle shall include a temperature control indicator and a mechanical agitator. The kettle shall be capable of maintaining the treatment material at the manufacturer's specified application temperature range. The kettle shall include an insulated applicator hose and application wand. The hose shall be equipped with a shutoff control. The kettle shall include a mechanical fullsweep agitator to provide continuous blending. The unit shall be equipped with thermometers to monitor the material temperature and the heating oil temperature. The unit shall be equipped with thermostatic controls that allow the operator to regulate material temperature up to at least 425 °F.

- (2) Application Wand and Squeegee Applicator: The material shall be applied with a wand followed by a squeegee applicator. The squeegee applicator shall be of commercial/industrial quality designed with a "U" shaped configuration. It shall be of a size adequate to strike off, flush with the surrounding pavement surface and without overflow around the sides, all hot joint and crack sealant placed to seal cracks. This tool shall be either attached to the applicator wand or used separately as its own long handled tool.
- (3) Hot Air Lance: The unit shall be designed for cleaning and drying the pavement surface cracks. Minimum compressed air capacity shall be 100 psi. The compressed air emitted from the tip of the lance shall be flame free and be capable of achieving a temperature of at least 1500°F.

**4. Construction Methods:** The crack sealing operation shall proceed in accordance with the requirements of the "Maintenance and Protection of Traffic" and "Prosecution and Progress" specifications.

- (1) Weather Requirements: Work will not be performed unless the pavement is dry. No frost, snow, ice or standing water may be present on the roadway surface or within the cracks. No work shall be done if the ambient temperature is below 40° F during the field application operations.
- (2) Material Mixing Procedure: Field mixing of the Performance Grade Binder and the Polyester Fibers is not allowed. The field mix or prepackaged material shall not exceed 400 °F.
- (3) Crack Preparation: Pavement surface cracks, joints, and surfaces to be sealed shall be treated with a hot-air lance prior to application of the crack sealant material. Two passes, minimum, shall be made with the hot-air lance. The hot air lance operation shall proceed at a rate no greater than 120 feet per minute. There shall be no more than 10 minutes time lapse between the second hot-air lance treatment and the material application. Should this time be exceeded the Contractor shall make an additional pass(es) with the hot air lance. The use of the hot air lance is not intended

to heat the crack or joint. It is to be used to blow all debris from the crack or joint to the bottom of the crack or joint or surface to be sealed, or a depth of at least 1.25 inches, whichever is lower, and to remove any latent moisture or dampness from inside the crack or joint until the inside of the crack or joint is completely dry in the opinion of the Engineer. "Moisture" does not include standing water. The hot air lance is not to be used to "boil off" or blow standing water from the bottom of a crack or joint. If standing water is present in the bottom of any crack or joint, the sealing operation shall be postponed until such time as the standing water evaporates naturally. The Contractor may be allowed to use compressed, oil-free air (not heated) to blow standing water from a crack or joint to help accelerate the natural evaporation of any standing water. If this is done, the crack or joint must be allowed to dry naturally until all standing water is visibly gone. Then the hot air lance can be used. If a crack is already completely dry, in the opinion of the Engineer, the hot air lance should be operated at its lowest temperature possible.

TABLE 1 – MINIMUM AND MAXIMUM SEALING WIDTH

Crack or Joint Type	Minimum Sealing Width	Maximum Sealing Width
Cracks	Any width*	¾ inch
Joints	Any width*	¾ inch
Surfaces To Be Sealed**	N/A**	N/A**

**Note (\*): "Any width" is to be less than the Maximum Sealing Width and is to be changed to 1/8 of an inch if Engineer determines it is unfeasible and impractical to accomplish the work at lesser width.**

**Note (\*\*): "Surfaces To Be Sealed" could include vertical faces of bituminous concrete that has been saw-cut, joints between newly placed bituminous concrete and adjacent existing bituminous concrete, edges of patch areas, or other areas where sealant material is being used to prevent infiltration of water.**

(3).ii Additional preparation requirements of cracks and joints to be sealed

In the event that cracks or joints are packed tightly with debris, dirt, vegetation, or other material except previously placed sealant or filler, the Contractor shall use a vertically mounted power driven wire brush to remove debris and vegetation and burnish the sides of the crack to a depth of at least 1.25 inches. Cracks or joints treated with the wire power brush shall subsequently be treated with a hot air lance as described in this section. The conjunction of the use of the wire power brush and the hot-air lance treatment shall result in the complete removal of all material in the crack or joint (except previously placed sealant or filler) to a depth of at least 1.25 inches such that the sides of the crack are completely free and clean of any debris and moisture as described in this section.

- (4) Crack Sealing: All cracks prepared for treatment are to be filled to refusal. The sealing material shall be maintained at the manufacturer's specified application temperature range at all times. The sealing operation shall be suspended if the temperature of the crack sealing material falls outside the specified/recommended

- temperature range and shall remain suspended until the crack sealing material is brought within the specified temperature range. Cracks and joints must not be overfilled with sealant as they may detrimentally affect the planned overlay treatment. Any portion of the crack that is overfilled shall be squeegeed immediately following application of the crack sealing material, striking excess sealant as flat to the adjacent pavement surface as possible. There shall be no build-up of treatment material above or adjacent to the crack at any time. When the initial application of crack sealing material fails to fill the crack or shrinks upon cooling such that there is a depression formed of at least one quarter of an inch or greater, a second application of sealant shall be placed over the first application to fill the crack as described above.
- (5) Protection of Sealed Cracks and Joints: No traffic shall be permitted on the pavement until the crack seal material is set, whereas the crack seal material does not track and is not subject to deformation or pull-out by traffic. If a detackifier and/or blotting agent is used it shall be one recommended by the supplier of the crack sealing material and shall be used as recommended by the supplier, except that no paper, cotton, or other organic materials shall be allowed for either blotting or detackifying. Information on the type and usage of a detackifier and/or blotting agent shall be presented to the Engineer prior to its use. Any acceptance of the detackifier and/or blotting agent shall be granted by the Engineer in writing.
- (6) Surplus Treatment Material: Treatment material remaining in the contractor's kettle at the close of the daily work session shall be discarded. At no time shall treatment material be re-heated for use in subsequent crack sealing or filling applications unless permitted by the Engineer following a review of field operation circumstances.
- (7) All debris generated from the operations described above shall be removed from the roadway by the Contractor and disposed in accordance with State of Connecticut law.
- (8) Replacement of existing pavement markings obliterated by the crack and joint treatment work: Existing pavement markings obliterated by the crack and joint treatment work shall be replaced with temporary pavement markings before the roadway is opened to traffic. All costs associated with repair of work damaged by traffic and placement of temporary pavement markings will be borne by the Contractor.
- (9) Required Project Documentation. Provide the Engineer, on a daily basis, a report with the following information:
1. Control section, job number, and route number.
  2. Date, air temperature (°F), a.m. and p.m. weather.
  3. Beginning and ending locations for the day, including lane(s) and direction.
  4. Quantity of materials used for the day, including lot number.
  5. Traffic control typically used, number of traffic control moves, and checks on the traffic control conducted.
  6. Unique or different situations on the project.

7. Contractor's signature.

**5. Acceptance of Work:** When work is complete on the project, or on a project location if multiple locations are included in the project, an inspection of the work shall be scheduled with the Engineer. The inspection is to take place before the subsequent surface treatment included in the project is applied. The Engineer will note all deficiencies including areas exhibiting adhesion failure, cohesion failure, tracking of sealant material, missed cracks or joints, and/or other factors that show the work is not acceptable. Work identified by the Engineer as not acceptable shall be re-done at the Contractor's expense. The Contractor shall notify the Engineer upon completion of required corrective work, or upon completion of work on the project location if corrective work is not required.

**6. Method of Measurement:** This work shall be measured by the total number or linear feet of crack, joint, or surface designated to be sealed, measured in its largest dimension (length), as indicated in the Contract plans and documents and as measured, verified, and accepted by the Engineer.

**7. Basis of Payment:** The accepted quantity of pavement surface cracks or joints sealed shall be paid for at the contract unit price per linear foot. The price shall include all materials, equipment, tools, and labor incidental thereto. No payment will be issued to the contractor prior to document submissions required.

<u>Pay Item</u>	<u>Pay Unit</u>
0406194A Joint and Crack Sealing of Bituminous Concrete Pavement	L.F.

## **ITEM #0406195A – FILLING JOINTS AND CRACKS IN BITUMINOUS CONCRETE PAVEMENT**

### **Description:**

This work consists of furnishing and applying a hot-applied mixture of Performance-Graded (PG) asphalt binder and polyester fibers to bituminous concrete pavement cracks, longitudinal and transverse paving joints, joint-reflection cracks, and raveled transverse joints in flexible or composite pavement that are otherwise sound and do not display signs of active aggregate loss.

Joint and crack filling shall be constructed in accordance with these specifications and in close conformity with the lines, grades, thickness, and typical cross section shown on the plans or established by the Engineer. Joint and crack filling may be used in conjunction with other joint and crack treatments including, but not limited to, joint and crack sealing and patching in which case the relative sequence of crack treatments will be prescribed in the Plans, a Notice to Contractor, or other Contract documents.

### **Definitions:**

Composite pavement: Bituminous Concrete overlay of a Portland-cement-concrete (PCC) pavement.

Crack: For the purposes of this specification, a crack is a void in the pavement structure.

- Its length is defined as the longest dimension of the void. Additionally, the length is at minimum three (3) times the depth of the crack and is at minimum six (6) times the nominal maximum aggregate size of the mix at the surface.
- Its width is defined as the dimension perpendicular to the length at the pavement surface.
- Its depth is defined as the dimension that extends vertically into the pavement structure from the surface. The crack depth is greater than the crack width.

For the purpose of this document, the use of the word “crack,” including all work specified for “cracks” herein, will also apply to “raveled longitudinal joints” and “raveled transverse joints”, unless otherwise specified.

Joint: Purposely placed discontinuity in the pavement mat.

Longitudinal joints: Joints formed along the direction of travel between adjacent paving passes (or handwork or by other means) on the surface lift of a bituminous-concrete pavement structure. This includes, but is not limited to, joints formed by patching, utility work trenching, widening, new construction, and reconstruction.

Transverse joints: Joints formed perpendicular to the direction of travel on the surface lift of a bituminous-concrete pavement structure. This includes, but is not limited to, joints formed by patching, utility work trenching, widening, new construction, and reconstruction.

Working crack or joint: A crack or joint the width of which experiences horizontal contraction or expansion greater than  $\frac{1}{8}$  of an inch in the course of an annual or seasonal temperature cycle. Cracks or joints experiencing vertical movement under loads are beyond this description and should be treated as deteriorated cracks or joints.

Longitudinal cracks: Cracks, the endpoints of which are more distant in the direction of roadway travel than across the width of the pavement.

Transverse cracks: Cracks, the endpoints of which are more distant across the width of the pavement than along the direction of travel.

Continuous longitudinal joints or cracks: Longitudinal joints or cracks greater than 100 feet in length.

Longitudinal joint-reflection cracks: Longitudinal cracks formed atop the underlying longitudinal joint of a PCC pavement which has been surfaced with bituminous concrete pavement.

Transverse joint-reflection cracks: Transverse cracks formed atop the underlying transverse joint of a PCC pavement which has been surfaced with bituminous concrete pavement.

Double transverse joint-reflection cracks: Two transverse joint-reflection cracks with a minimum crack spacing of 1.5 inches and a maximum crack spacing of six (6) inches. The minimum crack length of either crack is greater than  $\frac{1}{4}$  the length of the underlying joint.

Associated transverse joint-reflection cracks: In double transverse joint-reflection cracks, the joint-reflection crack with the lower width. When these two cracks are of equal width and length, one will be treated as the transverse-joint-reflection crack and the other will be treated as the associated transverse joint-reflection crack.

Deteriorated transverse joint-reflection cracks: Single or double transverse joint-reflection cracks with potholes or patches more than  $\frac{1}{4}$  the length of the underlying joint. Additionally, if double transverse joint-reflection cracks form blocks between them that are less than 3 feet long in their longest dimension, this length will be considered deteriorated.

Raveled longitudinal joints: Defined as longitudinal joints formed between subsequent paver passes (or handwork or by other means) which have lost, due to aging of the pavement surface, at least  $\frac{1}{2}$  inch in depth of the original pavement surface material

placed. This includes, but is not limited to, joints formed by patching, utility work trenching, widening, new construction, and reconstruction. For filling consideration the joints need to be sound and not displaying signs of active aggregate loss.

Raveled transverse joints: Defined as transverse joints formed between paver passes (or handwork or by other means) which have lost, due to aging of the pavement surface, at least ½ inch in depth of the original pavement surface material placed. This includes, but is not limited to, joints formed by patching, utility work trenching, widening, new construction, and reconstruction. For filling consideration the joints need to be sound and not displaying signs of active aggregate loss.

Minimum width: The minimum width of a crack or joint to be included in the work of filling joints and cracks under this item.

Maximum width: The maximum width of crack or joint to be included in the work of filling joints and cracks under this item.

Flush fill: A method of filling a joint or crack to refusal such that minimal crack filling material is allowed to overflow onto the adjacent pavement surface immediately around the crack or joint. The total width of a flush fill when observed from above the pavement surface will be 1.5 inches or less. Any excess material is to be stricken off with a squeegee immediately after placement of the filler while the filler is still liquid. This shall be accomplished using the appropriate application wand and squeegee to place liquid crack filler in a crack or joint.

Recessed fill: A method of filling a joint or crack such that no crack filling material is allowed to overflow onto the adjacent pavement surface immediately around the crack or joint. This shall be accomplished using the appropriately sized and tipped application wand to place liquid crack filler in a joint or crack.

### **Materials:**

(1) Hot-Applied Crack Filler:

The hot-applied crack filling material will be composed of a mixture of Performance Graded Asphalt Binder and polyester fibers blended to provide 4.5 to 5.5 percent polyester fibers by weight. No field mixing of the fibers is allowed. The crack filling material (with fibers) will be prepackaged and arrive on site ready to be placed in the melter applicator. The materials will meet the following requirements:

(2) Polyester Fibers.

A General Certification from the manufacturer is required for this material. The polyester fibers must meet the following requirements:

Length: 6.4 mm ± 0.05 mm (0.25 inches ± 2 mils)

Crimps: (ASTM D-3937) None

Tensile Strength, (ASTM D-2256)\* 480 MPa (69,600 psi) minimum  
Denier, (ASTM D-1577)\* 3.0 to 6.0  
Specific Gravity 1.32 to 1.40  
Melting Temperature 245 °C (473 °F) minimum  
Ignition Temperature 540 °C (1000 °F) minimum  
\* This data must be obtained prior to cutting the fibers.

(3) Performance Graded (PG) Asphalt binder

The Performance Graded (PG) Asphalt binder will be Performance Grade 76-22 and will meet the requirements of AASHTO M-320(M) and AASHTO R-29(M). The Contractor shall submit a Certified Test Report and bill of lading representing each delivery in accordance with AASHTO R-26(M). The Certified Test Report must also indicate the asphalt binder specific gravity at 77°F, rotational viscosity at 275°F and 329°F, and a mixing and compaction viscosity-temperature chart as if the asphalt binder were to be used as binder for the construction of hot-mix asphalt. The blending of PG asphalt binder from different Suppliers is strictly prohibited. Contractors who blend PG asphalt binders shall be classified as a Supplier and shall be required to certify the asphalt binder in accordance with AASHTO R-26(M).

The contractor must submit to the Engineer all Material Safety Data Sheet documents from the material manufacturer(s) prior to the commencement of work. During work progress, the contractor must submit to the Engineer the manufacturer's certificate of testing for compliance to applicable specifications for each batch or lot of material utilized on the contract.

**Construction Methods:**

**1. Equipment:**

The equipment used by the contractor will include, but be not limited to, one or more of each of the following:

- (1) Melter Applicator: The unit will consist of a boiler kettle equipped with pressure pump, hose, and applicator wand; the boiler kettle may be a combination melter and pressurized applicator of a double-boiler type with space between the inner and outer shells filled with heat transfer oil. Heat transfer oil will have a flash point of not less than 600°F. The kettle will include a temperature control indicator and a mechanical agitator. The kettle will be capable of maintaining the treatment material at the manufacturer's specified application temperature range. The kettle will include an insulated applicator hose and application wand. The hose will be equipped with a shutoff control. The kettle will include a mechanical full sweep agitator to provide continuous blending. The unit will be equipped with thermometers to monitor the material temperature and the heating oil temperature. The unit

will be equipped with thermostatic controls that allow the operator to regulate material temperature up to at least 425 °F.

- (2) Application Wand and Squeegee Applicator: The material shall be applied with a wand followed by a squeegee applicator. The squeegee applicator will be of commercial/industrial quality designed with a “U” shaped configuration. It will be of a size adequate to strike off, flush with the surrounding pavement surface and without overflow around the sides, all hot joint and crack filler placed to fill joints and cracks. This tool will be either attached to the applicator wand or used separately as its own long handled tool.
- (3) Hot Air Lance: The unit will be designed for cleaning and drying the pavement surface cracks. Minimum compressed air capacity will be 100 psi. The compressed air emitted from the tip of the lance will be flame free and be capable of achieving a temperature of at least 1500°F.

**2. Operations:**

The crack filling operation shall proceed in accordance with the requirements of the “Maintenance and Protection of Traffic” and “Prosecution and Progress” specifications.

- (1) Weather Requirements:  
Work shall not be performed unless the pavement is dry. No frost, snow, ice or standing water may be present on the roadway surface or within the cracks. No work shall be done if the ambient temperature is below 40° F during the field application operations.
- (2) Cracks and Raveled Longitudinal and Transverse Joints to be Filled:  
The width and depth requirements for “cracks” and “raveled longitudinal and raveled transverse joints” to be filled are not the same.

All pavement surface cracks between the Minimum Crack Width and the Maximum Crack Width listed in Table 1 below shall be prepared in this manner, subject to the criteria in Table 3.

**Table 1 – Nominal Minimum and Maximum Crack Width**

Minimum Crack Width	½ inch
Maximum Crack Width	1.5 inches

All raveled pavement surface joints between the Minimum Raveled Joint Width and the Maximum Raveled Joint Width listed in Table 2 below shall be prepared in this manner, subject to the criteria in Table 3.

**Table 2 – Nominal Minimum and Maximum Raveled Joint Width**

Minimum Raveled Joint Width	½ inch
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Maximum Raveled Joint Width	3 inches
Minimum Raveled Joint Depth	½ inch
Maximum Raveled Joint Depth	1 inch

**Table 3 - Criteria for Selecting Cracks/Joints to Fill**

Type	Description	Action
Crack	Between Minimum Crack Width and Maximum Crack Width	Seal the part of the crack that is between the Minimum Crack Width and Maximum Crack Width
Crack	Less than Minimum Crack Width	Do not seal
Crack	Greater than Maximum Crack Width	Do not seal
Raveled Joint	Less than Minimum Raveled Joint Depth	Do not seal
Raveled Joint	Greater than Maximum Raveled Joint Depth	Take the action specified for a crack of similar dimensions.
Raveled Joint	Less than Minimum Raveled Joint Width	Do not seal
Raveled Joint	Greater than Maximum Raveled Joint Width	Do not seal
Raveled Joint	Between Minimum and Maximum Raveled Joint Depth and between Minimum and Maximum Raveled Joint Width	Seal

All crack and raveled joint width determinations shall be made by measuring the pavement crack or joint width flush at the surface of the pavement to be filled. A straightedge shall be used whenever necessary to establish the location or limits of the “flush” surface of the pavement.

**Note:** The width determinations made to identify joints and cracks to be filled may not be the same as the finished width after placement of the filler material. The act of striking off all filler placed may cause the finished appearance of a filled joint or crack to be wider than what was initially measured. This final width is not the width to be used to determine whether a crack or joint should be filled under this specification. It is the width measured before placement of any filler that is to be used to determine the appropriate widths of cracks and joints to be filled.

(3) Preparation:

Cracks shall be prepared to a depth of at least 0.75 inch for cracks between the Minimum Crack Width and one half of the Maximum Crack Width, and to a depth of 1.25 inches for cracks between one half of the Maximum Crack Width and the Maximum Crack Width.

Joints shall be prepared to a depth of 1 inch or the total depth of the joint, whichever is smaller, for cracks between the Minimum Raveled Joint Width and the Maximum Raveled Joint Width.

In the event that cracks are packed tightly with debris, dirt, vegetation, or other material except previously placed sealant or filler that cannot be removed by a hot air lance, the Contractor shall use a vertically mounted power driven wire brush to remove debris and vegetation and burnish the sides of the crack. Cracks treated with the wire power brush shall subsequently be treated with a hot air lance as described below. The conjunction of the use of the wire power brush and the hot-air lance treatment shall result in the complete removal of all material in the crack (except previously placed sealant or filler) such that the sides of the crack are completely free and clean of any debris and moisture as described in this section.

Pavement surface cracks and, raveled longitudinal joints, and raveled transverse joints to be filled shall be treated with a hot-air lance prior to application of the crack fill material. Two passes, minimum, shall be made with the hot-air lance. The hot air lance operation shall proceed at a rate no greater than 120 feet per minute. There shall be no more than a 10 minute time lapse between the second hot-air lance treatment and the material application. Should this time be exceeded the Contractor shall make an additional pass(es) with the hot air lance.

The use of the hot air lance is not intended to heat the crack; it is to remove any latent moisture or dampness from inside the crack until the inside of the crack is completely dry in the opinion of the Engineer. "Moisture" does not include standing water. The hot air lance is not to be used to "boil off" or blow standing water from the bottom of a crack or joint. If standing water is present in the bottom of any crack or joint, the filling operation shall be postponed until such time that the standing water evaporates naturally. The Contractor may be allowed to use compressed, oil-free, air (not heated) to blow standing water from a crack to help accelerate the natural evaporation of any standing water. If this is done, the crack must be allowed to dry naturally until all standing water is visibly gone. Then the hot air lance may be used. If a crack is already completely dry, in the opinion of the Engineer, the hot air lance should be operated at its lowest temperature possible.

(4) Material Mixing Procedure:

Field mixing of the Performance Grade Binder and the Polyester Fibers is not allowed. The prepackaged material shall be added to the melter applicator. It shall then be heated and mixed/circulated to the recommended application temperature. The crack fill material will never exceed 400 °F. Material exceeding 400 °F shall be rejected and discarded.

(5) Crack Filling:

Cracks are to be filled to refusal along their entire length. The treatment material shall be maintained within the manufacturer's specified application temperature range at all times. The filling operation shall be suspended if the temperature of the crack filling material falls outside the specified temperature range and shall remain suspended until the crack filling material is brought within the specified temperature range. The Engineer reserves the right to reject any overheated material. Cracks must not be overfilled as they may detrimentally affect any planned overlay treatment. If any portion of the crack is overfilled it shall be squeegeed immediately following application of the crack filler material, striking excess material as flat to the adjacent pavement surface as possible. Filled cracks are to be squeegeed immediately following application of the crack filling material, striking excess filler flat to the adjacent pavement surface. There will be no build-up of treatment material above or adjacent to the crack at any time. In cases where the initial application of filler material fails to fill the crack or shrinks upon cooling such that there is a depression formed of at least 1/4 of an inch or greater, a second application of filler shall be placed over the first application to fill the crack adequately as described above.

(6) Protection of Filled Joints and Cracks:

No traffic shall be permitted on the pavement until the crack fill material is set and the material does not track and is not deformed or pulled out by traffic.

If plans call for placing a bituminous surface treatment (e.g. overlay) over the crack filler, a detackifier (sand or liquid or spray or other) or blotter may not be used. Use of any detackifier may interfere with the bonding of any material placed over the material.

If plans do not call for placing a bituminous surface treatment (e.g. overlay) over the crack filler a detackifier may be used. The detackifier will be one recommended by the supplier of the filler material and shall be used as recommended by the supplier. No paper, cotton, or other organic materials will be allowed for either blotting or detackifying. Information on the type and usage of a detackifier shall be presented to the Engineer in writing. Any acceptance of the detackifier shall be granted by the Engineer in writing.

(7) Surplus Treatment Material:

Treatment material remaining in the contractor's kettle at the close of the daily work session shall be discarded. At no time shall treatment material be reheated for use in subsequent crack filling applications unless permitted by the Engineer following a review of field operation circumstances.

(8) Debris Removal:

All debris generated from the operations described above shall be removed from the roadway by the Contractor and disposed in accordance with State of Connecticut law.

- (9) Replacement of existing pavement markings obliterated by the crack and joint treatment work:

Existing pavement markings obliterated by the crack and joint treatment work shall be replaced with temporary pavement markings before the roadway is opened to traffic. All costs associated with repair of work damaged by traffic and placement of temporary pavement markings shall be borne by the Contractor.

- (10) Required Project Documentation:

Provide the Engineer, on a daily basis, a report with the following information:

1. Job number and route number.
2. Date, air temperature (°F), a.m. and p.m. weather.
3. Beginning and ending locations for the day, including lane(s) and direction.
4. Unique or different situations on the project.
5. Contractor's signature.

### **3. Acceptance of Work:**

When work is complete on the project or on a project location if multiple locations are included in the project, an inspection of the work shall be scheduled with the Engineer. The Engineer shall note all deficiencies including areas exhibiting adhesion failure, cohesion failure, tracking of filler material, missed cracks or joints, and/or other factors that show the work is not acceptable. Work identified by the Engineer as not acceptable shall be repaired at the Contractor's expense. The Contractor shall notify the Engineer upon completion of required corrective work so he/she can inspect it. All inspections are to take place before applying any subsequent surface treatments.

### **Method of Measurement:**

This work shall be measured by the number of linear feet of crack filler placed by the Contractor and measured by the Engineer. The amount of crack filler placed shall be measured and accepted by the Engineer.

### **Basis of Payment:**

The total number of linear feet measured shall be paid for at the contract unit price per linear foot. The price will include all materials, equipment, tools, and labor incidental thereto. No payment shall be issued to the contractor prior to document submittals required.

<u>Pay Item</u>	<u>Pay Unit</u>
0406195A – Filling Joints and Cracks in Bituminous Concrete Pavement	L.F.

**ITEM #0406285A – FINE MILLING OF HOT MIX ASPHALT (HMA) (0” - 4”)**

**Description:** This work shall consist of the milling, removal, and disposal of existing HMA pavement.

**Materials:** The existing HMA surface shall be disposed of offsite by the Contractor at an approved disposal facility unless otherwise stated in the Contract.

**Construction Methods:** The Contractor shall remove the HMA material using means acceptable to the Engineer. The pavement surface shall be removed to the line, grade, and existing or typical cross-section shown on the plans or directed by the Engineer.

Any milled surface, or portion thereof, that is exposed to traffic shall be paved within five (5) calendar days unless otherwise stated in the plans or Contract.

The equipment for milling the pavement surface shall be designed and built for milling flexible pavements. It shall be self propelled with sufficient power, traction, and stability to maintain depth and slope and shall be capable of removing the existing HMA pavement.

The milling machine shall be equipped with a built-in automatic grade averaging control system that can control the longitudinal profile and the transverse cross-slope to produce the specified results. The longitudinal controls shall be capable of operating from any longitudinal grade reference, including string line, contact ski (30 feet minimum), non-contact ski (20 feet minimum), or mobile string line (30 feet minimum). The transverse controls shall have an automatic system for controlling cross-slope at a given rate. The Engineer may waive the requirement for automatic grade or slope controls where the situation warrants such action.

The machine shall be able to provide a 0 to 4 inch deep cut in one pass. The rotary drum of the machine shall use carbide or diamond tip tools spaced not more than  $\frac{5}{16}$  inches apart. The forward speed of the milling machine shall be limited to no more than 45 feet/minute. The tools on the revolving cutting drum must be continually maintained and shall be replaced as warranted to provide a uniform pavement texture.

The machine shall be equipped with an integral pickup and conveying device to immediately remove material being milled from the surface of the roadway and discharge the millings into a truck, all in one operation. The machine shall also be equipped with a means of effectively limiting the amount of dust escaping from the milling and removal operation.

When milling smaller areas or areas where it is impractical to use the above described equipment, the use of a lesser equipped milling machine may be permitted when approved by the Engineer.

Protection shall be provided around existing catch basin inlets, manholes, utility valve boxes, and any similar structures. Any damage to such structures as a result of the milling operation is the Contractor's responsibility and shall be repaired at the Contractor's expense.

To prevent the infiltration of milled material into the storm drainage system, the Contractor shall take special care to prevent the milled material from falling into the inlet openings or inlet grates. Any milled material that has fallen into inlet openings or inlet grates shall be removed at the Contractor's expense.

**Surface Tolerance:** The milled surface shall provide a satisfactory riding surface with a uniform textured appearance. The milled surface shall be free from gouges, longitudinal grooves and ridges, oil film, and other imperfections that are a result of defective equipment, improper use of equipment, or poor workmanship. The Contractor, under the direction of the inspector, shall perform random spot-checks with a Contractor supplied ten-foot straightedge to verify surface tolerances at a minimum of five locations per day. The variation of the top of two ridges from the testing edge of the straightedge, between any two ridge contact points, shall not exceed  $\frac{1}{4}$  inch. The variation of the top of any ridge to the bottom of the groove adjacent to that ridge shall not exceed  $\frac{1}{4}$  inch. Any unsatisfactory surfaces produced are the responsibility of the Contractor and shall be corrected at the Contractor's expense and to the satisfaction of the Engineer.

The depth of removal will be verified by taking measurements every 250 feet per each pass of the milling machine, or as directed by the Engineer. These depth measurements shall be used to monitor the average depth of removal.

Where a surface delamination between HMA layers or a surface delamination of HMA on Portland cement concrete causes a non-uniform texture to occur, the depth of milling shall be adjusted in small increments to a maximum of a  $\pm \frac{1}{2}$  inch to eliminate the condition.

When removing HMA pavement entirely from an underlying Portland cement concrete pavement, all of the HMA pavement shall be removed leaving a uniform surface of Portland cement concrete, unless otherwise directed by the Engineer.

Any unsatisfactory surfaces produced by the milling operation are the Contractor's responsibility and shall be corrected at the Contractor's expense and to the satisfaction of the Engineer.

No vertical face, transverse or longitudinal, shall be left exposed to traffic unless the requirements below are met. This shall include roadway structures (catch basins, manholes, utility valve boxes, etc.). If any vertical face is formed in an area exposed to traffic, a temporary paved transition shall be established according to the requirements shown on the plans. If the milling machine is used to form a temporary transition, the length of the temporary transition shall conform to Special Provision Section 4.06 – Bituminous Concrete, "Transitions for Roadway Surface", the requirements shown on the plans, or as directed by the Engineer. At all permanent limits of removal, a clean vertical face shall be established by saw cutting prior to paving.

Roadway structures shall not have a vertical face of greater than one (1) inch exposed to traffic as a result of milling. All structures within the roadway that are exposed to traffic and greater

than one (1) inch above the milled surface shall receive a transition meeting the following requirements:

For roadways with a posted speed limit of 35 mph or less\*:

1. Round structures with a vertical face of greater than one (1) inch to 2.5 inches shall be transitioned with a hard rubber tapered protection ring of the appropriate inside diameter designed specifically to protect roadway structures.
2. Round structures with a vertical face greater than 2.5 inches shall receive a transition of bituminous concrete formed at a minimum 24 to 1 (24:1) taper in all directions.
3. All rectangular structures shall receive a transition of bituminous concrete formed at a minimum 24 to 1 (24:1) taper in all directions.

\*Bituminous concrete tapers at a minimum 24 to 1 (24:1) taper in all directions may be substituted for the protection rings if approved by the Engineer.

For roadways with a posted speed limit of 40, 45 or 50 mph:

1. All structures shall receive a transition of bituminous concrete formed at a minimum 36 to 1 (36:1) taper in all directions of travel. Direction of travel shall include both the leading and trailing sides of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

For roadways with a posted speed limit of greater than 50 mph:

1. All structures shall receive a transition of bituminous concrete formed at a minimum 60 to 1 (60:1) taper in the direction of travel. Direction of travel shall include both the leading and trailing sides of a structure. The minimum taper shall be 24 to 1 (24:1) in all other directions.

All roadway structure edges and bituminous concrete tapers shall be clearly marked with florescent paint. The paint shall be maintained throughout the exposure to traffic.

The milling operation shall proceed in accordance with the requirements of the “Maintenance and Protection of Traffic” and “Prosecution and Progress” specifications, or other Contract requirements. The more stringent specification shall apply.

Prior to opening an area which has been milled to traffic, the pavement shall be thoroughly swept with a sweeper truck. The sweeper truck shall be equipped with a water tank and be capable of removing the millings and loose debris from the surface. The sweeper truck shall operate at a forward speed that allows for the maximum pickup of millings from the roadway surface. Other sweeping equipment may be provided in lieu of the sweeper truck where acceptable by the Engineer.

Any milled area that will not be exposed to live traffic for a minimum of 48 hours prior to paving shall require a vacuum sweeper truck in addition to, or in lieu of, mechanical sweeping. The

vacuum sweeper truck shall have sufficient power and capacity to completely remove all millings from the roadway surface including any fine particles within the texture of the milled surface. Vacuum sweeper truck hose attachments shall be used to clean around pavement structures or areas that cannot be reached effectively by the main vacuum. Compressed air may be used in lieu of vacuum attachments if approved by the Engineer.

**Method of Measurement:** This work will be measured for payment by the number of square yards of area from which the milling of asphalt has been completed and the work accepted. No area deductions will be made for minor unmilled areas such as catch basin inlets, manholes, utility boxes and any similar structures.

**Basis of Payment:** This work will be paid for at the Contract unit price per square yard for “Fine Milling of HMA (0” – 4”).” This price shall include all equipment, tools, labor, and materials incidental thereto.

No additional payments will be made for multiple passes with the milling machine to remove the bituminous surface.

No separate payments will be made for cleaning the pavement prior to paving; providing protection and doing handwork removal of bituminous concrete around catch basin inlets, manholes, utility valve boxes and any similar structures; repairing surface defects as a result of the Contractor's negligence; providing protection to underground utilities from the vibration of the milling operation; removal of any temporary milled transition; removal and disposal of millings; furnishing a sweeper and sweeping after milling. The costs for these items shall be included in the Contract unit price.

Pay Item  
Fine Milling of Hot Mix Asphalt (HMA) (0” – 4’)

Pay Unit  
S.Y.

## **ITEM #0406287A – RUMBLE STRIPS - AUTOMATED**

## **ITEM #0406288A – RUMBLE STRIPS - MANUAL**

### **Description:**

Work under this item shall consist of installing rumble strips on asphalt highway shoulders where shown on the plans or where directed by the Engineer, and in conformance with these specifications.

### **Construction Methods:**

The Contractor shall pre-mark the location of the edge of the cut, and the beginning and ending points of the sections, prior to the installation of the rumble strips. The Engineer shall review and approve the locations.

The Contractor shall arrange for a technical representative, from the company which produces the milling machine to be used on the project, who will be required to be on-site from the beginning of the operation in order to ensure results that meet the requirements of the plans and specifications until such time the Engineer is satisfied.

Rumble strips should not be installed on bridge decks, in acceleration and deceleration lanes, at drainage structures, at loop detector sawcut locations, or in other areas identified by the Engineer.

### **Automated (Wide Shoulders):**

The equipment shall be able to install the rumble strips in sections where the shoulder width from the edge line to an obstruction is greater than or equal to 4 feet. Where there are no obstructions, the equipment shall be used in sections where the shoulder width from the edge line is a minimum of 3 feet. The equipment shall consist of a rotary type cutting head with a maximum outside diameter of 24" and shall be a minimum of 16" long. The cutting head(s) shall have the cutting tips arranged in such a pattern as to provide a relatively smooth cut (approximately 1/16 of an inch between peaks and valleys) in one pass. The cutting head shall be on its own independent suspension from that of the power unit to allow the tool to self align with the slope of the shoulder or any irregularities in the shoulder surface. The equipment shall include suitable provisions for the application of water to prevent dusting. The Contractor shall use a machine capable of creating the finished pattern at a minimum output of 60 rumble strips per minute.

### **Manual (Narrow Shoulders):**

The equipment shall be able to install the rumble strips in sections where the shoulder width from the edge line to an obstruction is between 3 feet and 4 feet. The cutting head(s) shall have the cutting tips arranged in such a pattern as to provide a relatively smooth cut (approximately 1/16 of an inch between peaks and valleys) in one pass. The equipment shall include suitable provisions for the application of water to prevent dusting.

**Finished Cut (Automated or Manual)**

The rumble strips shall have finished dimensions of 7" (+/- 1/2") wide in the direction of travel and shall be a 16" (+/- 1/2") long measured perpendicular to the direction of travel. The depressions shall have a concave circular shape with a minimum 1/2" depth at center (maximum allowable depth is 5/8" measured to a valley). The rumble strips shall be placed in relation to the roadway according to the patterns shown in the plans or on the Rumble Strip Details. Alignment of the edge of the cut shall be checked and verified by the Engineer.

The cutting tool shall be equipped with guides to provide consistent alignment of each cut in relation to the roadway.

The Contractor shall pick up any waste material resulting from the operation in a manner acceptable to the Engineer. This waste material shall be disposed of in accordance with Subarticle 2.02.03-10(a).

The work area shall be returned to a debris-free state prior to re-opening to traffic.

The Contractor shall provide all traffic control according to the Maintenance and Protection of Traffic Specification included elsewhere in the contract.

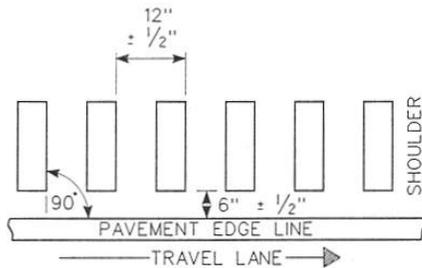
**Method of Measurement:**

This work will be measured for payment by the actual number of feet of shoulder where the rumble strips are placed and accepted. This distance shall be measured longitudinally along the edge of pavement with deductions for bridge decks, acceleration and deceleration lanes, drainage structures, loop detector sawcut locations, and other sections where the rumble strips were not installed.

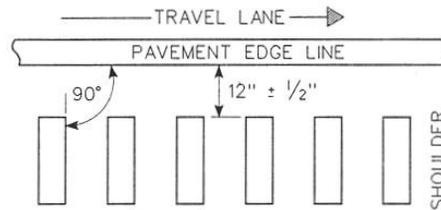
**Basis of Payment:**

This work will be paid for at the Contract unit price per foot for "Rumble Strips - Automated" or "Rumble Strips - Manual." The price shall include furnishing all equipment, tools, labor, a technical representative and work incidental thereto and also disposal of any waste material resulting from the operation. The Contractor will not be paid under the item "Rumble Strips - Manual" if the field conditions allow for the use of the "Rumble Strips - Automated" item, even if the manual method was used.

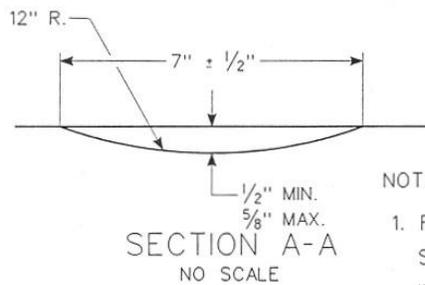
DETAILS AND SECTIONS OF RUMBLE STRIPS



LOCATION DETAIL (TYP.)  
LEFT SHOULDER



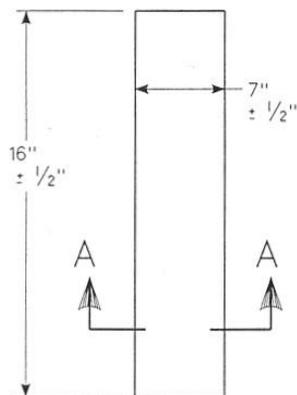
LOCATION DETAIL (TYP.)  
RIGHT SHOULDER



SECTION A-A  
NO SCALE

NOTES:

1. RUMBLE STRIP ALIGNMENT SHALL GENERALLY BE STRAIGHT AND OFFSET APPROXIMATELY 6" IN THE LEFT SHOULDER AND 12" IN THE RIGHT SHOULDER FROM THE OUTER EDGE OF THE EDGE LINE AND SHALL BE AT LEAST 12" FROM THE LONGITUDINAL JOINT IN COMPOSITE PAVEMENTS. THIS OFFSET MAY BE ADJUSTED TO ACCOMMODATE VARIATIONS IN THE EDGE LINE AND THE SHOULDER WIDTH.



PLAN DETAIL

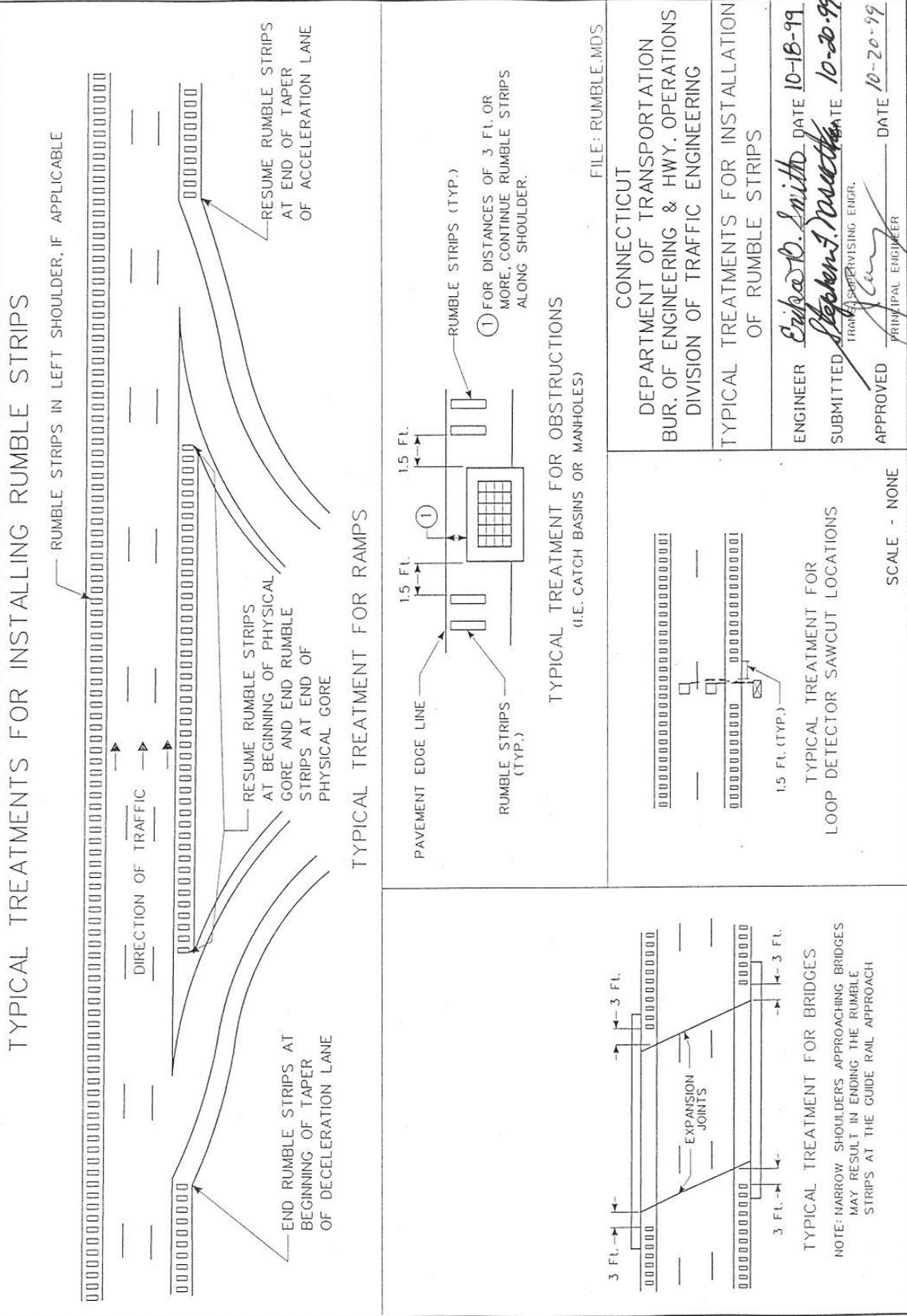
FILE: RUMBLE.MDS

CONNECTICUT  
DEPARTMENT OF TRANSPORTATION  
BUR. OF ENGINEERING & HWY. OPERATIONS  
DIVISION OF TRAFFIC ENGINEERING

RUMBLE STRIP DETAILS

ENGINEER *Erika B. Smith* DATE 10-18-99  
SUBMITTED *Stephen J. Smith* DATE 10-20-99  
TRAFFIC SUPERVISING ENGR.  
APPROVED *[Signature]* DATE 10-20-99  
PRINCIPAL ENGINEER

SCALE - NONE



**ITEM #0406314A – 80 MIL PAVEMENT MARKING GROOVE 5” WIDE**

**ITEM #0406315A – 80 MIL PAVEMENT MARKING GROOVE 7” WIDE**

**ITEM #0406316A – 80 MIL PAVEMENT MARKING GROOVE 9” WIDE**

**ITEM #0406317A – 80 MIL PAVEMENT MARKING GROOVE 13” WIDE**

**Description:**

Work under this item shall consist of grooving the pavement surface in a continuous or regularly spaced fashion for the placement of recessed pavement markings. Unless otherwise noted, the groove shall be 1 inch wider than the anticipated pavement marking. The groove for double-yellow centerline markings shall be 13 inches wide.

**Groove Width:** 5 inches wide for 4-inch markings  
7 inches wide for 6-inch markings  
9 inches wide for 8-inch markings  
13 inches wide for 12-inch markings and double yellow centerline

**Groove Depth:** 80 Mils (0.080 inches) ± 10 Mils (0.010 inches)

The groove shall not be installed continuously for intermittent pavement markings, but only where markings are to be applied.

The groove shall not be installed on bare concrete bridge decks, on metal bridge decks, on bridge joints, at drainage structures, at loop detector sawcut locations, or in other areas identified by the Engineer.

**Equipment:**

The grooving equipment shall be equipped with a free-floating, depth-controlled head which provides a consistent groove depth over irregular pavement surfaces. The grooving head shall only be equipped with diamond saw blades. Any ridges in the bottom of the groove shall have a maximum height of 15 Mils (0.015 inches).

The grooving equipment shall be capable of installing a groove 6 inches away from any vertical or horizontal obstruction.

**Construction Methods:**

The pavement marking groove shall be installed in accordance with the current ConnDOT pavement marking standard drawings.

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ITEM #0406315A  
ITEM #0406316A  
ITEM #0406317A

The Contractor shall establish control points for measuring offsets and pre-marks along the entire distance of pavement being grooved. Prior to installation of the groove, the Contractor shall verify the equipment is capable of installing the correct width and spacing of the groove. The control points, pre-marks, and equipment will be reviewed by the Engineer prior to commencement of the work.

The groove will be considered defective if any edge of the groove varies more than 0.25 inch in a 10-foot length, or if the alignment of the groove visibly deviates from the normal alignment of the road.

**Final Cleaning:** The Contractor shall immediately collect all debris and dust resulting from the grooving operation by vacuuming the pavement groove and adjacent pavement surface. Collected debris and any waste material shall be properly disposed of by the Contractor.

The work area shall be returned to a debris-free state prior to re-opening to traffic.

**Repair of Unacceptable Groove:**

The Contractor shall repair any defective groove(s) to the satisfaction of the Engineer. All work in conjunction with this repair shall be performed at no additional cost to the State.

**Pavement Marking Requirements:**

The Contractor is required to install permanent epoxy resin pavement markings in the grooves before the lane or roadway is opened to live traffic. If the permanent pavement markings cannot be installed before the lane or roadway is opened to live traffic, temporary 5-Mil (0.005-inch) hot-applied waterborne pavement markings without glass beads shall be installed before the lane or roadway is opened to live traffic at no additional cost to the State. Within 10 calendar days, permanent epoxy resin pavement markings shall be applied in the groove over the 5-Mil (0.005-inch) hot-applied waterborne pavement markings.

**Groove Depth Gauge:**

The Contractor shall supply the Engineer with two accurate, easily readable gauges with which to verify groove depth for the duration of the project. The gauges shall be delivered no less than one week prior to the anticipated beginning of grooving operations. Gauges shall be accompanied by manufacturer's instructions for their use. The gauges will be returned to the Contractor at the conclusion of the project.

**Method of Measurement:**

This work will be measured for payment by the number of linear feet of groove installed in the pavement as ordered and accepted by the Engineer.

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ITEM #0406317A

**Basis of Payment:**

This work will be paid for at the contract unit price per linear foot of “Pavement Marking Groove” installed in the pavement and accepted. This price shall include cleaning of the pavement, all materials, equipment, tools, depth gauges, and labor incidental thereto, and disposal of any waste material resulting from the operation.

**Pay Item**

- 80 Mil Pavement Marking Groove 5” Wide
- 80 Mil Pavement Marking Groove 7” Wide
- 80 Mil Pavement Marking Groove 9” Wide
- 80 Mil Pavement Marking Groove 13” Wide

**Pay Unit**

- L.F.
- L.F.
- L.F.
- L.F.

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ITEM #0406315A  
ITEM #0406316A  
ITEM #0406317A

## **ITEM #0406999A – ASPHALT ADJUSTMENT COST**

**The Asphalt Price is available on the Department of Transportation web site at:**

<http://www.ct.gov/dot/asphaltadjustment>

The asphalt adjustment cost will be based on the variance in price for the performance-graded binder component of hot mix asphalt (HMA), Polymer Modified Asphalt (PMA), and Ultra-Thin Bonded Hot-Mix Asphalt mixtures completed and accepted in the contract.

An asphalt adjustment cost will be applied only if all of the following conditions are met:

- I. For HMA and PMA mixtures:
  - a. The HMA or PMA mixture in which the adjustment is being applied is listed as a contract item with a pay unit of tons or metric tons.
  - b. The total quantity for all HMA and PMA mixtures in a contract or individual purchase order (Department of Administrative Service contract awards) exceeds 1000 tons or more.
  - c. The difference between the posted *Asphalt Base Price* and *Asphalt Period Price* varies by more than \$5.00.
- II. For Ultra-Thin Bonded HMA mixtures:
  - a. The Ultra-Thin Bonded HMA mixture in which the adjustment is being applied is listed as a contract item.
  - b. The total quantity for Ultra-Thin Bonded HMA mixture in a contract exceeds:
    - i. 800 tons (727 metric tons) if Ultra-Thin Bonded HMA is listed as a contract item with a pay unit of tons or metric tons.
    - ii. 30,000 square yards (25,080 square meters) if Ultra-Thin Bonded HMA is listed as a contract item with a pay unit of square yards or square meters.

Note: The quantity of Ultra-Thin Bonded HMA measured in tons shall be determined from the material documentation requirements set forth in the Ultra-Thin Bonded HMA Special Provision.
  - c. The difference between the posted *Asphalt Base Price* and *Asphalt Period Price* varies by more than \$5.00.
  - d. No Asphalt Adjustment Cost shall be applied to the liquid emulsion that is specified as part of the Ultra-Thin Bonded HMA mixture system.

- III. Regardless of the binder used in all HMA and/or PMA mixtures, the Asphalt Adjustment Cost will be based on PG 64-22.

The Connecticut Department of Transportation (ConnDOT) shall post on its website, the average per ton selling price (asphalt price) of the performance-graded binder. The average is based on the high and low selling price published in the most recent available issue of the **Asphalt Weekly Monitor**® furnished by Poten & Partners, Inc. under the “East Coast Market – New England, New Haven, Connecticut area”, F.O.B. manufacturer’s terminal.

The selling price furnished from the Asphalt Weekly Monitor ® is based on a standard ton (US\$/ST). The metric ton price is determined by applying a factor of 1.1023 (US\$/ST x 1.1023 = US\$/mton). Example: \$150.00/ton x 1.1023 = \$165.34/mton

Formula:  $HMA \times \frac{PG\%}{100} \times [(Period\ Price - Base\ Price)] = \$ \underline{\hspace{2cm}}$ , where

- **HMA:**
  1. For HMA, PMA, and Ultra-Thin Bonded HMA mixtures with pay units of mass:  
The quantity (tons or metric tons) of accepted HMA, PMA, or Ultra-Thin Bonded HMA mixture measured and accepted for payment.
  2. For Ultra-Thin Bonded HMA mixtures with pay units of area:  
The quantity of Ultra-Thin Bonded HMA mixture delivered, placed, and accepted for payment, calculated in tons or metric tons as documented according to the Material Documentation provision (section E) of the Ultra-Thin Bonded HMA Special Provision.
- **Asphalt Base Price:** The asphalt price that is posted on the ConnDOT website 28 days before the actual bid opening posted.
- **Asphalt Period Price:** The asphalt price that is posted on the ConnDOT website for the period in which the HMA, PMA mixture is placed.
- Performance-Graded Binder percentage (**PG%**)
  1. For HMA or PMA mixes:  
PG% = 4.5
    - For Superpave 1.5 inch (37.5mm), Superpave 1.0 inch (25.0mm), PMA S1, HMA S1, and Class 4  
  
PG % = 5.0
    - For Superpave 0.50 inch (12.5mm), HMA S0.5, PMA S0.5, and Class 1

- PG % = 6.0
- For Superpave 0.375 inch (9.5mm), HMA S0.375, PMA S0.375, Superpave 0.25 inch (6.25mm), HMA S0.25, PMA S0.25, Superpave #4 (4.75mm) and Class 2
2. For Ultra-Thin Bonded HMA mixes:  
PG% = Design % PGB (Performance Graded Binder) in the approved job mix formula, expressed as a percentage to one decimal point (e.g. 5.1%)

The adjustment shall not be considered as a changed condition in the contract because of this provision and because the Contractors are being notified before submission of bids.

**Basis of Payment:** The "Asphalt Adjustment Cost" will be calculated using the formula indicated above. A payment will be made for an increase in costs. A deduction from monies due the Contractor will be made for a decrease in costs.

The sum of money shown on the estimate, and in the itemized proposal as "Estimated Cost", for this item will be considered the bid price although payment will be made as described above. The estimated cost figure is not to be altered in any manner by the bidder. If the bidder should alter the amount shown, the altered figure will be disregarded and the original cost figure will be used to determine the amount of the bid for the Contract.

## **ITEM #0511006A – CLEANING WEEPHOLES**

Work under this item shall conform to the requirements of Section 6.53 supplemented and amended as follows:

**Article 6.53.01 -Description:** *Replace the subarticle with the following:*

The work included in this item shall consist of furnishing all equipment, tools, labor, and materials and performing all work necessary for cleaning, removing and disposing of all sludge, dirt, sand, gravel, roots, grease, and other debris from the existing bridge drainage system which includes: weep pipes, approximately 1½” in diameter, and approximately 3’ to 6’ in length. The pipes to be cleaned are as shown on plans or as ordered by the Engineer.

**Article 6.53.04-Method of Measurement:** *Replace the subarticle with the following:*

Weep pipes cleaned under this item will be measured for payment by the actual number of units cleaned.

**Article 6.53.05- Basis of Payment:** *Replace the subarticle with the following:*

This work will be paid for at the Contract unit price for each weep hole for “Cleaning Weepholes”, which price shall include all equipment, tools, and labor incidental to the completion of the item. All costs incidental to the disposal of sludge, dirt, sand, gravel, roots, grease, and other debris will be included in the price above.

Pay Item	Pay Unit
Cleaning Weepholes	EA.

## **ITEM #0520036A – ASPHALTIC PLUG EXPANSION JOINT SYSTEM**

**Description:** Work under this item shall consist of furnishing and installing an asphaltic plug expansion joint system (APJ) in conformance with ASTM D6297, as shown on the plans, and as specified herein.

Work under this item shall also consist of the removal and disposal of bituminous concrete, membrane waterproofing, existing joint components and sealing elements, cleaning and sealing median barrier joints, parapet joints, and sidewalk joints.

Work under this item excludes the removal of Portland cement concrete headers.

**Materials:** The APJ component materials shall conform to ASTM D6297 and the following:

Aggregate: The aggregate shall meet the following requirements:

- a) Loss on abrasion: The material shall show a loss on abrasion of not more than 25% using AASHTO Method T96.
- b) Soundness: The material shall not have a loss of more than 10% at the end of five cycles when tested with a magnesium sulfate solution for soundness using AASHTO Method T 104.
- c) Gradation: The aggregate shall meet the requirements of Table A below:
- d) Dust: aggregate shall not exceed 0.5% of dust passing the #200 sieve when tested in accordance with AASHTO T-11.

**Table A**

<b><u>Square Mesh Sieves</u></b>	<b>1” (25.0 mm)</b>	<b>¾” (19.0 mm)</b>	<b>½” (12.5 mm)</b>	<b>⅜” (9.5 mm)</b>	<b>No. 4 (4.75 mm)</b>
<b>% passing</b>	<b>100</b>	<b>90 - 100</b>	<b>20 - 55</b>	<b>0 - 15</b>	<b>0 - 5</b>

A sample of the aggregate shall be submitted to the Department with a Certified Test Report in accordance with Article 1.06.07 for each 20 tons of loose material or its equivalent number of bags delivered to the job site. The Certified Test report must include a gradation analysis resulting from a physical test performed on the actual material that accompanies the report.

Anti-Tacking Material: This material shall be a fine graded granular material with 100% passing the 3/16” sieve and no more than 5% passing the #200 when tested in accordance with AASHTO T-27.

Backer Rod: All backer rods shall satisfy the requirements of ASTM D5249, Type 1.

**Bridging Plate:** The bridging plates shall be steel conforming to the requirements of ASTM A36 and be a minimum ¼” thick and 8” wide. For joint openings in excess of 3” the minimum plate dimensions shall be ⅜” thick by 12” wide. Individual sections of plate shall not exceed 4’ in length. Steel locating pins for securing the plates shall be size 16d minimum, hot-dip galvanized, and spaced no more than 12” apart.

**Concrete Leveling Material:** Shall be a cementitious-based material that conforms to ASTM C928 Standard Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repair, for R3 performance requirements in Table 1 and achieve the following:

- a. Final set in 45 Minutes
- b. 2500 psi compressive strength in 24 hours
- c. 5000 psi compressive strength in 7 days

**Parapet Sealant:** The sealant used in parapet joint openings shall be a single component non-sag silicone sealant that conforms to the requirements of ASTM D5893.

**Sidewalk Sealant:** The sealant used in sidewalk joint openings shall be a rapid cure, self-leveling, cold applied, two-component silicone sealant. The silicone sealant shall conform to the requirements listed in Table B:

**Table B**

<b>Properties - As Supplied</b>	<b>Test Method</b>	<b>Requirement</b>
Extrusion Rate	ASTM C1183	200-600 grams/min
Leveling	ASTM C639	Self-Leveling
Specific Gravity	ASTM D792	1.20 to 1.40
<b>Properties - Mixed</b>	<b>Test Method</b>	<b>Requirement</b>
Tack Free Time	ASTM C679	60 min. max.
Joint Elongation – Adhesion to concrete	ASTM D5329 <sup>1,2,3</sup>	600% min
Joint Modulus @ 100% elongation	ASTM D5329 <sup>1,2,3</sup>	15 psi max
Cure Evaluation	ASTM D5893	Pass @ 5 hours

1. Specimens cured at 77±3<sup>0</sup>F and 50±5% relative humidity for 7 days
2. Specimens size: ½”wide by ½”thick by 2” long
3. Tensile Adhesion test only

The date of manufacture shall be provided with each lot. No sealant shall be used beyond its maximum shelf-life date.

The two-part silicone sealants shown in Table C are known to have met the specified requirements:

**Table C**

<b>Product</b>	<b>Supplier</b>
Dow Corning 902RCS	Dow Corning Corporation 2200 W Salzburg Road Auburn, Michigan 48611
Wabo SiliconeSeal	BASF/Watson Bowman Acme Corporation 95 Pineview Drive Amherst, New York 14228

Other two-component silicone joint sealants expressly manufactured for use with concrete that conform to the aforementioned ASTM requirements will be considered for use provided they are submitted in advance for approval to the Engineer. Other joint sealants will be considered for use only if a complete product description is submitted, as well as documentation describing at least five installations of the product. These documented installations must demonstrate that the product has performed successfully for at least three years on similar bridge expansion joint applications.

A Materials Certificate and Certified Test Report for the asphaltic binder shall be submitted by the Contractor in accordance with the requirements of Article 1.06.07 certifying that the asphaltic binder satisfies the requirements of the most current version of ASTM D6297.

A Materials Certificate for all other components of the APJ, leveling material, backer rod and sealant used in sealing parapet and sidewalk joint openings, shall be submitted by the Contractor in accordance with the requirements of Article 1.06.07

**Construction Methods:** The APJ shall be installed at the locations shown on the plans and in stages in accordance with the traffic requirements in the special provisions “Maintenance and Protection of Traffic” and “Prosecution and Progress”.

At least 30 days prior to start of the work, the Contractor shall submit to the Engineer for approval a detailed Quality Control Plan for the installation of the APJ. The submittal shall include:

- a) A list of all manufactured materials and their properties to be incorporated in the joint system, including, but not limited to the asphaltic binder, anti-tack material, backer rod, sealant, leveling material, as well as the aggregate’s source.
- b) A detailed step by step installation procedure and a list of the specific equipment to be used for the installation. The Quality Control Plan must fully comply with the specifications and address all anticipated field conditions, including periods of inclement weather.

The APJ shall not be installed when bituminous concrete overlay or joint cutout is wet. The APJ shall only be installed when the bridge superstructure surface temperature is within the limits specified in Table D and when the ambient air temperature is within the range of 45<sup>0</sup>F to 95<sup>0</sup>F. The bridge superstructure surface temperature range is determined using the thermal movement range provided on the contract plans for the proposed APJ deck installation location and the selected APJ product.

**Table D**

<b>Installation Restrictions</b>	
<b>Designed Deck Joint Thermal Movement Range<sup>2</sup></b>	<b>Bridge Superstructure Surface Temperature<sup>1</sup></b>
0" to 1"	45° F to 95° F
1-1/8"	45° F to 90° F
1-1/4"	45° F to 80° F
1-3/8"	45° F to 70° F
1-1/2"	45° F to 65° F

1. *The superstructure surface temperature shall be determined from the average of three or more surface temperature readings taken at different locations on the interior girder surfaces by the Contractor as directed by the Engineer. Temperature measurements of the superstructure shall be taken by the contractor with a calibrated hand held digital infrared laser-sighted thermometer on the surfaces of an interior steel girder, or interior concrete girder protected from direct sunlight. The infrared thermometer to be supplied by the Contractor for this purpose shall meet certification requirements of EN61326-1, EN61010-1, and EN60825-1 maintained by the European Committee for Electrotechnical Standardization (CENELEC). The thermometer shall have a minimum distance-to-spot ratio of 50:1 and shall have adjustable emissivity control. The thermometer shall have a minimum accuracy value of  $\pm 1\%$  of reading or  $\pm 2^{\circ}\text{F}$ , whichever is greater. The thermometer shall be used in strict accordance with the manufacturer's written directions. An additional infrared thermometer satisfying the same standards to be used in this application shall also be provided to the Engineer for quality assurance purposes.*
2. *Linear interpolation may be used to determine an allowable surface temperature range for thermal movement ranges in between values shown in the table, as approved by the Engineer.*

Prior to installing the APJ, the Contractor shall determine the exact location of the deck joint beneath the bituminous concrete overlay.

The APJ shall be installed symmetrically about the deck joint opening to the dimensions shown on the plans or as directed by the Engineer; not to exceed 24 inches measured perpendicular to the deck joint. The proposed saw cut lines shall be marked on the bituminous concrete overlay by the Contractor and approved by the Engineer, prior to saw-cutting. The saw-cuts delineating the edges of the APJ shall extend full depth of the bituminous concrete overlay.

The existing bituminous concrete overlay, waterproofing membrane and/or existing expansion joint material, within the saw cut limits shall be removed and disposed of by the Contractor to create the joint cutout.

Concrete surfaces that will support the bridging plates shall be smooth and form a plane along and across the deck joint. Rough or damaged concrete surfaces shall be repaired with a leveling compound meeting the requirements of this specification. Deteriorated concrete areas within the joint limits shall be repaired as directed by the Engineer: such repairs, when deemed necessary by the Engineer, shall be compensated for under the applicable concrete deck repair items in the Contract. The existing and repaired concrete surfaces shall provide continuous uniform support for the bridging plate and prevent the plate from rocking and deflecting.

Prior to the installation of the backer rod, all horizontal and vertical surfaces of the joint cutout shall be abrasive blast cleaned using an oil-free, compressed air supply. The entire cutout shall then be cleared of all loose blast media, dust, debris and moisture using an oil-free, hot air lance capable of producing an air stream at 3,000°F with a velocity of 3,000 feet per second.

A single backer rod, with a diameter at least 25% greater than the existing joint opening at the time of installation, shall be installed at an inch below the bridging plate in the existing deck joint opening between the concrete edges.

Asphaltic binder shall be heated to a temperature within the manufacturer's recommended application temperature range which shall be provided in the Quality Control Plan. During application, the temperature of the binder shall be maintained within this range. In no case shall the temperature of the binder go below 350° F nor exceed the manufacturer's recommended maximum heating temperature.

Asphaltic binder shall then be poured into the joint opening until it completely fills the gap above the backer rod. A thin layer of binder shall next be applied to the all horizontal and vertical surfaces of the joint cutout.

Bridging plates shall be abrasive blast-cleaned on-site prior to installation and then placed over the deck joint opening in the joint cutout. The plates shall be centered over the joint opening and secured with locating pins along its centerline. The plates shall be placed end to end, without overlap, such that the gap between plates does not exceed 1/4". The plates shall extend to the gutter line and be cut to match the joint's skew angle, where concrete support exists on both

sides of the joint. Within APJ installation limits, where concrete support does not exist at both sides of the joint opening (such as where a bridge deck end abuts a bituminous concrete roadway shoulder), bridging plates shall not be installed. Installed bridging plates shall not rock or deflect in any way. After installation of bridging plates, a thin layer of asphaltic binder shall be applied to all exposed surfaces of the plates.

The remainder of the joint cutout shall then be filled with a mixture of hot asphaltic binder and aggregate prepared in accordance with the submitted Quality Control Plan and the following requirements:

- The aggregate shall be heated in a vented, rotating drum mixer by the use of a hot-compressed air lance to a temperature of between 370° F. to 380° F. This drum mixer shall be dedicated solely for the heating and, if necessary, supplemental cleaning of the aggregate. Venting of the gas and loose dust particles shall be accomplished through ¼” drilled holes spaced no more than 3” on center in any direction along the entire outside surface of the drum
- Once the aggregate has been heated, it shall then be transferred to a secondary drum mixer where it shall be fully coated with asphaltic binder. A minimum of two gallons of binder per 100lbs of stone is required.
- The temperature of the aggregate and binder shall be monitored by the contractor with a calibrated digital infrared thermometer.
- The coated aggregate shall be loosely placed in the joint cutout in lifts not to exceed 2 inches.
- Each lift shall be leveled, compacted and then flooded with hot asphaltic binder to the level of the aggregate to fill all voids in the coated aggregate layer. The surface of each lift shall be flooded until only the tips of the aggregate protrude out of the surface.
- The final lift shall be placed such that no stones shall project above the level of the adjacent overlay surface following compaction of the coated aggregate.
- Following installation of the final lift, sufficient time and material shall be provided to allow all voids in the mixture to fill. This step may be repeated as needed.
- The joint shall then be top-dressed by heating the entire area with a hot-compressed air lance and applying binder. The final joint surface must be smooth with no protruding stones and be absent of voids.
- Once top-dressed, the joint shall have an anti-tack material spread evenly over the entire surface to prevent tracking.

The Contractor shall be responsible for removing all binder material that leaks through the joint and is deposited on any bridge component, including underside of decks, headers, beams, diaphragms, bearings, abutments and piers.

Traffic shall not be permitted over the joint until it has cooled to 130° F when measured with a digital infrared thermometer. Use of water to cool the completed joint is permitted.

Sidewalk, parapet, and/or curb joint openings

Before placement of any sealing materials in parapets, curbs, or sidewalks, the joints shall be thoroughly cleaned of all scale, loose concrete, dirt, dust, or other foreign matter by abrasive blast cleaning. Residual dust and moisture shall then be removed by blasting with oil free compressed air using a hot air lance. Projections of concrete into the joint space shall also be removed. The backer rod shall be installed in the joint as shown on the plans. The joint shall be clean and dry before the joint sealant is applied. Under no circumstances is the binder material to be used as a substitute for the joint sealant.

Whenever abrasive blast cleaning is performed under this specification, the Contractor shall take adequate measures to ensure that the abrasive blast cleaning will not cause damage to adjacent traffic or other facilities.

The joint sealant shall be prepared and placed in accordance with the manufacturer's instructions and with the equipment prescribed by the manufacturer. Extreme care shall be taken to ensure that the sealant is placed in accordance with the manufacturer's recommended thickness requirements.

The joint sealant shall be tooled, if required, in accordance with the manufacturer's instructions.

Primer, if required, shall be supplied by the sealant manufacturer and applied in accordance with the manufacturer's instructions.

When the sealing operations are completed, the joints shall be effectively sealed against infiltration of water. Any sealant which does not effectively seal against water shall be removed and replaced at the Contractor's expense.

Any installed joint that exhibits evidence of failure, as determined by the Engineer, such as debonding, cracking, rutting, or shoving of the APJ mixture shall be removed and replaced full-width and full-depth to a length determined by the Engineer at no additional cost to the State.

**Method of Measurement:** This work will be measured for payment by the number of cubic feet of "Asphaltic Plug Expansion Joint System" installed and accepted within approved horizontal limits. No additional measurement will be made for furnishing and installing backer rod and joint sealant in the parapets, concrete medians, curbs and/or sidewalks.

**Basis of Payment:** This work will be paid for at the contract unit price per cubic foot for "Asphaltic Plug Expansion Joint System," complete in place, which price shall include the saw-cutting, removal and disposal of bituminous concrete, membrane waterproofing, existing joint components and sealing elements, the furnishing and placement of the leveling compound, cleaning of the joint surfaces, furnishing and installing bridging plates, the furnishing and installing of the asphaltic plug joint mixture, the cost of furnishing and installing joint sealant in the parapets, concrete medians, curbs and sidewalks, and all other materials, equipment including, but not limited to, portable lighting, tools, and labor incidental thereto. No additional

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payment shall be made for the 12" wide bridging plates that are required for deck joint openings with widths in excess of 3".

## **ITEM #0601318A – PARTIAL DEPTH PATCH**

**Description:** Work under this item shall consist of the removal of spalled, delaminated or otherwise deteriorated concrete from existing bridge decks and/or approach slabs, and replacement with fast setting patching material as shown on the plans, as directed by the Engineer, and hereinafter specified. Where ordered by the Engineer, work under this item shall also include repairing pop-outs on the underside of the deck caused by the removal of deteriorated concrete. Work under this item shall also include the furnishing and installation of deformed steel bars, reinforcing wire ties and vertical supports on inadequately supported and/or defective reinforcing steel within deck patch areas and providing of a safe access to the structure for the delineation of the repair locations and review of the performed repair work.

**Materials:** The material shall conform to the following requirements:

1. High Early Strength Concrete – The high early strength concrete (HESC) shall conform to one of the following:

A. Unless otherwise approved by the Engineer, the HESC shall be one of the following materials:

Rapid Set DOT Cement HD-50  
CTS Cement Manufacturing Dayton Superior Corporation  
1023 Dogwood Lane PO Box 355  
West Chester, PA 19382 Oregon, IL 61061  
215-429-4956 800-745-3707

Speed Crete Green Line  
Tamms Industries  
730 Casey Ave.  
Wilkes-Barre, PA 18702  
800-218-2667

B. In lieu of the above HESC mixes, the Contractor may propose the use of another proprietary-type mix. This mix shall meet the physical requirements as stated below. The high early strength concrete shall be of a high strength, have rapid strength gain characteristics in normal weather (above 10°C ambient temperature), bond to the existing concrete, and be durable. The concrete material shall be able to accept coarse aggregate to extend the yield and result in a workable mixture. The high early strength concrete, as delivered without additional coarse aggregate, and mixed in accordance with the manufacturer's instructions, shall have the following properties:

- A minimum one hour compressive strength of 2,500 psi, a 24 hour strength of 3,500 psi and a 28 day strength of 5,000 psi (ASTM C109)
- A minimum bond strength of 220 psi after 24 hours. (ASTM C882)
- A minimum initial setting time of 5 minutes at 24°±1°C. (ASTM C266)
- The ability to withstand 50 cycles of freeze-thaw (10% NaCl solution) with a maximum loss of 6%. (ASTM C666)

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- Expansion of no more than 0.40% and contraction of no more than 0.05%. (ASTM C157)
- A workable mixture when extended with a minimum 60% No. 8 aggregate by weight of dry concrete component.

A mix design for this material shall be submitted at least two weeks prior to its use. The mix design shall state the percentage of each component to be utilized along with substantive data that demonstrates the ability of the material to meet the specification requirements.

2. Deformed Steel Bars: Section 6.02.

**Construction Methods:**

- 1) Inspection of the Structural Slab: Before any existing concrete is removed from the structural slab, the Contractor will provide the Engineer clear access to the bridge deck. During this time, the Engineer will perform an inspection of the structural slab and designate areas where concrete removal will be required. Due to the nature of the operations, the inspection can be performed only after some existing materials, notably overlays and waterproofing system, have first been removed from the structural slab. It shall be the responsibility of the Contractor to arrange the construction schedule so that the required operations may be performed without causing delay to the work.

No operations will be performed by the Engineer until after the following construction work has been completed:

- a) The existing bituminous overlay or concrete wearing course, if present, has been removed.
- b) The existing waterproofing system, if present, has been removed.

Note: The removal of this material will be paid for under other applicable items.

- c) Installation of sedimentation controls for the prevention of materials entering the bridge drainage system.

The Contractor shall furnish and install sedimentation controls at bridge scuppers to prevent concrete debris from entering the bridge drainage system. The methods proposed by the Contractor will be approved by the Engineer.

It shall be the responsibility of the Contractor to inform the Engineer, in writing, of the date that a structure will be available for inspection operations. Notification shall be given to the Engineer at least seven (7) days prior to the date that the area in question will be in a condition acceptable to the Engineer.

The Contractor is hereby informed that the following time period will be necessary to perform the required inspection operations:

One working day with suitable weather conditions per each six thousand square feet, or portion thereof, of structural slab area.

The Contractor will not be allowed to do any further work to the structural slab, until all necessary inspection operations have been performed, unless given permission by the Engineer.

The Contractor will include any costs related to the allowance for this inspection in the general cost of the work.

2) Removal of Deteriorated Concrete: All deteriorated concrete designated for removal under this construction item shall be removed within the limits shown on the plans and where ordered by the Engineer. The lateral limits of each area to be repaired will be delineated by the Engineer and suitably marked. Where several areas to be repaired are very close together, the Engineer may combine these individual patches into a large area. The outlines of each such area shall first be cut to a depth of one-half (1/2) inch with an approved power saw capable of making straight cuts. In the event that reinforcing steel is encountered within the upper 1/2 inch depth during sawing operations, the depth of saw-cut shall immediately be adjusted to a shallower depth so as not to damage the steel bars. If so directed by the Engineer, saw cutting shall again be carried down to the 1/2 inch depth at other locations of repair provided reinforcing steel is not again encountered. Where over-breakage occurs resulting in a featheredge, the featheredge shall be squared up to a vertical edge in an approved manner. Where sawing is impractical, the area shall be outlined by chisel or other approved means.

All deteriorated concrete shall be removed by pneumatic hammers, hydro-demolition will not be permitted.

The weight of pneumatic hammers when used shall not exceed 30 pounds for concrete removal above the top reinforcing steel nor 15 pounds for concrete removal below the top reinforcing steel.

The depth of concrete removal shall be as shown on the plans but shall be such as to include all spalled, delaminated, or otherwise deteriorated concrete. The Engineer will be sole determiner of what constitutes deteriorated concrete, using sounding methods or other evaluation measures at his discretion.

For deterioration on the deck underside, the Contractor shall design, furnish and install protective shielding on the underside to prevent an unexpected fall of deteriorated concrete to areas below the bridge. The protective shielding shall be designed, furnished and installed by the Contractor.

Working drawings and design calculations for the temporary shielding shall be submitted in accordance with the requirements of Article 1.05.02(a). The working drawings and design calculations shall be prepared, sealed and signed by a Professional Engineer, licensed in the State of Connecticut. The furnishing of such plans shall not serve to relieve the contractor of any part of his responsibility for the safety of the work or for the successful completion of the project.

Where the existing reinforcing steel is damaged or corroded, it shall be cut out and replaced with new reinforcing steel of the same size. Any sound reinforcing steel damaged during the concrete removal operations, shall be repaired or replaced by the Contractor at his expense as directed by the Engineer. New steel shall be attached beneath or beside existing steel with a minimum splice length as indicated on the plans, or as directed by the Engineer. The concrete shall be removed to a minimum depth of 1 inch below the new steel.

3) Surface Preparation: Sound reinforcing steel which is in the proper position in the slab shall be left in place and cleaned of all concrete, the smaller fragments to be removed with hand tools in patch areas where pneumatic hammers were used.

Reinforcing bar wire ties and vertical supports shall be installed on inadequately supported and/or vibrating reinforcing steel, as directed by the Engineer. The concrete surface and reinforcing steel to receive patching material shall be sandblasted, followed by air blasting in order to remove all loose particles and dust. All blasting operations shall be performed using techniques approved by the Engineer, taking care to protect all pedestrians, traffic, and adjacent property. All compressed air sources shall have properly sized and designed oil separators, attached and functional, to allow delivered air at the nozzle to be oil-free. The patch area shall be cleaned of all additional loose or powder-like rust, oil, solvent, grease, dirt, dust, bitumen, loose particles, and foreign matter just prior to patching.

The entire concrete surface to be patched shall be dampened. All free water shall be removed from the patch area.

4) Mixing, Placing, and Finishing: Mixing and placing concrete should not be done unless the ambient temperature is above 35°F. All mixing shall be accomplished by means of a standard drum-type portable mixer. A continuous type mobile mixer may be used if permitted by the Engineer. The Contractor shall calibrate the mobile mixer under supervision of the Engineer.

Calibration shall be in accordance with the applicable sections of ASTM method C685. The total mix shall be limited to the quantity that can be mixed and placed in 15 minutes. The concrete mix shall be spread evenly and compacted to a level slightly above the pavement surface. Vibration, spading or rodding shall be used to thoroughly compact concrete and fill the entire patch area. Where practical, internal vibration shall be used in cases where concrete has been removed below the reinforcing steel. Hand tamping shall be used to consolidate concrete in smaller patches, including popouts.

Vibrating plates or vibrating screeds shall be used on the surface of all patches for strike off and consolidation. After the concrete has been spread evenly and compacted to a level slightly above the pavement surface, the vibrating plate or screed shall be drawn over the surface at a uniform speed without stopping, in order to finish the surface smooth and even with adjacent concrete.

The surface shall be float finished.

Finishing operations shall be completed before initial set takes place.

Cured patches, having a hollow sound when chain dragged or tapped (indicating delamination), shall be replaced by the Contractor at his expense until a patch acceptable to the Engineer is in place.

5) Tolerances in Finished Patched Surfaces: The surface profile of the patched area shall not vary more than one-eighth inch in a distance of 10 feet, when a 10 foot long straightedge is placed on the surface at any angle relative to the centerline of the bridge. Humps in the patch that exceed the one-eighth inch tolerance shall be ground down by approved machinery. Sags or depressions in the

surface of the patch area that exceed one-eighth inch tolerance shall be repaired by removal of the concrete in the depression over an area determined by the Engineer to a depth of one inch and repaired in the previously described manner.

6) Underside of Bridge Deck Treatment: The Engineer shall examine the underside of the bridge deck for pop-outs caused by the removal of deteriorated concrete. The surface area of pop-outs shall be coated with epoxy resin where ordered by the Engineer. The concrete surface and exposed reinforcing steel, if any, which is to receive the coating material shall be cleaned of all loose or powder-like rust, oil, dust, dirt, loose particles, and other bond inhibiting matter just prior to coating.

The epoxy resin shall be mixed in accordance with the manufacturer's instructions. Also in accordance with the manufacturer's instructions, two coats of the mixed material shall be applied in uniform coats of approximately 2 to 3 mil dry film thickness each.

If the pop-outs extend beyond the bottom layer of reinforcing steel, the pop-outs shall be repaired as ordered by the Engineer.

6) Test Cylinders: The Contractor shall make and perform compressive strength tests on representative cylinders under the supervision of the Engineer. The dimensions, type of cylinder mold and number of cylinders shall be specified by the Engineer. Traffic shall not be permitted on patched surfaces until the patch material attains a strength of 2500 psi, as determined by breaks of the test cylinders.

A portable compression testing machine shall be provided by the Contractor and available on site for cylinder testing. All testing and equipment shall conform to ASTM C39.

Note: This compression machine must be calibrated in accordance with the provisions of Section 5, ASTM C39.

7) Time Schedule: Work under this item begun on any specific bridge during a construction season shall be completed, at least, to include this item and placing of first course of wearing surface as soon as possible and specifically before the beginning of the construction season's winter shutdown.

All work shall proceed as required by the "Maintenance and Protection of Traffic" and "Prosecution and Progress" specifications contained elsewhere within the contract documents. Traffic will not be allowed on any areas where the Contractor has removed deteriorated concrete until a minimum of 1.5 hours after the placing and finishing operations on the areas are complete as required by this specification.

**Method of Measurement:** This work will be measured for payment by the actual volume in cubic feet of replacement concrete, complete and accepted. No deduction will be made for the volume of reinforcing steel. Removal of concrete, furnishing and installation of reinforcing steel and providing of a safe access for delineation and inspection of the performed repairs will not be measured for payment.

**Basis of Payment:** This work will be paid for at the contract unit price per cubic foot of deck concrete repaired for “Partial Depth Patch”, complete in place and accepted, which price shall include removal of deteriorated concrete, surface preparation of patch areas, epoxy resin coating of the underside of deck pop-out surfaces, concrete replacement, the furnishing and installation of deformed steel bars, reinforcing bar wire ties and vertical supports for inadequately supported and/or deteriorated existing reinforcing steel, furnishing and installing protective shielding, providing inspection access for delineation and inspection of performed repairs, all materials, equipment, including the portable compression testing machine required for the testing of the repair material, tools, labor and work incidental thereto.

Pay Item

Partial Depth Patch

Pay Unit

c.f.

## **ITEM #0707001A – MEMBRANE WATERPROOFING (WOVEN GLASS FABRIC)**

**Description:** Work under this item shall consist of furnishing and applying a waterproof membrane system to the surface of concrete decks and curbs as shown on the plans, in accordance with these specifications, the manufacturer's recommendations, and as directed by the Engineer

**Materials:** Materials for this work shall be as follows:

Curb primer shall be SEBS bitumen primer, or approved equal.

Deck primer shall be a rapid cure primer conforming to ASTM D41.

Curb bitumen shall be a SEBS modified liquid bitumen and conform to the following tests: Softening Point; ASTM D-2398: Penetration at 77°F; ASTM D-5: Flexibility; CGSB 37-GP-50M: Elongation at 77°F; 700%; Flash Point; ASTM D-92: Flow at 140° F; ASTM D-1191.

Deck bitumen shall be liquid bitumen conforming to ASTM D449, Type III.

Woven glass fabric shall be a fabric saturated with resin or asphalt and conform to ASTM D1168.

**Construction Methods:** Only concrete surfaces with smooth, rounded projections of a height and depth under ¾” may be waterproofed. Any hole or projection considered detrimental to the performance of the membrane by the Engineer shall be repaired prior to installation of the membrane. The repair method shall be subject to the approval of the Engineer.

No priming or waterproofing shall be done in wet weather or when the temperature is below 35° F, without special authorization from the Engineer. Should the surface become wet it shall be allowed to dry prior to application of the primer.

After the concrete surface is deemed acceptable, the surface shall be thoroughly cleaned of loose or foreign substances by blowing the area clean with compressed air or leaf blowers.

At the curbs, apply the curb primer, a minimum of 2” up the face of the curb and extending 16” onto the deck. The curb primer shall be applied with a roller or spray without allowing the primer to pond. The curb primer shall be applied at a rate of not less than 1 gallon per 100 square feet. Drying time for the curb primer is approximately one hour at 77° F and 55% relative humidity.

On the remainder of the deck, the deck primer shall be applied with a sprayer, roller, or squeegee without allowing the primer to pond. The primer shall be applied at a rate recommended by the Manufacturer, but not less than 1/20<sup>th</sup> of a gallon per square yard. The primer normally requires 2

hours of drying time at 77° F and 55% relative humidity. Higher temperatures require less drying time.

Both the liquid bitumen and the liquid modified bitumen shall be contained in double jacketed melters or shall be delivered directly to the job site by tanker truck. Liquid bitumen in melters shall be heated to a temperature between 300 and 460° F. The temperature of liquid bitumen in tanker trucks shall not exceed 480° F. Melters and tanker trucks shall be equipped with approved thermometers. Melters shall be equipped with an agitation system to prevent local overheating.

At the curbs, apply a base coat of the hot modified liquid bitumen over the areas on the curb and deck previously coated with the curb primer. Place an 18' wide strip of woven glass fabric on the base coat, a minimum of 2" up the face of the curb and the remaining width extending onto the deck. Care shall be taken to ensure that the strip of fabric is pressed firmly against the curb. Apply a top coat of hot modified liquid bitumen over the strip of fabric to ensure a watertight joint along the curb line.

Whenever possible, placement of the woven glass fabric on the deck shall begin at the curbs (the low point of the surface) so that water will run over and not against or along the laps. Beginning at the curb line, apply a base coat of hot liquid bitumen for a width slightly greater than the full width of the fabric and roll a full width strip of fabric into the bitumen. Press the fabric into place to eliminate all air bubbles and to bond the fabric to the base coat of bitumen. Each subsequent strip of full width fabric shall be "shingled" into a base coat of hot liquid bitumen so that there will be 2 layers of fabric at all points with longitudinal laps not less than 2" wide. All end laps shall be at least 12". If so ordered by the Engineer, additional strips of woven glass fabric shall be placed over any other areas of the concrete surface which the Engineer believes require special protection.

After the fabric has been placed on the surface to be waterproofed, apply a top coat of hot liquid bitumen to saturate the entire fabric area. The top coat of hot liquid bitumen shall be sufficiently heavy to completely conceal the fabric weave. Special care shall be taken that all laps are thoroughly sealed down. If areas of fabric are exposed after this application of liquid bitumen, or are determined not to be thoroughly saturated, an additional coat of liquid bitumen shall be applied to those areas.

The Contractor shall also take adequate measures to prevent the liquid bitumen from flowing into deck joints, weepholes or drainage facilities whenever such items are present in the deck.

The entire waterproofing membrane shall be free of wrinkles, air bubbles, or other defects. In the event bubbles or blisters form under the membrane, they shall be punctured with a sharp pointed instrument and the membrane pressed firmly into contact with the deck. All tears, holes, or inadequately lapped seams or other damage shall be repaired with a patch. Patches, made of layers of hot liquid bitumen and fabric, shall extend at least 12" beyond the outermost damaged portion, and the second ply shall extend at least 3" beyond the first.

Vehicular traffic shall not be allowed to pass over the finished membrane waterproofing. The Contractor shall take every precaution necessary to prevent damage to the finished membrane by workers and equipment passing over it.. Only necessary construction vehicles may travel over the membrane. The Contractor shall repair, at his expense, any damage that occurs to the membrane.

Upon completion of the membrane waterproofing, at least one course of the hot mix asphalt overlay shall be placed as soon as practical in order to prevent damage to the membrane waterproofing. In no case the membrane shall be left unprotected for a time period to exceed the recommendations of the membrane manufacturer.

**Method of Measurement:** This work will be measured for payment by the actual number of square yards of waterproofed surface in the completed and accepted work.

**Basis of Payment:** This work will be paid for at the contract unit price per square yard for “Membrane Waterproofing (Woven Glass Fabric)” which price shall include furnishing all materials, equipment, tools, labor and incidentals necessary thereto to complete the work.

## **ITEM #0969000A – PROJECT COORDINATOR**

*Section 1.05.08 of the Standard Specifications is hereby deleted and replaced with the following:*

**Description:** Under this item the Contractor shall furnish the services of an administrative employee, entitled the Project Coordinator, for this project to coordinate and expedite all phases of the work required for the project and to ensure that the construction schedule is maintained.

The minimum lump sum bid for this item shall be equal to 0.5% of the Contractor's total bid. Failure of the Contractor to bid at least the minimum amount will result in the Department adjusting the Contractor's bid to include the minimum bid amount for this item.

The Project Coordinator shall be submitted for approval by name, in writing, with a resume of his qualifications, within seven (7) calendar days of the award of the Contract, but not later than the Preconstruction Meeting, and shall not be changed without prior written notice to the Department.

This resume must demonstrate the Project Coordinator is experienced and versatile in the preparation, interpretation and modification of Critical Path Method (CPM) construction schedules. This must include successful completion of at least three (3) construction projects of similar complexity, where he served in a lead scheduling capacity. If the Contractor does not have a person in their company that has these skills, then the Contractor shall engage the services of a Consultant, subject to the approval of the Engineer, for the scheduling work required. If a Consultant is engaged, they shall be present at the first meeting, along with the Project Contractor, prepared to discuss, in detail, the methods and techniques he proposes to use. Thereafter, the Project Coordinator or the Consultant responsible for updating the CPM Schedule shall attend all meetings between the Contractor, its Subcontractors, and any other meetings, which will affect the CPM schedule. The Contractor shall prepare CPM Schedules utilizing the latest version of Primavera Project Planner software as described more fully hereinafter.

If the Contract includes Article 1.20 the following requirement shall also apply:

The Project Coordinator shall have, in addition to the above noted requirements, a minimum of eight (8) years' experience related to commercial/industrial building construction as a Project Coordinator performing duties similar to those required herein.

The Project Coordinator shall have knowledge of all trades involved in the construction, including civil/site work, environmental work, concrete work, masonry work, steel work, wood work, electrical work, and mechanical work.

Other combinations of experience and education totaling ten (10) years in commercial building construction will be considered subject to the approval of the Engineer.

**Computer Software and Printer:** The Contractor shall provide the following equipment with all the required maintenance and repairs (to include labor and parts) throughout the Contract life. The Engineer reserves the right to expand or relax the specification to adapt to the software and hardware limitations and availability.

The Contractor shall provide the Engineer with a licensed copy registered in the Department's name of the latest versions of the software listed and maintain customer support services offered by the software producer for the duration of the project. The Contractor shall deliver to the Engineer all supporting documentation for the software and hardware including any instructions or manuals.

A. **Software – Minimum Specification:** \_\_The Contractor shall provide the Engineer with a licensed copy of the latest version of the Primavera Contractor – Deluxe Version scheduling software, registered in the Department's name, and maintain the Primavera customer support service contract over the duration of the project.

B. **HP Officejet Pro K8600 Color Printer** – Minimum or equivalent (to be installed as a local printer on a computer provided under the Construction Field Office specification):

Paper – 11 in x17 in, 8.5 in x 11 in and duplex/double-side print  
Resolution – 1200x1200 DPI  
Print Drivers – Must support HP PCL6.  
RAM – 32 MB RAM  
Print speed – 10 ppm – color, 13 ppm - black  
Printer cable – 6 ft (1.8 m)

The Contractor is responsible for service and repairs to all computer hardware. All repairs must be performed within 24 hours. If the repairs require more than a 24 hours then a replacement must be provided.

**Construction Methods:** The Project Coordinator shall attend all meetings between the Contractor and the Department, the Contractor and its Subcontractors, and any other meetings that affect the progress of the job. The Project Coordinator shall be knowledgeable of the status of all parts of the work throughout the length of the Contract.

The Contractor shall prepare a CPM Schedule in accordance with the pertinent provisions of "Section 1.03 - Award and Execution of Contract," "Section 1.05 - Control of the Work," and "Section 1.08 - Prosecution of Progress" of the Standard Specifications. The schedule shall incorporate the Sequence of Construction as outlined on the Plans and in the Specifications. All other limiting factors that affect construction shall also be incorporated into the schedule. All milestones or constrained dates within the schedule shall be clearly indicated.

The CPM schedule shall contain a list of activities that represent the major elements of the project. At a minimum, this list should include a breakdown by individual structure or stage, including major components of each. The schedule shall contain sufficient detail to describe the progression of the work in a comprehensive manner. As a guide, 10 to 15 activities should be provided for each \$1 million of contract value.

The following list of items is provided as an example only and is not meant to be all-inclusive (or all-applicable):

General Items Applicable to all projects

Contractual Constraints including but not limited to

- Winter shutdowns
- Environmental permits/applications time of year restrictions
- Milestones
- Third Party approvals
- Long lead time items (procurement and fabrication of major elements)
- Adjacent Projects or work by others

Award

Notice to Proceed

Signing (Construction, temporary, permanent by location)

Mobilization

Permits as required

Field Office

Utility Relocations

Submittals/shop drawings/working drawings/product data

Construction of Waste Stock pile area

Clearing and Grubbing

Earthwork (Borrow, earth excavation, rock excavation, etc.)

Traffic control items (including illumination and signalization)

Pavement markings

Roadway Construction (Breakdown into components)

Drainage (Breakdown into components)

Culverts

Final Plantings (including turf establishment)

Final Cleanup

The following additional guidelines supplement the general guidelines listed above for the specific project types indicated:

- A. For bridges and other structures, include major components such as: Abutments, wingwalls, piers, decks and retaining walls; further breakdown by footings, wall sections, parapets etc.

Temporary Earth Retention Systems

Cofferdam and Dewatering

- Structure Excavation
- Piles/test piles
- Temporary Structures
- Removal of Superstructure
- Bearing Pads
- Structural Steel (Breakdown by fabrication, delivery, installation, painting etc.)
- Bridge deck

- B. Multiple location projects such as traffic signal, incident management, lighting, planting and guiderail projects will be broken down first by location and then by operation. Other major activities of these types of projects should include, but are not limited to:

- Installation of anchors
- Driving posts
- Foundations
- Trenching and Backfilling
- Installation of Span poles/mast arms
- Installation of luminaires
- Installation of cameras
- Installation of VMS
- Hanging heads
- Sawcut loops
- Energizing equipment

- C. Facility Projects shall reflect the same breakdown of the project as the schedule of values:

- CSI Division 2 – Existing Conditions
- CSI Division 3 – Concrete
- CSI Division 4 – Masonry
- CSI Division 5 – Metals
- CSI Division 6 – Wood, Plastic, and Composites
- CSI Division 7 – Thermal and Moisture Protection
- CSI Division 8 – Openings
- CSI Division 9 – Finishes
- CSI Division 10 – Specialties
- CSI Division 11 – Equipment
- CSI Division 12 – Furnishings
- CSI Division 13 – Special Construction
- CSI Division 14 – Conveying Equipment
- CSI Division 21 – Fire Suppression
- CSI Division 22 – Plumbing
- CSI Division 23 – Heating, Ventilating, and Air Conditioning
- CSI Division 26 – Electrical
- CSI Division 27 – Communications
- CSI Division 28 – Electronic Safety and Security

CSI Division 31 – Earthwork  
CSI Division 32 – Exterior Improvements  
CSI Division 33 – Utilities

The CPM schedule will be compiled using this list of major activities. It will be the responsibility of the contractor to detail all milestones, environmental permit “window” periods; winter shutdowns etc. and include them on their schedule under the corresponding dates.

Proper relationship between all major activities shall be indicated. Node numbers shall be coded such that the major activities shown on the Critical Path Schedule shall be easily referenced to the Detailed Project Schedule when it is developed. Break down the work covered under each Special Provision, or Division and Section of Article 1.20 of the Standard Specifications, into individual activities required and logically group related activities together within the CPM.

If the Engineer determines that additional detail is necessary, the Contractor shall provide it.

All documents, which require approval by the Department, shall be clearly identified within the schedule. The Department and any outside agency shall be allocated a minimum number of calendar days in accordance with Article 1.20-1.05.02. If Article 1.20 does not apply, then the Department shall be allocated a minimum of thirty (30) calendar days (exclusive of weekends and holidays) for review and approval of each submittal. Any submittals requiring approval by an outside Agency (ConnDEEP, Coast Guard, Army Corps of Engineers, etc.) shall be allocated a minimum of sixty (60) calendar days. The Department shall not be held responsible for any delay associated with the approval or rejection of any substitution or other revisions proposed by the Contractor.

The schedule shall indicate the logic of the work for the major elements and components of work under the Contract, such as the planned mobilization of plant and equipment, sequences of operations, procurement of materials and equipment, duration of activities, type of relationship, lag time (if any), and such other information as it is necessary to present a clear statement of the intended activities.

The Contractor is responsible to inform its subcontractor(s) and supplier(s) of the project schedule and any relevant updates.

The schedules shall consist of a network technique of planning, scheduling and control, shall be a clear statement of the logical sequence of work to be done, and shall be prepared in such a manner that the Contractor's work sequence shall be optimized between early start and late start restraints. The Contractor shall use the same criteria in a consistent manner throughout the term of the project. If, at any time, the Contractor alters logic, original durations, and descriptions, adds activities or activity codes or in any way modifies the Baseline Schedule, they must notify the Engineer of the change, in writing, presenting in detail the reasons for the change. The Engineer reserves the right to approve or reject any such change.

The critical path of the project must be identified on the CPM schedule. The critical path is the longest-duration path through the network. The significance of the critical path is that the activities that lie on it cannot be delayed without delaying the project. Because of its impact on the entire project, critical path analysis is an important aspect of project planning.

The critical path can be identified by determining the following four parameters for each activity:

- ES - earliest start time: the earliest time at which the activity can start given that its precedent activities must be completed first.
- EF - earliest finish time, equal to the earliest start time for the activity plus the time required to complete the activity.
- LF - latest finish time: the latest time at which the activity can be completed without delaying the project.
- LS - latest start time, equal to the latest finish time minus the time required to complete the activity.

The *float time* for an activity is the time between its earliest and latest start time, or between its earliest and latest finish time. Float is the amount of time that an activity can be delayed past its earliest start or earliest finish without delaying the project. Delays to activities on the critical path through the project network in which no float exists, that is, where  $ES=LS$  and  $EF=LF$  will delay the project.

Float available in the schedule, at any time shall not be considered for the exclusive use of either the State or the Contractor. During the course of contract execution, any float generated due to the efficiencies of either party is not for the sole use of the party generating the float; rather it is a shared commodity to be reasonably used by either party. Project float will be a resource available to both the State and the Contractor.

Each CPM Schedule submittal shall be in the form of an activity on node diagram (precedence diagramming method) and shall include at a minimum; an Early Start computer sort, a Total Float computer sort, an Activity Number computer sort, a Schedule Diagram in the Time Scaled Logic format and a backup data CD-ROM which includes all Primavera project files. The diagrams shall be on 2' x 3' sheets. Additional, more detailed diagrams for important aspects or phases of the work will be required on large or complex projects.

Activity I.D. numbers shall be keyed to the item numbers assigned on the detailed estimate sheet. The first three digits (four digits for highway illumination, signing, traffic signals and utility work) of the activity I.D. number shall be identical to the first three digits of the item number in the contract. The remaining digits may be used to provide unique, orderly and sequential I.D. numbers for each activity.

Activity codes shall be added to the schedule dictionary at the direction of the Engineer. At a minimum, activity codes for responsibility (prime, subcontractor by name), location of work

(bridge #, span #, sta. #, site, building, type of work, etc.) and stage or phase number should be included.

The Project Coordinator shall be required to prepare and submit the following documents:

1. Baseline Submittal Requirements: The Contractor shall be guided by the following requirements when submitting the CPM Schedules for review and approval.

- a. Within ten (10) calendar days after award, the Contractor and their scheduler will attend a meeting to discuss the submittal requirements. Within twenty (20) calendar days after contract award, the Contractor shall prepare and submit for review and approval a detailed CPM Schedule for all work. The review and approval process may take up to 21 calendar days and is more fully described in paragraph (b) of this section.

The work shall be broken out into sufficient detail such that no activity has a duration greater than twenty (20) days, unless approved by the Engineer. As a guide, 25 to 35 activities should be provided per \$1 million of contract work. The Engineer shall be the sole judge as to whether the schedule is sufficiently detailed.

All work shall be shown in sufficient detail such that the Critical Path may be identified and the schedule shall incorporate all contract milestones. Upon approval, this schedule shall be designated the "Baseline".

Failure to submit and gain approval for the "Baseline" may result in the Contractor being found in violation of Article 1.02.02 of the Standard Specifications. All elapsed contract time prior to the approval of the "Baseline", will be considered to be accurately represented by the actual as-built schedule of that time period. No claims for delays during that period will be allowed.

The approval of a Baseline Schedule shall in no way waive the requirements of the contract nor shall it excuse the Contractor from any obligations under the contract.

In no instance will the Contractor be permitted to commence work on any significant portion of the work for which a Baseline Schedule has not been approved without prior written approval from the Department.

- b. The Contractor, represented by the Project Coordinator and/or the Consultant, shall participate with the Engineer in the review and evaluation of each schedule submitted. Any and all revisions made necessary as a result of this review shall be made by the Contractor and a revised schedule submitted within ten (10) calendar days. Any further revisions required thereafter shall also be submitted for approval within (10) calendar days.

2. Monthly Updates: Each month, as of a calendar date mutually acceptable to the Contractor and to the Engineer, the Contractor shall deliver to the Engineer three (3) prints of all

required schedule diagrams and tabulations. In addition, the Contractor shall deliver one (1) copy of the project backup data CD-ROM(s), which includes all Primavera project files. The schedule shall be updated to show the work actually accomplished during the preceding months, the actual time consumed for each activity, and the estimated time remaining for any activity which has been started but not completed.

The monthly update shall also include revisions to the CPM schedule necessitated by revisions to the project, which have been directed by the Engineer (including, but not limited to extra work) during the month preceding the update. Similarly, any changes to the schedule due to Contractor influences shall also be included within the schedule.

Any changes or revisions made to the approved Baseline shall be identified in narrative form in a cover letter accompanying the monthly update. The Engineer reserves the right to approve or reject any such changes. The narrative shall also describe in general terms the progress of the work since the last schedule update and shall identify any items of special interest. If the schedule revisions extend the Contract completion date, due to extra or added work or delays beyond the control of the Contractor, the Contractor must submit a request in writing for an extension of time in accordance with Article 1.08.08. This request should be supported by the schedules submitted previously.

The Contractor shall be responsible to develop mitigation measures for all delays, regardless of responsibility, and to identify all time and cost impacts to the work associated with those mitigation measures.

Except as otherwise authorized by the Engineer, monthly submissions received after the due date are considered late.

The reports required for each monthly update shall include all reports generated for approval of the CPM Schedule for that particular portion of the work. On larger or complex projects, the Engineer may require the schedule data sorted by an activity code to better reflect the progression of the work. Summary barcharts may also be required.

3. Biweekly Schedules: Each week, the Contractor shall be required to produce and submit to the Engineer a biweekly schedule showing all activities planned for the following two week period. This short term schedule may be handwritten; however a two week "look ahead" filter from the CPM Schedule is preferred. The biweekly schedule shall clearly indicate all work planned on a crew basis for the two week period.
4. Recovery Schedules: If, in the opinion of the Engineer, the updated schedule indicates that the Project has fallen behind schedule, or that a revision in sequence of operations may be necessary for any other reason, absent a justifiable time extension, the Contractor shall immediately institute all necessary steps to improve the Project's progress and shall submit such revised network diagrams, tabulations and operational plans, as may be deemed necessary by the Engineer, to demonstrate the manner in which an acceptable rate of progress will be regained.

Should the Contractor not demonstrate an ability to regain an acceptable rate of progress, the Engineer shall require the schedule to be resource loaded with the next monthly update. No additional compensation will be allowed for resource loading the schedule.

5. As-Built Schedules: Within thirty (30) days of completion of the project, including all corrective work, the Contractor shall submit an "As-Built Schedule" showing the actual progress of work. The Contractor shall submit three prints of this final CPM Schedule and one project backup data CD-ROM which include all Primavera project files for the Engineer's exclusive use.

If the contract includes Article 1.20 the following shall also apply:

6. Daily Construction Reports: The Project Coordinator shall assist the Engineer in the preparation of a daily construction report by ensuring that each of the Contractor's employees and subcontractors working on the Project Site on a given day signs the Engineer's sign-in sheet for that day; and by keeping and providing to the Engineer its own daily list of employees and subcontractors who worked on the Project Site on that day.

**Method of Measurement:** Within ten (10) calendar days of the award of the Contract, the Contractor shall submit to the Engineer for approval a breakdown of its lump sum bid price for this item detailing:

1. The development cost to prepare the Baseline Schedule in accordance with these specifications. Development costs shall not exceed 25% of the total cost of the item and shall include costs to furnish and install all specified hardware.
2. The cost to provide the services of the Project Coordinator, including costs to prepare and submit the Monthly Updates; furnish and submit any Recovery Schedules; furnish and submit Two Week Look Ahead Schedules and maintenance of and supplies for the specified hardware noted above. A per month cost will be derived by taking this cost divided by the number of Contract months remaining from the date of acceptance of the Baseline Schedule.
3. The cost of submission and certification of the As-Built Schedule in accordance with these specifications. The submission and certification costs shall be no less than 2% of the total cost of the item.
4. Substantiation showing that the costs submitted are reasonable based on the Contractor's lump sum bid.

Upon approval of the payment schedule by the Engineer, payments for work performed will be made as follows:

1. Upon approval of the "Baseline" Schedule by the Engineer, the lump sum development cost will be certified for payment.

2. Upon receipt of each monthly update of the "Baseline" Schedule, the per month cost for the services of the Project Coordinator will be certified for payment.
3. Upon approval of the As-Built Schedule by the Engineer, the lump sum submission and certification cost will be certified for payment.

**Basis of Payment:** This service will be paid for at the contract lump sum price for "Project Coordinator" complete, which price shall include the preparation and submission of all schedules, updates, reports and submittals. The lump sum price shall also include the cost of providing a complete, licensed copy of the Primavera software which will remain the property of the Engineer, and all materials, equipment, labor and work incidental of this service.

The lump sum price will be certified for payment as described in "Method of Measurement" subject to the following conditions:

1. Any month where the monthly update of the "Baseline" CPM schedule is submitted late, without authorization from the Engineer, will result in the following actions:
  - a. The monthly payment for the Project Coordinator item shall be deferred to the next monthly payment estimate. If any monthly submittal is more than thirty (30) calendar days late, there will be no monthly payment for the services of the Project Coordinator.
  - b. The greater of 5% of the monthly payment estimate or \$25,000 shall be retained from the monthly payment estimate until such time as the Contractor submits all required reports.
  - c. If in the opinion of the Engineer, the contractor is not in compliance with this specification, the Engineer may withhold all project payments.
2. In the event the project extends beyond the original completion date by more than thirty (30) calendar days, and a time extension is granted to the Contractor, the Department may require additional CPM updates which will be paid at the per month cost for the services of the Project Coordinator.
3. If, in the opinion of the Engineer, the contractor is not in compliance with this specification or has failed to submit a "Baseline", monthly update or Recovery Schedule for any portion of the work in accordance with this specification, it shall result in the withholding of all contract payments until the schedule is submitted to, and approved by, the Engineer.

Pay Item  
Project Coordinator

Pay Unit  
L.S.

**ITEM #0969064A – CONSTRUCTION FIELD OFFICE, LARGE**

**Description:** Under the item included in the bid document, adequate weatherproof office quarters will be provided by the Contractor for the duration of the work, and if required, for a maximum of ninety days thereafter for the exclusive use of ConnDOT forces and others who may be engaged to augment ConnDOT forces with relation to the contract. The office quarters shall be located convenient to the work site and installed in accordance with Article 1.08.02, this office shall be separated from any office occupied by the Contractor. Ownership and liability of the office quarters shall remain with the Contractor.

**Materials:** Materials shall be in like new condition for the purpose intended and shall be approved by the Engineer.

**Office Requirements:** The Contractor shall furnish the office quarters and equipment as described below.

	<b>Description:</b>
1,000 SF	Sq. Ft. of floor space with a minimum ceiling height of 7 ft. and shall be partitioned as shown on building floor plan as provided by the Engineer.
2 EA	Minimum number of exterior entrances.
10 EA	Minimum number of parking spaces.

**Office layout:** The office shall have a minimum square footage as indicated in the table above, and shall be partitioned as shown on building floor plan as provided by the Engineer. The underside of the office shall be fully skirted to the ground.

**Lavatory Facilities:** The Contractor shall furnish a minimum of two (2) separate lavatories and toilet facilities (“men” and “women”), in separately enclosed rooms that are properly ventilated and comply with applicable sanitary codes. The Contractor shall provide each lavatory with hot and cold running water and flush-type toilets. He shall also supply lavatory and sanitary supplies as required.

**Windows and Entrances:** The windows shall be of a type that will open and close conveniently, shall be sufficient in number and size to provide adequate light and ventilation, and shall be fitted with locking devices, blinds and screens. The entrances shall be secure, screened, and fitted with a lock for which four keys shall be furnished. All keys to the construction field office shall be furnished to the Department and will be kept in their possession while State personnel are using the office. Any access to the entrance ways shall meet applicable building codes and be slip resistant, with appropriate handrails.

**Lighting:** The Contractor shall equip the office interior with electric lighting that provides a minimum illumination level of 100 foot-candles at desk level height, and electric outlets for each desk and drafting table. The Contractor shall also provide exterior lighting that provides a minimum illumination level of 2 foot-candles throughout the parking area and for a minimum distance of 10 ft. on each side of the field office.

The Contractor shall provide the following additional equipment, facilities, and/or services at the Field Office on this project to include at least the following to the satisfaction of the Engineer:

Parking Facility: Adequate parking spaces with adequate illumination on a paved surface, with surface drainage if needed. If paved parking does not exist adjacent to the field office, the Contractor shall provide a parking area of sufficient size to accommodate the number of vehicles indicated in the table above. Construction of the parking area and driveway, if necessary, will consist of a minimum of 6 inches of processed aggregate base graded to drain. The base material will be extended to the office entrance.

Field Office Security: Physical Barrier Devices - This shall consist of physical means to prevent entry, such as: 1) All windows shall be barred or security screens installed; 2) All field office doors shall be equipped with dead bolt locks and regular day operated door locks; and 3) Other devices as directed by the Engineer to suit existing conditions.

Electric Service: The field office shall be equipped with an electric service panel to serve the electrical requirements of the field office, including: lighting, general outlets, computer outlets, calculators etc., and meet the following minimum specifications:

- A. 120/240 volt, 1 phase, 3 wire.
- B. Ampacity necessary to serve all equipment. Service shall be a minimum 100 amp dedicated to the construction field office.
- C. The electrical panel shall include a main circuit breaker and branch circuit breakers of the size and quantity required.
- D. Additional 120 volt, single phase, 20 amp, isolated ground dedicated power circuit with dual NEMA 5-20 receptacles will be installed at each computer workstation location.
- E. Additional 120 volt, single phase, 20 amp, isolated ground dedicated power circuit with dual NEMA 5-20 receptacles will be installed, for use by the Telephone Company.
- F. Additional 120-volt circuits and duplex outlets as required meeting National Electric Code requirements.
- G. One exterior (outside) wall mounted GFI receptacle, duplex, isolated ground, 120 volt, straight blade.
- H. After work is complete and prior to energizing, the State's ConnDOT electrical inspector, must be contacted at 860-594-2240. (Do Not Call Local Town Officials)
- I. Prior to field office removal the ConnDOT Data Communications office must be notified to deactivate the communications equipment.

Heating, Ventilation and Air Conditioning (HVAC): The field office shall be equipped with sufficient heating, air conditioning and ventilation equipment to maintain a temperature range of 68°-80° Fahrenheit within the field office.

The Following Furnishings and Equipment Shall Be Provided In The Applicable Field Office Type:

Qty	Description:
5 EA	Office desks (2.5 ft x 5 ft) with drawers, locks, and matching desk chairs that have

Qty	Description:
	pneumatic seat height adjustment and dual wheel casters on the base.
4 EA	Office Chairs.
2 EA	Fire resistant cabinets (legal size/4 drawer), locking.
2 EA	Non-fire resistant cabinets (legal size/4 drawer), locking.
1 EA	Storage racks to hold 3 ft x 5 ft display charts.
1 EA	Mail slot bin - legal size.
1 EA	Drafting type tables (3 ft x 6 ft) and supported by wall brackets and legs; and matching drafters stool that have pneumatic seat height adjustment, seat back and dual wheel casters on the base.
1 EA	Flat file (4/drawers).
3 EA	Personal computer tables (4 ft x 2.5 ft).
1 EA	Hot and cold water dispensing unit and supply of cups and bottled water shall be supplied by the Contractor for the duration of the project.
2 EA	Electronic office type printing calculators capable of addition, subtraction, multiplication and division with memory and a supply of printing paper.
4 EA	Telephone.
1 EA	Telephone answering machine.
1 EA	Plain paper facsimile (FAX) machine capable of transmitting via telephone credit card. All supplies, paper and maintenance shall be provided by the Contractor.
1 EA	Copier/Scanner - dry, plain paper with automatic feeder and reducing capability. All supplies, paper and maintenance shall be provided by the Contractor.
4 EA	Computer systems as specified below under <u>Computer Hardware and Software</u> . All supplies and maintenance shall be provided by the Contractor.
1 EA	Laser printer as specified below under <u>Computer Hardware and Software</u> . All supplies, paper and maintenance shall be provided by the Contractor.
3 EA	Digital Camera as specified below under <u>Computer Hardware and Software</u> . All supplies and maintenance shall be provided by the Contractor.
1 EA	Wastebaskets - 30 gal., including plastic waste bags.
6 EA	Wastebaskets - 5 gal., including plastic waste bags.
2 EA	Electric pencil sharpeners.
* EA	Fire extinguishers - provide and install type and number to meet applicable State and local codes for size of office indicated, including a fire extinguisher suitable for use on a computer terminal fire.
6 EA	Interior partitions - 6 ft x 6 ft, soundproof type, portable and freestanding.
2 EA	Vertical plan racks for 2 sets of 2 ft x 3 ft plans for each rack..
1 EA	Double door supply cabinet with 4 shelves and a lock - 6 ft x 4 ft.
1 EA	Easel/chalkboard.
2 EA	Open bookcases - 3 shelves - 3 ft long.
1 EA	Infrared Thermometer, including certified calibration, case, cleaning wipes.
1 EA	Concrete Curing Box as specified below under <u>Concrete Testing Equipment</u> .
1 EA	Concrete Air Meter as specified below under <u>Concrete Testing Equipment</u> .
1 EA	Concrete Slump Cone as specified below under <u>Concrete Testing Equipment</u> .

The furnishings and equipment required herein shall remain the property of the Contractor. Any supplies required to maintain or operate the above listed equipment or furnishings shall be provided by the Contractor for the duration of the project.

Telephone Service: This shall consist of two (2) telephone lines: one (1) line for phone/voice service and one (1) line dedicated for the facsimile machine. The Contractor shall pay all charges except for out-of-state toll calls made by State personnel.

Data Communications Facility Wiring: Contractor shall install a Category 5e 468B patch panel in a central wiring location and Cat 5e cable from the patch panel to each PC station, terminating in a (category 5e 468B) wall or surface mount data jack. The central wiring location shall also house either the data circuit with appropriate power requirements or a category 5 cable run to the location of the installed data circuit. The central wiring location will be determined by the ConnDOT Data Center staff in coordination with the designated field office personnel as soon as the facility is in place. The ConnDOT Project Engineer will provide the Contractor with a copy of the current PC specifications, approved printer list and data wiring schematic as soon as possible after the contract is awarded.

Contractor to run a CAT 5e LAN cable a minimum length of 25 feet for each computer to LAN switch area leaving an additional 10 feet of cable length on each side with terminated RJ45 connectors. Each run / jack shall be clearly labeled with an identifying Jack Number.

The installation of a data communication circuit between the field office and the ConnDOT Data Communication Center in Newington will be coordinated between the ConnDOT District staff, ConnDOT Office of Information Systems and the local phone company. The ConnDOT District staff will coordinate the installation of the data communication service with ConnDOT PC Support once the field office phone number is issued. The Contractor shall provide the field office telephone number(s) to the ConnDOT Project Engineer as soon as possible to facilitate data line and computer installations.

Computer Hardware and Software:

The ConnDOT Project Engineer will provide the Contractor with a copy of the current PC specifications, approved printer list and data wiring schematic as soon as possible after the contract is awarded.

Before ordering the computer hardware and software, the Contractor must submit a copy of their proposed PC specifications and the type of printer to the ConnDOT Project Engineer for review by the ConnDOT Data Center. If the specification meets or exceeds the minimum specifications listed below, then the Contractor will be notified that the order may be placed.

Before any equipment is delivered to the Data Center, arrangements must be made a minimum of 24 hours in advance by contacting 860-594-3500. All software, hardware and licenses listed below shall be clearly labeled, specifying the (1) Project No., (2) Contractor Name, (3) Project Engineer's Name and (4) Project Engineer's Phone No., and shall be delivered to the ConnDOT

Data Center, 2710 Berlin Turnpike, Newington, CT, where it will be configured and prepared for field installation. Installation will then be coordinated with ConnDOT field personnel and the computer system specified will be stationed in the Department's project field office.

The computer system furnished shall have all software and hardware necessary for the complete installation of the latest versions of the software listed, and therefore supplements the minimum specifications below. The Engineer reserves the right to expand or relax the specification to adapt to the software and hardware limitations and availability, the compatibility with current agency systems, and to provide the Department with a computer system that can handle the needs of the project. This requirement is to ensure that the rapid changing environment that computer systems have experienced does not leave the needs of the project orphan to what has been specified. There will not be any price adjustment due to the change in the minimum system requirements.

The Contractor shall provide the Engineer with a licensed copy registered in the Department's name of the latest versions of the software listed and maintain customer support services offered by each software producer for the duration of the Contract. The Contractor shall deliver to the Engineer all supporting documentation for the software and hardware including any instructions or manuals. The Contractor shall provide original backup media for the software.

The Contractor shall provide the computer system with all required supplies, maintenance and repairs (including labor and parts) throughout the Contract life.

Once the Contract has been completed, the computer will remain the property of the Contractor. Prior to the return of any computer(s) to the Contractor, field personnel will coordinate with the Data Center personnel for the removal of Department owned equipment, software, data, and associated equipment.

A) Computer – Minimum Specification:

Processor – Intel® Core 2 Duo Processor (2.00 GHz, 800 MHz FSB 2MB L2 Cache)

Memory – 2 GB DIMM DDR2 667MHz.

Monitor – 19.0 inch LCD color monitor.

Graphics – Intel Graphics Media Accelerator 3100. or equivalent.

Hard Drive – 160 GB Ultra ATA hard drive (Western Digital, IBM or Seagate).

Floppy Drive – 3.5 inch 1.44MB diskette drive.

Optical Drive – CD-RW/DVD-RW Combo.

Multimedia Package – Integrated Sound Blaster Compatible AC97 Sound and speakers.

Case – Small Form or Mid Tower, capable of vertical or horizontal orientation.

Integrated Network Adapter – comparable to 3COM PCI 10/100 twisted pair Ethernet.

Keyboard – 104+ Keyboard.

Mouse – Optical 2-button mouse with scroll wheel.

Operating System – Windows XP Professional Service Pack 2; Windows Vista Capable.

Application Software – MS Office 2007 Professional Edition.

Additional Software (Latest Releases, including subscription services for the life of the Contract.–

- Norton Anti-Virus and CD/DVD burning software (ROXIO or NERO),
- Adobe Acrobat Standard

Resource or Driver CD/DVD – CD/DVD with all drivers and resource information so that computer can be restored to original prior to shipment back to the contractor.  
Uninterrupted power supply – APC Back-UPS 500VA.

Note A1: All hardware components must be installed before delivery. All software documentation and CD-ROMs/DVD for Microsoft Windows XP Professional, Microsoft Office 2007 Professional Edition, and other software required software must be provided. Computer Brands are limited to Dell, Gateway and HP brands only. No other brands will be accepted. The ConnDOT Project Engineer will provide the Contractor with a copy of the current PC specifications and approved printer list as soon as possible after the contract is awarded.

Note A2: As of June 30, 2008, Microsoft will no longer distribute Windows XP for retail sale, although the date for specific computer manufacturers may be different. Please consult your manufacturer for details. The Department still requires Windows XP on all PCs. Microsoft has stated that any PCs that are purchased with either Windows Vista Business, or Vista Ultimate are automatically entitled to “downgrade rights”, which allow the PC to be rolled back to Windows XP. Please consult the specific manufacturer for details on downgrading new PCs to Microsoft Windows XP after June 30, 2008.

**B) Laser Printer – Minimum Specification:**

Print speed – 20 ppm.  
Resolution – 1,200 x 1,200 dpi.  
Paper size – Up to 216 mm x 355 mm (8.5 in x 14 in).  
RAM – 16 MB.  
Print Drivers – Must support HP PCL6 and HP PCL5e.  
Printer cable – 1.8 m (6 ft).

Note B1: Laser printer brands are limited to Hewlett-Packard and Savin brands only. The ConnDOT Project Engineer will provide the Contractor with a copy of the current PC specifications and approved printer list as soon as possible after the contract is awarded.

Note B2: It is acceptable to substitute a multi-function all-in-one printer/copier/scanner/fax machine listed on the approved printer list in place of the required laser printer and fax machine.

**C) Digital Camera – Minimum Specification:**

Optical – 5 mega pixel, with 3x optical zoom.  
Memory – 2 GB.  
Features – Date/time stamp feature.  
Connectivity – USB cable or memory card reader.  
Software – Must be compatible with Windows XP and Vista.  
Power – Rechargeable battery and charger.

The Contractor is responsible for service and repairs to all computer hardware. All repairs must be performed with-in 48 hours. If the repairs require more than a 48 hours then a replacement must be provided. All supplies, paper and maintenance for the computers, laptops, printers, copiers, and fax machines shall be provided by the Contractor.

Concrete Testing Equipment: If the Contract includes items that require compressive strength cylinders for concrete, in accordance with the Schedule of Minimum Testing Requirements for Sampling Materials for Test, the Contractor shall provide the following. All testing equipment will remain the property of the Contractor at the completion of the project.

- A) Concrete Cylinder Curing Box – meeting the requirements of Section 6.12 of the Standard Specifications.
- B) Air Meter – The air meter provided shall be in good working order and will meet the requirements of AASHTO T 152.
- C) Slump Cone Mold – Slump cone, base plate, and tamping rod shall be provided in like-new condition and meet the requirements of AASHTO T119, Standard Test Method for Slump of Hydraulic-Cement Concrete.

Insurance Policy: The Contractor shall provide a separate insurance policy, with no deductible, in the minimum amount of forty thousand dollars (\$40,000.00) in order to insure all State-owned data equipment and supplies used in the office against all losses. The Contractor shall be named insured on that policy, and the Department shall be an additional named insured on the policy. These losses shall include, but not be limited to: theft, fire, and physical damage. The Department will be responsible for all maintenance costs of Department owned computer hardware. In the event of loss, the Contractor shall provide replacement equipment in accordance with current Department equipment specifications, within seven days of notice of the loss. If the Contractor is unable to provide the required replacement equipment within seven days, the Department may provide replacement equipment and deduct the cost of the equipment from monies due or which may become due the Contractor under the contract or under any other contract. The Contractor's financial liability under this paragraph shall be limited to the amount of the insurance coverage required by this paragraph. If the cost of equipment replacement required by this paragraph should exceed the required amount of the insurance coverage, the Department will reimburse the Contractor for replacement costs exceeding the amount of the required coverage.

Maintenance: During the occupancy by the Department, the Contractor shall maintain all facilities and furnishings provided under the above requirements, and shall maintain and keep the office quarters clean through the use of weekly professional cleaning to include, but not limited to, washing & waxing floors, cleaning restrooms, removal of trash, etc. Exterior areas shall be mowed and clean of debris. A trash receptacle (dumpster) with weekly pickup (trash removal) shall be provided. Snow removal, sanding and salting of all parking, walkway, and entrance ways areas shall be accomplished during a storm if on a workday during work hours, immediately after a storm and prior to the start of a workday. If snow removal, salting and

sanding are not completed by the specified time, the State will provide the service and all costs incurred will be deducted from the next payment estimate.

**Method of Measurement:** The furnishing and maintenance of the construction field office will be measured for payment by the number of calendar months that the office is in place and in operation, measured to the nearest month.

There will not be any price adjustment due to any change in the minimum computer system requirements.

**Basis of Payment:** The furnishing and maintenance of the construction field office will be paid at the listed unit price per month for the respective item “Construction Field Office, Large”, which price shall include all material, equipment, labor, utility services and work incidental thereto.

The cost of providing the parking area, external illumination, trash removal and snow and ice removal shall be included in the monthly unit price bid for the respective item “Construction Field Office, Large”.

The State will be responsible for payment of data communication user fees and for toll calls by State personnel.

<u>Pay Item</u>	<u>Pay Unit</u>
Construction Field Office, Large	Month

**ITEM #0970006A – TRAFFICPERSON (MUNICIPAL POLICE OFFICER)**

**9.70.01—Description:** Under this item the Contractor shall provide the services of Trafficpersons of the type and number, and for such periods, as the Engineer approves for the control and direction of vehicular traffic and pedestrians. Traffic persons requested solely for the contractor's operational needs will not be approved for payment.

9.70.03—Construction Method: Prior to the start of operations on the project requiring the use of Trafficpersons, a meeting will be held with the Contractor, Trafficperson agency or firm, Engineer, and State Police, if applicable, to review the Trafficperson operations, lines of responsibility, and operating guidelines which will be used on the project. A copy of the municipality's billing rates for Municipal Police Officers and vehicles, if applicable, will be provided to the Engineer prior to start of work.

On a weekly basis, the Contractor shall inform the Engineer of their scheduled operations for the following week and the number of Trafficpersons requested. The Engineer shall review this schedule and approve the type and number of Trafficpersons required. In the event of an unplanned, emergency, or short term operation, the Engineer may approve the temporary use of properly clothed persons for traffic control until such time as an authorized Trafficperson may be obtained. In no case shall this temporary use exceed 8 hours for any particular operation.

If the Contractor changes or cancels any scheduled operations without prior notice of same as required by the agency providing the Trafficpersons, and such that Trafficperson services are no longer required, the Contractor will be responsible for payment at no cost to the Department of any show-up cost for any Trafficperson not used because of the change. Exceptions, as approved by the Engineer, may be granted for adverse weather conditions and unforeseeable causes beyond the control and without the fault or negligence of the Contractor.

Trafficpersons assigned to a work site are to only take direction from the Engineer.

Trafficpersons shall wear a high visibility safety garment that complies with OSHA, MUTCD, ASTM Standards and the safety garment shall have the words "Traffic Control" clearly visible on the front and rear panels (minimum letter size 2 inches (50 millimeters)). Worn/faded safety garments that are no longer highly visible shall not be used. The Engineer shall direct the replacement of any worn/faded garment at no cost to the State.

A Trafficperson shall assist in implementing the traffic control specified in the Maintenance and Protection of Traffic contained elsewhere in these specifications or as directed by the Engineer. Any situation requiring a Trafficperson to operate in a manner contrary to the Maintenance and Protection of Traffic specification shall be authorized in writing by the Engineer.

Trafficpersons shall consist of the following types:

**1. Uniformed Law Enforcement Personnel:** Law enforcement personnel shall wear the high visibility safety garment provided by their law enforcement agency. If no high visibility safety garment is provided, the Contractor shall provide the law enforcement personnel with a garment meeting the requirements stated below for the Uniformed Flaggers' garment.

Law Enforcement Personnel may be also be used to conduct motor vehicle enforcement operations in and around work areas as directed and approved by the Engineer.

Municipal Police Officers: Uniformed Municipal Police Officers shall be sworn Municipal Police Officers or Uniformed Constables who perform criminal law enforcement duties from the Municipality in which the project is located. Their services will also include an official Municipal Police vehicle when requested by the Engineer. Uniformed Municipal Police Officers will be used on non-limited access highways. If Uniformed Municipal Police Officers are unavailable, other Trafficpersons may be used when authorized in writing by the Engineer. Uniformed Municipal Police Officers and requested Municipal Police vehicles will be used at such locations and for such periods as the Engineer deems necessary to control traffic operations and promote increased safety to motorists through the construction sites.

**2. Uniformed Flagger:** Uniformed Flaggers shall be persons who have successfully completed flagger training by the American Traffic Safety Services Association (ATSSA), National Safety Council (NSC) or other programs approved by the Engineer. A copy of the Flagger's training certificate shall be provided to the Engineer before the Flagger performs any work on the project. Uniformed Flaggers shall conform to Chapter 6E, Flagger Control, in the Manual of Uniformed Traffic Control Devices (MUTCD) and shall wear high-visibility safety apparel, use a STOP/SLOW paddle that is at least 18 inches (450 millimeters) in width with letters at least 6 inches (150 millimeters) high. The paddle shall be mounted on a pole of sufficient length to be 6 feet (1.8 meters) above the ground as measured from the bottom of the sign.

Uniformed Flaggers will only be used on non-limited access highways to control traffic operations when authorized in writing by the Engineer.

**9.70.04—Method of Measurement:** Services of Trafficpersons will be measured for payment by the actual number of hours for each person rendering services approved by the Engineer. These services shall include, however, only such trafficpersons as are employed within the limits of construction, project right of way of the project or along detours authorized by the Engineer to assist the motoring public through the construction work zone. Services for continued use of a detour or bypass beyond the limitations approved by the Engineer, for movement of construction vehicles and equipment, or at locations where traffic is unnecessarily restricted by the Contractor's method of operation, will not be measured for payment.

Trafficpersons shall not work more than twelve hours in any one 24 hour period. In case such services are required for more than twelve hours, additional Trafficpersons shall be furnished and measured for payment. In cases where the Trafficperson is an employee on the Contractor's payroll, payment under the item "Trafficperson (Uniformed Flagger)" will be made only for those hours when the Contractor's employee is performing Trafficperson services.

Travel time will not be measured for payment for services provided by Uniformed Municipal Police Officers or Uniformed Flaggers.

Mileage fees associated with Trafficperson services will not be measured for payment.

Safety garments and STOP/SLOW paddles will not be measured for payment.

**9.70.05—Basis of Payment:** Trafficpersons will be paid in accordance with the schedule described herein.

There will be no direct payment for safety garments or STOP/SLOW paddles. All costs associated with furnishing safety garments and STOP/SLOW paddles shall be considered included in the general cost of the item.

**1. Uniformed Law Enforcement Personnel:** The sum of money shown on the Estimate and in the itemized proposal as "Estimated Cost" for this work will be considered the bid price even though payment will be made as described below. The estimated cost figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded and the original price will be used to determine the total amount for the contract.

The Department will pay the Contractor its actual costs for "Trafficperson (Municipal Police Officer)" plus an additional 5% as reimbursement for the Contractor's administrative expense in connection with the services provided.

The invoice must include a breakdown of each officer's actual hours of work and actual rate applied. Mileage fees associated with Trafficperson services are not reimbursable expenses and are not to be included in the billing invoice. The use of a municipal police vehicle authorized by the Engineer will be paid at the actual rate charged by the municipality. Upon receipt of the invoice from the municipality, the Contractor shall forward a copy to the Engineer. The invoice will be reviewed and approved by the Engineer prior to any payments. *Eighty (80%) of the invoice will be paid upon completion of review and approval. The balance (20%) will be paid upon receipt of cancelled check or receipted invoice, as proof of payment.* The rate charged by the municipality for use of a uniformed municipal police officer and/or a municipal police vehicle shall not be greater than the rate it normally charges others for similar services.

**2. Uniformed Flagger:** Uniformed flaggers will be paid for at the contract unit price per hour for "Trafficperson (Uniformed Flagger)", which price shall include all compensation, insurance benefits and any other cost or liability incidental to the furnishing of the trafficpersons ordered.

Pay Item	Pay Unit
Trafficperson (Municipal Police Officer)	est.

## **ITEM #0971001A – MAINTENANCE AND PROTECTION OF TRAFFIC**

### **Article 9.71.01 – Description is supplemented by the following:**

The Contractor shall maintain and protect traffic as described by the following and as limited in the Special Provision "Prosecution and Progress":

#### **Route I-95**

The Contractor shall maintain and protect the minimum number of through lanes and shoulders as dictated in the Special Provision for Section 1.08 - Prosecution and Progress "Limitations of Operations - Minimum Number of Lanes to Remain Open" Chart, on a paved travel path not less than 12 feet in width per lane.

The Contractor shall be allowed to halt traffic for a period of time not to exceed 10 minutes as approved by the Engineer. If more than one 10-minute period is required, the Contractor shall allow all stored vehicles to proceed through the work area prior to the next stoppage.

#### **Ramps and Turning Roadways**

The Contractor shall maintain and protect existing traffic operations.

Excepted therefrom will be those periods, during the allowable periods, when the Contractor is actively working, at which time the Contractor shall be allowed to maintain and protect a minimum of one lane of traffic, on a paved travel path not less than 12 feet in width.

The Contractor will be allowed to close any ramps within the project limits and detour traffic. Suggested detour routes are shown on the Ramp Closure Plans contained in this special provision. The Contractor shall only be allowed to close one ramp at a time.

#### **All Other Roadways**

The Contractor shall maintain and protect a minimum of one lane of traffic in each direction, each lane on a paved travel path not less than 11 feet in width.

Excepted therefrom will be those periods, during the allowable periods, when the Contractor is actively working, at which time the Contractor shall maintain and protect at least an alternating one-way traffic operation, on a paved travel path not less than 11 feet in width. The length of the alternating one-way traffic operation shall not exceed 300 feet and there shall be no more than one alternating one-way traffic operation within the project limits without prior approval of the Engineer.

## **Commercial and Residential Driveways**

The Contractor shall maintain access to and egress from all commercial and residential driveways throughout the project limits. The Contractor will be allowed to close said driveways to perform the required work during those periods when the businesses are closed, unless permission is granted from the business owner to close the driveway during business hours. If a temporary closure of a residential driveway is necessary, the Contractor shall coordinate with the owner to determine the time period of the closure.

### **Article 9.71.03 - Construction Method is supplemented as follows:**

#### **General**

The Contractor is required to delineate any raised structures within the travel lanes, so that the structures are visible day and night, unless there are specific contract plans and provisions to temporarily lower these structures prior to the completion of work.

The Contractor shall schedule operations so that pavement removal and roadway resurfacing shall be completed full width across a roadway (bridge) section by the end of a workday (work night), or as directed by the Engineer.

When the installation of all intermediate courses of bituminous concrete pavement is completed for the entire roadway, the Contractor shall install the final course of bituminous concrete pavement.

If applicable, when an existing sign is removed, it shall be either relocated or replaced by a new sign during the same working day.

The Contractor shall not store any material on-site which would present a safety hazard to motorists or pedestrians (e.g. fixed object or obstruct sight lines).

The field installation of a signing pattern shall constitute interference with existing traffic operations and shall not be allowed, except during the allowable periods.

Construction vehicles entering travel lanes at speeds less than the posted speed are interfering with traffic, and shall not be allowed without a lane closure. The lane closure shall be of sufficient length to allow vehicles to enter or exit the work area at posted speeds, in order to merge with existing traffic.

#### **Existing Signing**

The Contractor shall maintain all existing overhead and side-mounted signs throughout the project limits during the duration of the project. The Contractor shall temporarily relocate signs and sign supports as many times as deemed necessary, and install temporary sign supports if necessary and as directed by the Engineer.

### **Requirements for Winter**

The Contractor shall schedule a meeting with representatives from the Department including the offices of Maintenance and Traffic, and the Town/City to determine what interim traffic control measures the Contractor shall accomplish for the winter to provide safety to the motorists and permit adequate snow removal procedures. This meeting shall be held prior to October 31 of each year and will include, but not be limited to, discussion of the status and schedule of the following items: lane and shoulder widths, pavement restoration, traffic signal work, pavement markings, and signing.

### **Signing Patterns**

The Contractor shall erect and maintain all signing patterns in accordance with the traffic control plans contained herein. Proper distances between advance warning signs and proper taper lengths are mandatory.

**Pavement Markings - Limited Access Highways, Turning Roadways and Ramps**

During construction, the Contractor shall maintain all pavement markings throughout the limits of the project.

**Interim Pavement Markings**

The Contractor shall install painted pavement markings, which shall include lane lines (broken lines), shoulder edge lines, stop bars, lane-use arrows and gore markings, on each intermediate course of bituminous concrete pavement and on any milled surface by the end of the work day/night. All painted pavement markings will be paid under the appropriate items.

If the Contractor does not install permanent Epoxy Resin Pavement Markings by the end of the work day/night on exit ramps where the final course of bituminous concrete pavement has been installed, the Contractor shall install temporary 12 inch wide white stop bars. The temporary stop bars shall consist of Temporary Plastic Pavement Marking Tape and shall be installed by the end of the work day/night. Stop bars may consist of two 6 inch wide white markings or three 4 inch wide white markings placed side by side. The Contractor shall remove and dispose of these markings when the permanent Epoxy Resin Pavement Markings are installed. The cost of furnishing, installing and removing the Temporary Plastic Pavement Marking Tape shall be at the Contractor's expense.

If an intermediate course of bituminous concrete pavement will be exposed throughout the winter, then Epoxy Resin Pavement Markings should be installed unless directed otherwise by the Engineer.

**Final Pavement Markings**

The Contractor should install painted pavement markings on the final course of bituminous concrete pavement by the end of the work day/night. If the painted pavement markings are not installed by the end of the work day/night, then Temporary Plastic Pavement Marking Tape shall be installed as described above and the painted pavement markings shall be installed by the end of the work day/night on Friday of that week.

If Temporary Plastic Pavement Marking Tape is installed, the Contractor shall remove and dispose of these markings when the painted pavement markings are installed. The cost of furnishing, installing and removing the Temporary Plastic Pavement Marking Tape shall be at the Contractor's expense.

The Contractor shall install permanent Epoxy Resin Pavement Markings in accordance with Section 12.10 entitled "Epoxy Resin Pavement Markings, Symbols, and Legends" after such time as determined by the Engineer.

## **TRAFFIC CONTROL DURING CONSTRUCTION OPERATIONS**

The following guidelines shall assist field personnel in determining when and what type of traffic control patterns to use for various situations. These guidelines shall provide for the safe and efficient movement of traffic through work zones and enhance the safety of work forces in the work area.

### **TRAFFIC CONTROL PATTERNS**

Traffic control patterns shall be used when a work operation requires that all or part of any vehicle or work area protrudes onto any part of a travel lane or shoulder. For each situation, the installation of traffic control devices shall be based on the following:

- Speed and volume of traffic
- Duration of operation
- Exposure to hazards

Traffic control patterns shall be uniform, neat and orderly so as to command respect from the motorist.

In the case of a horizontal or vertical sight restriction in advance of the work area, the traffic control pattern shall be extended to provide adequate sight distance for approaching traffic.

If a lane reduction taper is required to shift traffic, the entire length of the taper should be installed on a tangent section of roadway so that the entire taper area can be seen by the motorist.

Any existing signs that are in conflict with the traffic control patterns shall be removed, covered, or turned so that they are not readable by oncoming traffic.

When installing a traffic control pattern, a Buffer Area should be provided and this area shall be free of equipment, workers, materials and parked vehicles.

Typical traffic control plans 19 through 25 may be used for moving operations such as line striping, pot hole patching, mowing, or sweeping when it is necessary for equipment to occupy a travel lane.

Traffic control patterns will not be required when vehicles are on an emergency patrol type activity or when a short duration stop is made and the equipment can be contained within the shoulder. Flashing lights and appropriate trafficperson shall be used when required.

Although each situation must be dealt with individually, conformity with the typical traffic control plans contained herein is required. In a situation not adequately covered by the typical traffic control plans, the Contractor must contact the Engineer for assistance prior to setting up a traffic control pattern.

**PLACEMENT OF SIGNS**

Signs must be placed in such a position to allow motorists the opportunity to reduce their speed prior to the work area. Signs shall be installed on the same side of the roadway as the work area. On multi-lane divided highways, advance warning signs shall be installed on both sides of the highway. On directional roadways (on-ramps, off-ramps, one-way roads), where the sight distance to signs is restricted, these signs should be installed on both sides of the roadway.

**ALLOWABLE ADJUSTMENT OF SIGNS AND DEVICES SHOWN ON THE TRAFFIC CONTROL PLANS**

The traffic control plans contained herein show the location and spacing of signs and devices under ideal conditions. Signs and devices should be installed as shown on these plans whenever possible.

The proper application of the traffic control plans and installation of traffic control devices depends on actual field conditions.

Adjustments to the traffic control plans shall be made only at the direction of the Engineer to improve the visibility of the signs and devices and to better control traffic operations. Adjustments to the traffic control plans shall be based on safety of work forces and motorists, abutting property requirements, driveways, side roads, and the vertical and horizontal curvature of the roadway.

The Engineer may require that the traffic control pattern be located significantly in advance of the work area to provide better sight line to the signing and safer traffic operations through the work zone.

Table I indicates the minimum taper length required for a lane closure based on the posted speed limit of the roadway. These taper lengths shall only be used when the recommended taper lengths shown on the traffic control plans cannot be achieved.

**TABLE I – MINIMUM TAPER LENGTHS**

POSTED SPEED LIMIT MILES PER HOUR	MINIMUM TAPER LENGTH IN FEET FOR A SINGLE LANE CLOSURE
30 OR LESS	180
35	250
40	320
45	540
50	600
55	660
65	780

## **SECTION 1. WORK ZONE SAFETY MEETINGS**

- 1.a) Prior to the commencement of work, a work zone safety meeting will be conducted with representatives of DOT Construction, Connecticut State Police (Local Barracks), Municipal Police, the Contractor (Project Superintendent) and the Traffic Control Subcontractor (if different than the prime Contractor) to review the traffic operations, lines of responsibility, and operating guidelines which will be used on the project. Other work zone safety meetings during the course of the project should be scheduled as needed.
- 1.b) A Work Zone Safety Meeting Agenda shall be developed and used at the meeting to outline the anticipated traffic control issues during the construction of this project. Any issues that can't be resolved at these meetings will be brought to the attention of the District Engineer and the Office of Construction. The agenda should include:
- Review Project scope of work and time
  - Review Section 1.08, Prosecution and Progress
  - Review Section 9.70, Trafficpersons
  - Review Section 9.71, Maintenance and Protection of Traffic
  - Review Contractor's schedule and method of operations.
  - Review areas of special concern: ramps, turning roadways, medians, lane drops, etc.
  - Open discussion of work zone questions and issues
  - Discussion of review and approval process for changes in contract requirements as they relate to work zone areas

## **SECTION 2. GENERAL**

- 2.a) If the required minimum number of signs and equipment (i.e. one High Mounted Internally Illuminated Flashing Arrow for each lane closed, two TMAs, Changeable Message Sign, etc.) are not available; the traffic control pattern shall not be installed.
- 2.b) The Contractor shall have back-up equipment (TMAs, High Mounted Internally Illuminated Flashing Arrow, Changeable Message Sign, construction signs, cones/drums, etc.) available at all times in case of mechanical failures, etc. The only exception to this is in the case of sudden equipment breakdowns in which the pattern may be installed but the Contractor must provide replacement equipment within 24 hours.
- 2.c) Failure of the Contractor to have the required minimum number of signs, personnel and equipment, which results in the pattern not being installed, shall not be a reason for a time extension or claim for loss time.
- 2.d) In cases of legitimate differences of opinion between the Contractor and the Inspection staff, the Inspection staff shall err on the side of safety. The matter shall be brought to

the District Office for resolution immediately or, in the case of work after regular business hours, on the next business day.

### **SECTION 3. INSTALLING AND REMOVING TRAFFIC CONTROL PATTERNS**

- 3.a) Lane Closures shall be installed beginning with the advanced warning signs and proceeding forward toward the work area.
- 3.b) Lane Closures shall be removed in the reverse order, beginning at the work area, or end of the traffic control pattern, and proceeding back toward the advanced warning signs.
- 3.c) Stopping traffic may be allowed:
  - As per the contract for such activities as blasting, steel erection, etc.
  - During paving, milling operations, etc. where, in the middle of the operation, it is necessary to flip the pattern to complete the operation on the other half of the roadway and traffic should not travel across the longitudinal joint or difference in roadway elevation.
  - To move slow moving equipment across live traffic lanes into the work area.
- 3.d) Under certain situations when the safety of the traveling public and/or that of the workers may be compromised due to conditions such as traffic volume, speed, roadside obstructions, or sight line deficiencies, as determined by the Engineer and/or State Police, traffic may be briefly impeded while installing and/or removing the advanced warning signs and the first ten traffic cones/drums only. Appropriate measures shall be taken to safely slow traffic. If required, traffic slowing techniques may be used and shall include the use of Truck Mounted Impact Attenuators (TMAs) as appropriate, for a minimum of one mile in advance of the pattern starting point. Once the advanced warning signs and the first ten traffic cones/drums are installed/removed, the TMAs and sign crew shall continue to install/remove the pattern as described in Section 4c and traffic shall be allowed to resume their normal travel.
- 3.e) The Contractor must adhere to using the proper signs, placing the signs correctly, and ensuring the proper spacing of signs.
- 3.f) Additional devices are required on entrance ramps, exit ramps, and intersecting roads to warn and/or move traffic into the proper travel path prior to merging/exiting with/from the main line traffic. This shall be completed before installing the mainline pattern past the ramp or intersecting roadway.
- 3.g) Prior to installing a pattern, any conflicting existing signs shall be covered with an opaque material. Once the pattern is removed, the existing signs shall be uncovered.

- 3.h) On limited access roadways, workers are prohibited from crossing the travel lanes to install and remove signs or other devices on the opposite side of the roadway. Any signs or devices on the opposite side of the roadway shall be installed and removed separately.

**SECTION 4. USE OF HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW**

- 4.a) On limited access roadways, one Flashing Arrow shall be used for each lane that is closed. The Flashing Arrow shall be installed concurrently with the installation of the traffic control pattern and its placement shall be as shown on the traffic control plan. For multiple lane closures, one Flashing Arrow is required for each lane closed. If conditions warrant, additional Flashing Arrows should be employed (i.e.: curves, major ramps, etc.).
- 4.b) On non-limited access roadways, the use of a Flashing Arrow for lane closures is optional. The roadway geometry, sight line distance, and traffic volume should be considered in the decision to use the Flashing Arrow.
- 4.c) The Flashing Arrow shall not be used on two lane, two-way roadways for temporary alternating one-way traffic operations.
- 4.d) The Flashing Arrow board display shall be in the “arrow” mode for lane closure tapers and in the “caution” mode (four corners) for shoulder work, blocking the shoulder, or roadside work near the shoulder. The Flashing Arrow shall be in the “caution” mode when it is positioned in the closed lane.
- 4.e) The Flashing Arrow shall not be used on a multi-lane roadway to laterally shift all lanes of traffic, because unnecessary lane changing may result.

**SECTION 5. USE OF TRUCK MOUNTED IMPACT ATTENUATOR VEHICLES (TMAs)**

- 5.a) For lane closures on limited access roadways, a minimum of two TMAs shall be used to install and remove traffic control patterns. If two TMAs are not available, the pattern shall not be installed.
- 5.b) On non-limited access roadways, the use of TMAs to install and remove patterns closing a lane(s) is optional. The roadway geometry, sight line distance, and traffic volume should be considered in the decision to utilize the TMAs.
- 5.c) Generally, to establish the advance and transition signing, one TMA shall be placed on the shoulder and the second TMA shall be approximately 1,000 feet ahead blocking the lane. The flashing arrow board mounted on the TMA should be in the “flashing arrow” mode when taking the lane. The sign truck and workers should be immediately ahead of

the second TMA. In no case shall the TMA be used as the sign truck or a work truck. Once the transition is in place, the TMAs shall travel in the closed lane until all Changeable Message Signs, signs, Flashing Arrows, and cones/drums are installed. The flashing arrow board mounted on the TMA should be in the “caution” mode when traveling in the closed lane.

- 5.d) A TMA shall be placed prior to the first work area in the pattern. If there are multiple work areas within the same pattern, then additional TMAs shall be positioned at each additional work area as needed. The flashing arrow board mounted on the TMA should be in the “caution” mode when in the closed lane.
- 5.e) TMAs shall be positioned a sufficient distance prior to the workers or equipment being protected to allow for appropriate vehicle roll-ahead in the event that the TMA is hit, but not so far that an errant vehicle could travel around the TMA and into the work area. For additional placement and use details, refer to the specification entitled “Type ‘D’ Portable Impact Attenuation System”. Some operations, such as paving and concrete repairs, do not allow for placement of the TMA(s) within the specified distances. In these situations, the TMA(s) should be placed at the beginning of the work area and shall be advanced as the paving or concrete operations proceed.
- 5.f) TMAs should be paid in accordance with how the unit is utilized. When it is used as a TMA and is in the proper location as specified, and then it should be paid at the specified hourly rate for “Type ‘D’ Portable Impact Attenuation System”. When the TMA is used as a Flashing Arrow, it should be paid at the daily rate for “High Mounted Internally Illuminated Flashing Arrow”. If a TMA is used to install and remove a pattern and then is used as a Flashing Arrow, the unit should be paid as a “Type ‘D’ Portable Impact Attenuation System” for the hours used to install and remove the pattern, typically 2 hours (1 hour to install and 1 hour to remove), and is also paid for the day as a “High Mounted Internally Illuminated Flashing Arrow”.

## **SECTION 6. USE OF TRAFFIC DRUMS AND TRAFFIC CONES**

- 6.a) Traffic drums shall be used for taper channelization on limited-access roadways, ramps, and turning roadways and to delineate raised catch basins and other hazards.
- 6.b) Traffic drums shall be used in place of traffic cones in traffic control patterns that are in effect for more than a 36-hour duration.
- 6.c) Traffic Cones less than 42 inches in height shall not be used on limited-access roadways or on non-limited access roadways with a posted speed limit of 45 mph and above.
- 6.d) Typical spacing of traffic drums and/or cones shown on the Traffic Control Plans in the Contract are maximum spacings and may be reduced to meet actual field conditions as required.

**SECTION 7. USE OF (REMOTE CONTROLLED) CHANGEABLE MESSAGE SIGNS (CMS)**

- 7.a) For lane closures on limited access roadways, one CMS shall be used in advance of the traffic control pattern. Prior to installing the pattern, the CMS shall be installed and in operation, displaying the appropriate lane closure information (i.e.: Left Lane Closed - Merge Right). The CMS shall be positioned ½ - 1 mile ahead of the lane closure taper. If the nearest Exit ramp is greater than the specified ½ - 1 mile distance, than an additional CMS shall be positioned a sufficient distance ahead of the Exit ramp to alert motorists to the work and therefore offer them an opportunity to take the exit.
- 7.b) CMS should not be installed within 1000 feet of an existing CMS.
- 7.c) On non-limited access roadways, the use of CMS for lane closures is optional. The roadway geometry, sight line distance, and traffic volume should be considered in the decision to use the CMS.
- 7.d) The advance CMS is typically placed off the right shoulder, 5 feet from the edge of pavement. In areas where the CMS cannot be placed beyond the edge of pavement, it may be placed on the paved shoulder with a minimum of five (5) traffic drums placed in a taper in front of it to delineate its position. The advance CMS shall be adequately protected if it is used for a continuous duration of 36 hours or more.
- 7.e) When the CMS are no longer required, they should be removed from the clear zone and have the display screen cleared and turned 90° away from the roadway.
- 7.f) The CMS generally should not be used for generic messages (ex: Road Work Ahead, Bump Ahead, Gravel Road, etc.).
- 7.g) The CMS should be used for specific situations that need to command the motorist's attention which cannot be conveyed with standard construction signs (Examples include: Exit 34 Closed Sat/Sun - Use Exit 35, All Lanes Closed - Use Shoulder, Workers on Road - Slow Down).
- 7.h) Messages that need to be displayed for long periods of time, such as during stage construction, should be displayed with construction signs. For special signs, please coordinate with the Office of Construction and the Division of Traffic Engineering for the proper layout/dimensions required.
- 7.i) The messages that are allowed on the CMS are as follows:

<u>Message No.</u>	<u>Frame 1</u>	<u>Frame 2</u>	<u>Message No.</u>	<u>Frame 1</u>	<u>Frame 2</u>
1	LEFT LANE CLOSED	MERGE RIGHT	9	LANES CLOSED AHEAD	REDUCE SPEED
2	2 LEFT LANES CLOSED	MERGE RIGHT	10	LANES CLOSED AHEAD	USE CAUTION
3	LEFT LANE CLOSED	REDUCE SPEED	11	WORKERS ON ROAD	REDUCE SPEED
4	2 LEFT LANES CLOSED	REDUCE SPEED	12	WORKERS ON ROAD	SLOW DOWN
5	RIGHT LANE CLOSED	MERGE LEFT	13	EXIT XX CLOSED	USE EXIT YY
6	2 RIGHT LANES CLOSED	MERGE LEFT	14	EXIT XX CLOSED USE YY	FOLLOW DETOUR
7	RIGHT LANE CLOSED	REDUCE SPEED	15	2 LANES SHIFT AHEAD	USE CAUTION
8	2 RIGHT LANES CLOSED	REDUCE SPEED	16	3 LANES SHIFT AHEAD	USE CAUTION

For any other message(s), approval must be received from the Office of Construction prior to their use. No more than two (2) displays shall be used within any message cycle.

## NOTES FOR TRAFFIC CONTROL PLANS

1. IF A TRAFFIC STOPPAGE OCCURS IN ADVANCE OF SIGN (A), THEN AN ADDITIONAL SIGN (A) SHALL BE INSTALLED IN ADVANCE OF THE STOPPAGE.
2. SIGNS (AA), (A), AND (D) SHOULD BE OMITTED WHEN THESE SIGNS HAVE ALREADY BEEN INSTALLED TO DESIGNATE A LARGER WORK ZONE THAN THE WORK ZONE THAT IS ENCOMPASSED ON THIS PLAN.
3. SEE TABLE 1 FOR ADJUSTMENT OF TAPERS IF NECESSARY.
4. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN TRAFFIC DRUMS SHALL BE USED IN PLACE OF TRAFFIC CONES.
5. ANY LEGAL SPEED LIMIT SIGNS WITHIN THE LIMITS OF A ROADWAY / LANE CLOSURE AREA SHALL BE COVERED WITH AN OPAQUE MATERIAL WHILE THE CLOSURE IS IN EFFECT, AND UNCOVERED WHEN THE ROADWAY / LANE CLOSURE IS RE-OPENED TO ALL LANES OF TRAFFIC.
6. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN ANY EXISTING CONFLICTING PAVEMENT MARKINGS SHALL BE ERADICATED OR COVERED, AND TEMPORARY PAVEMENT MARKINGS THAT DELINEATE THE PROPER TRAVELPATHS SHALL BE INSTALLED.
7. DISTANCES BETWEEN SIGNS IN THE ADVANCE WARNING AREA MAY BE REDUCED TO 100' ON LOW-SPEED URBAN ROADS (SPEED LIMIT < 40 MPH).
8. IF THIS PLAN IS TO REMAIN IN OPERATION DURING THE HOURS OF DARKNESS, INSTALL BARRICADE WARNING LIGHTS - HIGH INTENSITY ON ALL POST-MOUNTED DIAMOND SIGNS IN THE ADVANCE WARNING AREA.
9. A CHANGEABLE MESSAGE SIGN SHALL BE INSTALLED ONE HALF TO ONE MILE IN ADVANCE OF THE LANE CLOSURE TAPER.
10. SIGN (P) SHALL BE MOUNTED A MINIMUM OF 7 FEET FROM THE PAVEMENT SURFACE TO THE BOTTOM OF THE SIGN.

TABLE 1 - MINIMUM TAPER LENGTHS

POSTED SPEED LIMIT (MILES PER HOUR)	MINIMUM TAPER LENGTH FOR A SINGLE LANE CLOSURE
30 OR LESS	180' (55m)
35	250' (75m)
40	320' (100m)
45	540' (165m)
50	600' (180m)
55	660' (200m)
65	780' (240m)

METRIC CONVERSION CHART (1" = 25mm)

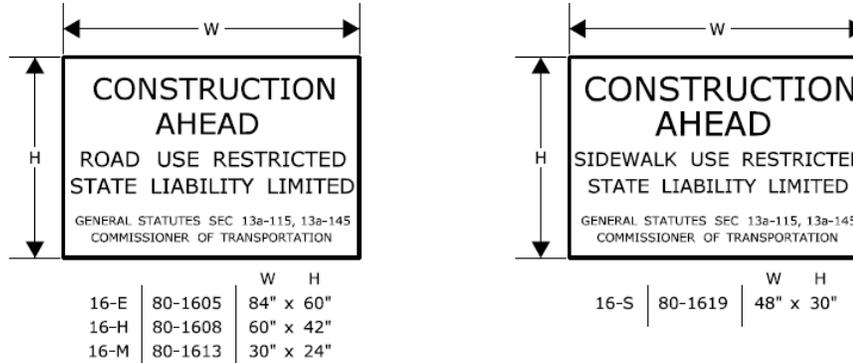
ENGLISH	METRIC	ENGLISH	METRIC	ENGLISH	METRIC
12"	300mm	42"	1050mm	72"	1800mm
18"	450mm	48"	1200mm	78"	1950mm
24"	600mm	54"	1350mm	84"	2100mm
30"	750mm	60"	1500mm	90"	2250mm
36"	900mm	66"	1650mm	96"	2400mm



SCALE: NONE

### CONSTRUCTION TRAFFIC CONTROL PLAN NOTES

### SERIES 16 SIGNS



THE 16-S SIGN SHALL BE USED ON ALL PROJECTS THAT REQUIRE SIDEWALK RECONSTRUCTION OR RESTRICT PEDESTRIAN TRAVEL ON AN EXISTING SIDEWALK.

SERIES 16 SIGNS SHALL BE INSTALLED IN ADVANCE OF THE TRAFFIC CONTROL PATTERNS TO ALLOW MOTORISTS THE OPPORTUNITY TO AVOID A WORK ZONE. SERIES 16 SIGNS SHALL BE INSTALLED ON ANY MAJOR INTERSECTING ROADWAYS THAT APPROACH THE WORK ZONE. ON LIMITED-ACCESS HIGHWAYS, THESE SIGNS SHALL BE LOCATED IN ADVANCE OF THE NEAREST UPSTREAM EXIT RAMP AND ON ANY ENTRANCE RAMPS PRIOR TO OR WITHIN THE WORK ZONE LIMITS.

THE LOCATION OF SERIES 16 SIGNS CAN BE FOUND ELSEWHERE IN THE PLANS OR INSTALLED AS DIRECTED BY THE ENGINEER.

SIGNS 16-E AND 16-H SHALL BE POST-MOUNTED.

SIGN 16-E SHALL BE USED ON ALL EXPRESSWAYS.

SIGN 16-H SHALL BE USED ON ALL RAMPS, OTHER STATE ROADWAYS, AND MAJOR TOWN/CITY ROADWAYS.

SIGN 16-M SHALL BE USED ON OTHER TOWN ROADWAYS.

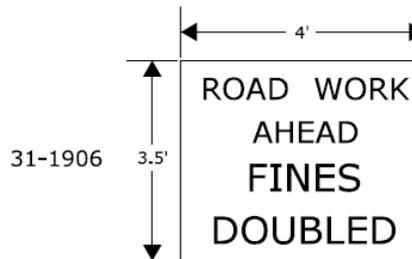
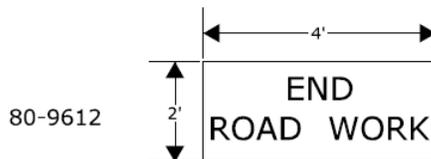
### REGULATORY SIGN "ROAD WORK AHEAD, FINES DOUBLED"

THE REGULATORY SIGN "ROAD WORK AHEAD FINES DOUBLED" SHALL BE INSTALLED FOR ALL WORK ZONES THAT OCCUR ON ANY STATE HIGHWAY IN CONNECTICUT WHERE THERE ARE WORKERS ON THE HIGHWAY OR WHEN THERE IS OTHER THAN EXISTING TRAFFIC OPERATIONS.

THE "ROAD WORK AHEAD FINES DOUBLED" REGULATORY SIGN SHALL BE PLACED AFTER THE SERIES 16 SIGN AND IN ADVANCE OF THE "ROAD WORK AHEAD" SIGN.

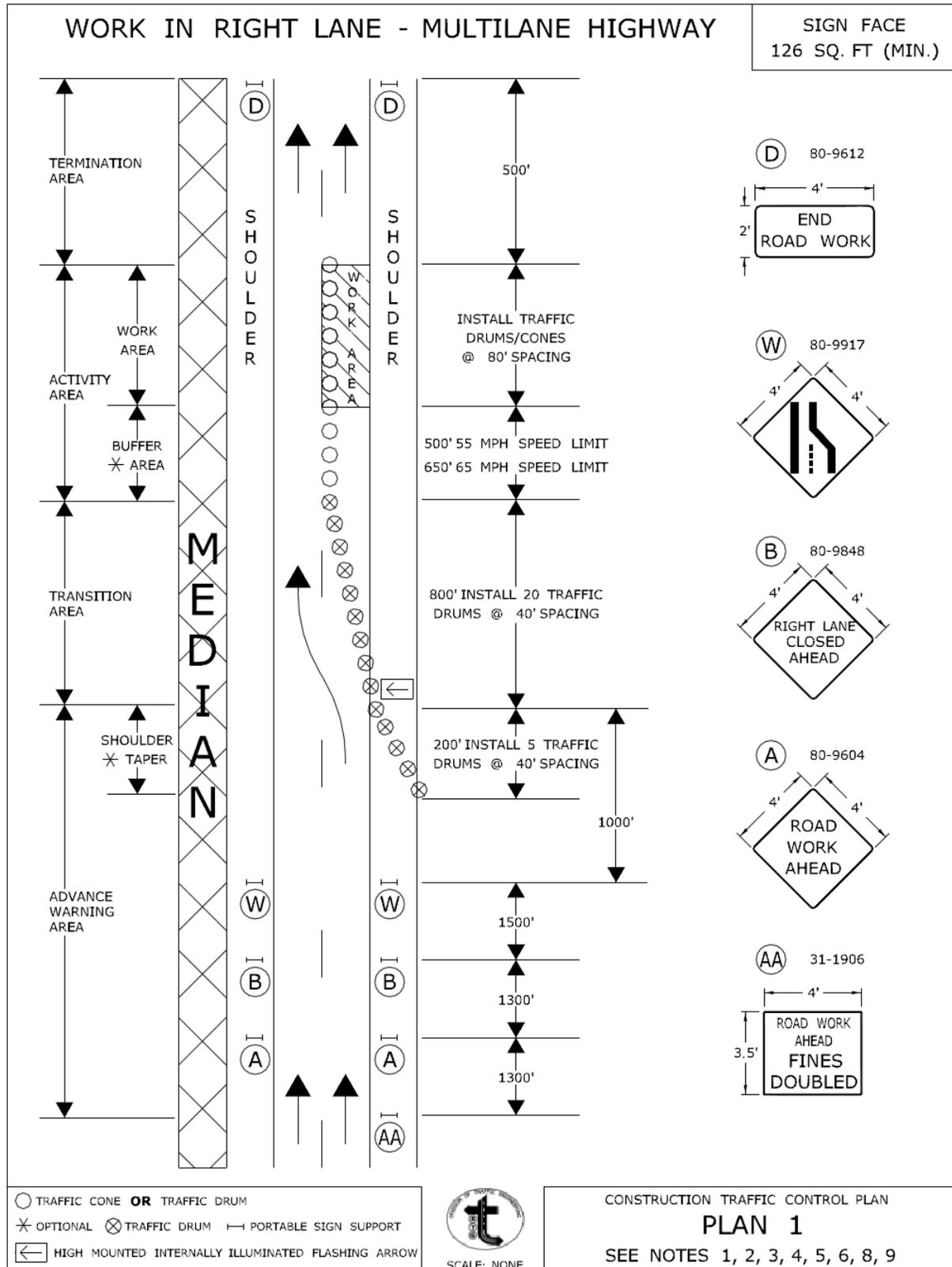
### "END ROAD WORK" SIGN

THE LAST SIGN IN THE PATTERN MUST BE THE "END ROAD WORK" SIGN.

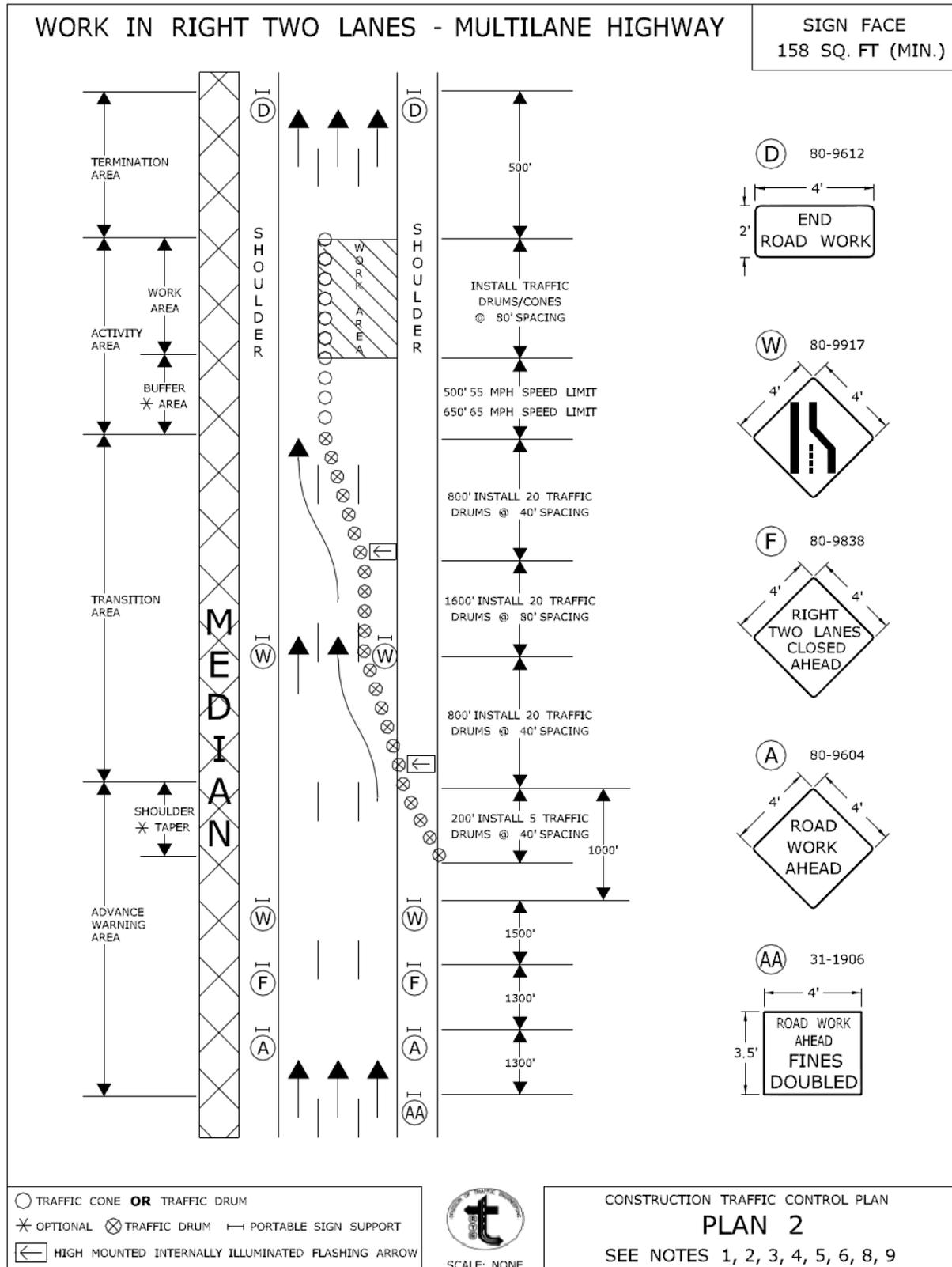


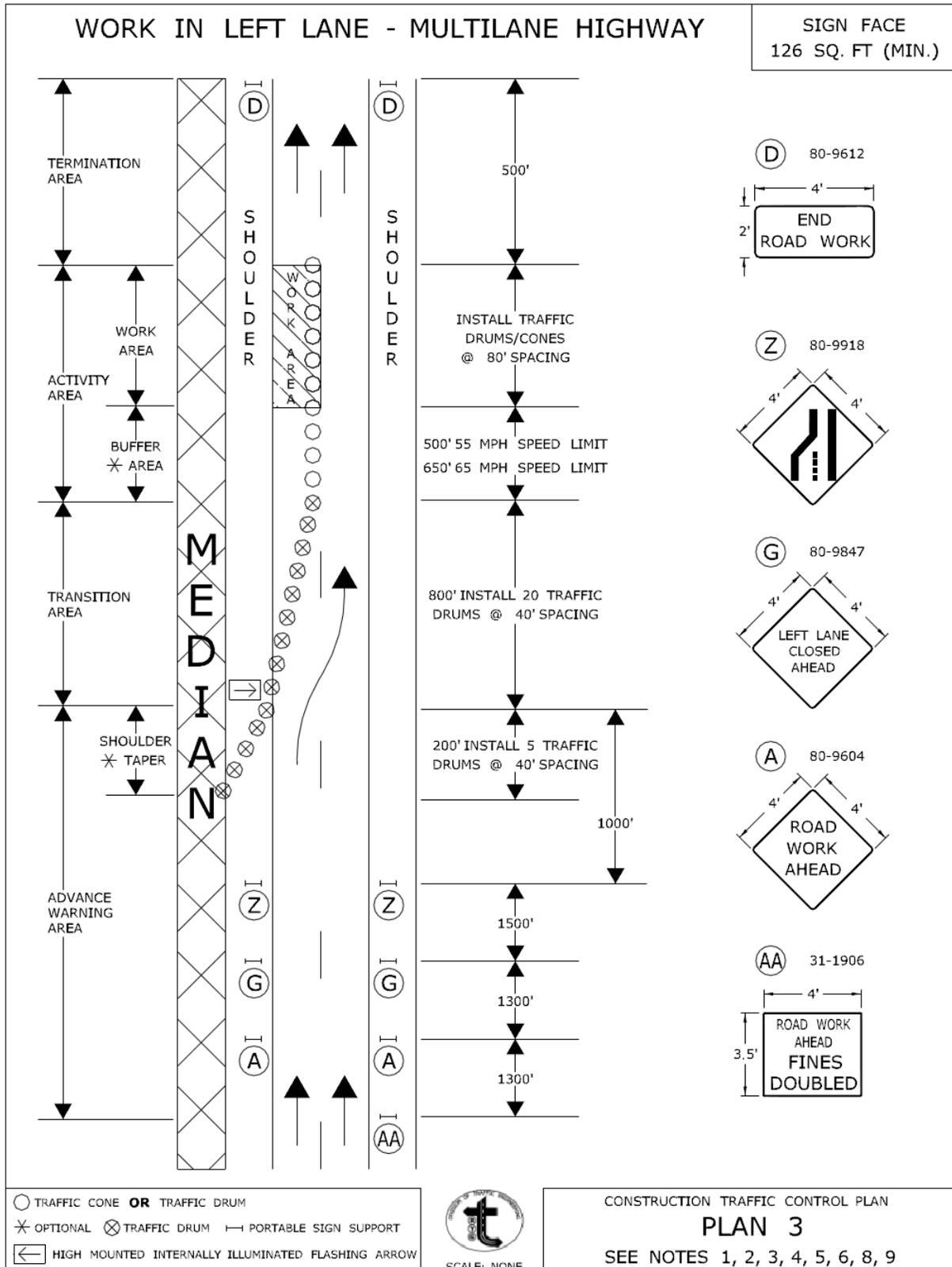
SCALE: NONE

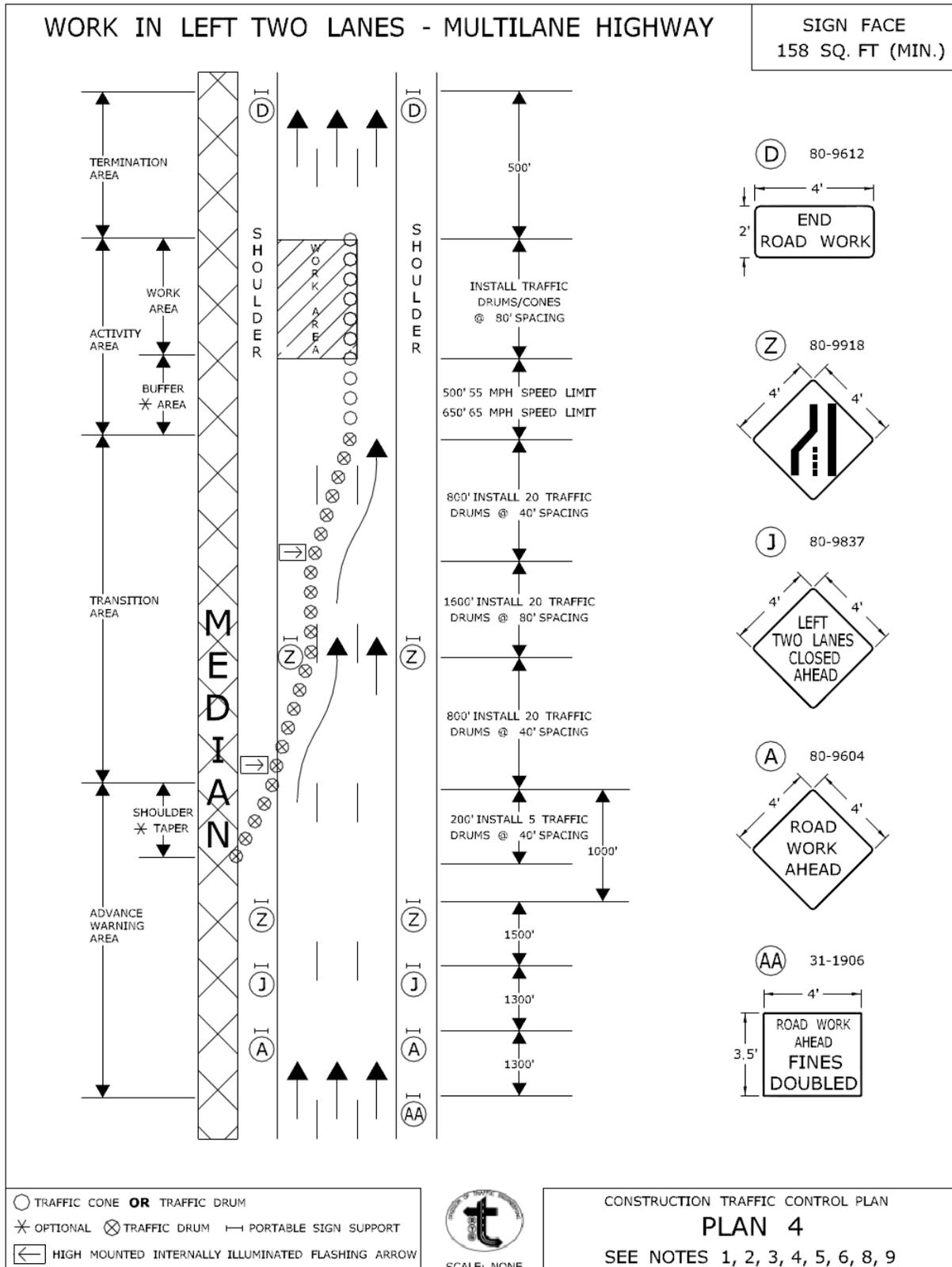
CONSTRUCTION TRAFFIC CONTROL PLAN  
**REQUIRED SIGNS**



APPROVED *Charles S. Harlow*  
 Charles S. Harlow  
 2012.06.05 15:51:00-0400  
 PRINCIPAL ENGINEER



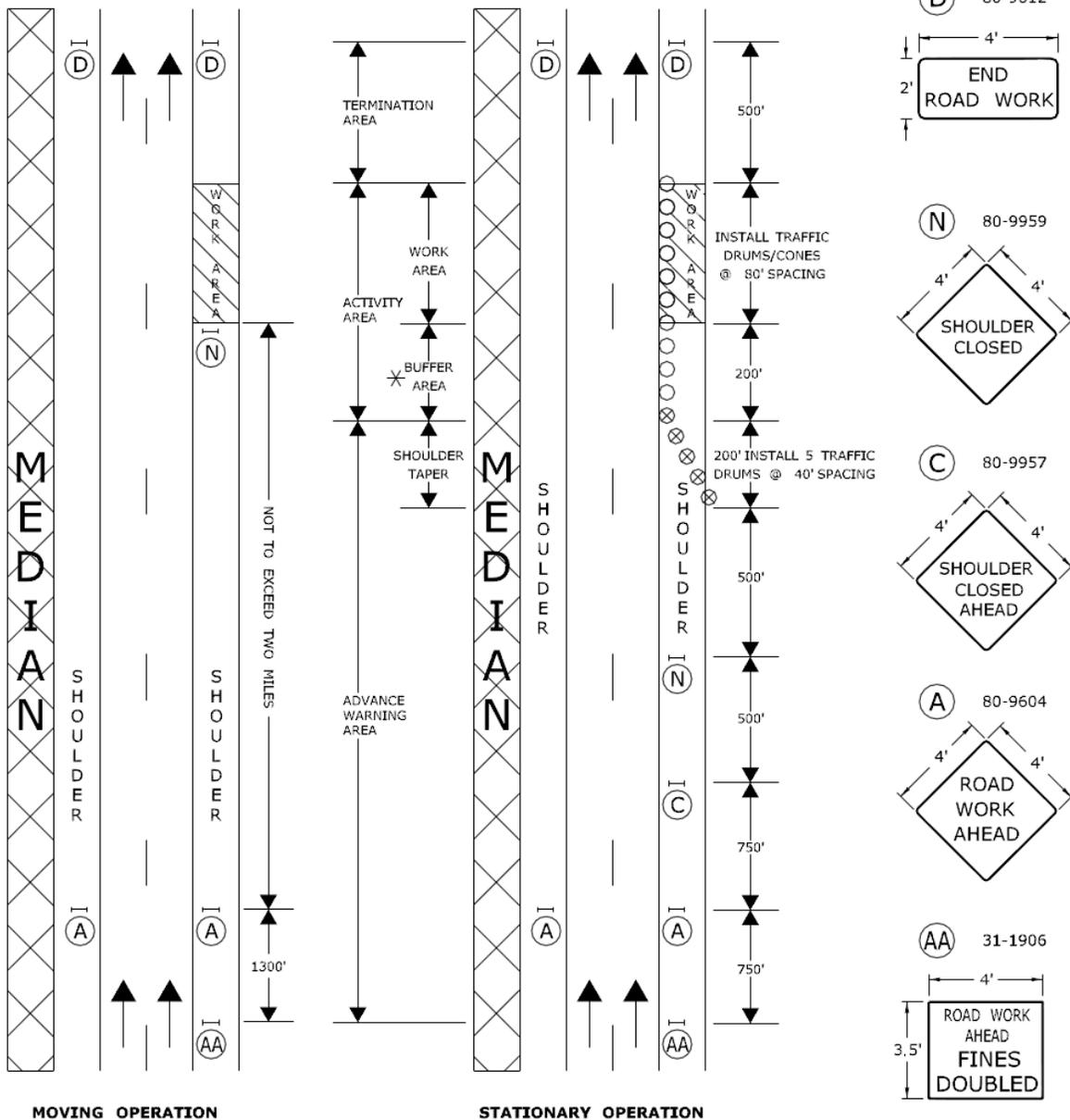




APPROVED *Charles S. Harlow*  
 Charles S. Harlow  
 2012.06.05 15:52:10-0400  
 PRINCIPAL ENGINEER

# WORK IN SHOULDER AREA - MULTILANE HIGHWAY

SIGN FACE  
94 SQ. FT (MIN.)



- TRAFFIC CONE OR TRAFFIC DRUM
- \* OPTIONAL ⊗ TRAFFIC DRUM — PORTABLE SIGN SUPPORT
- ◀ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW



SCALE: NONE

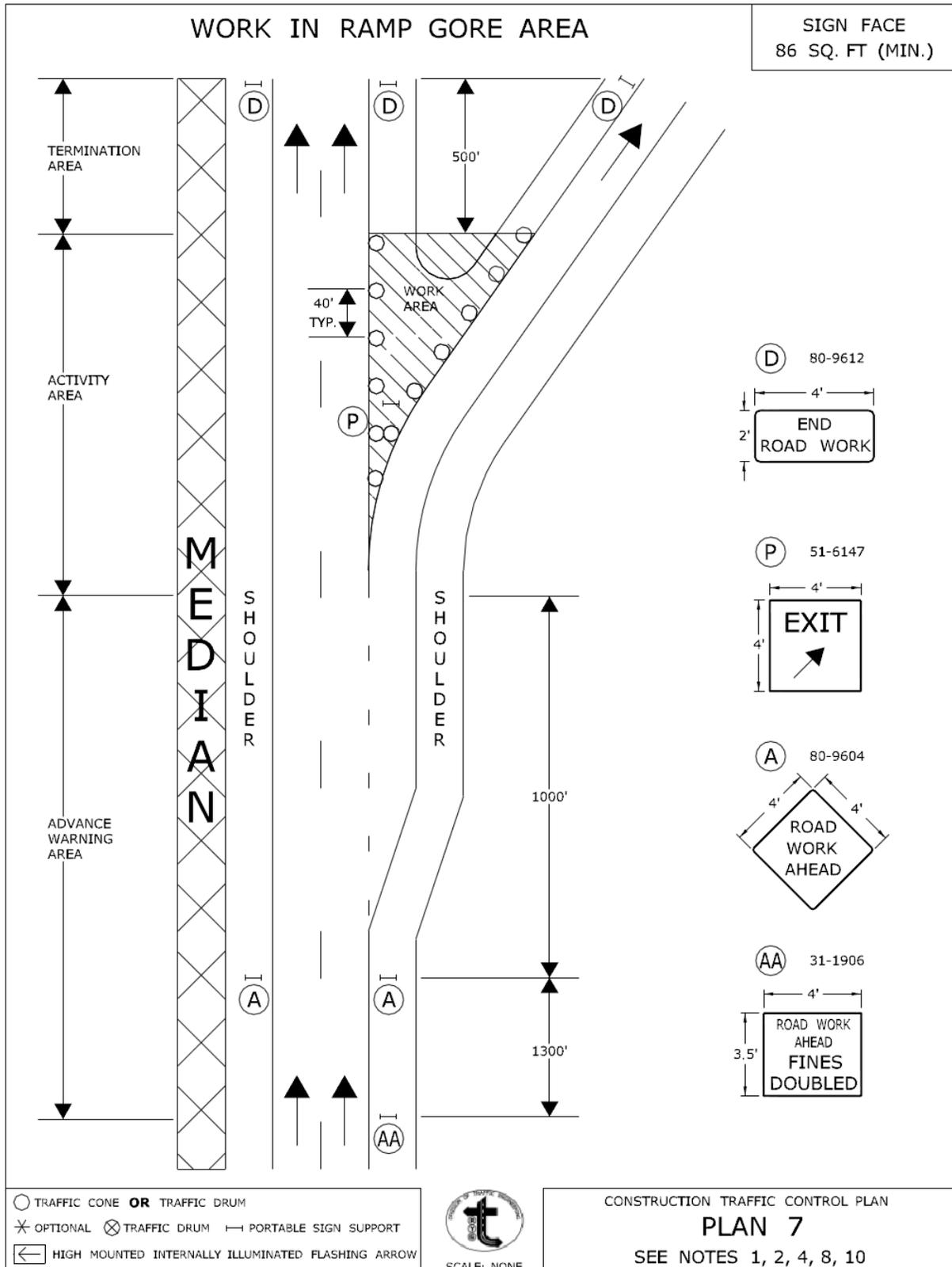
CONSTRUCTION TRAFFIC CONTROL PLAN

## PLAN 6

SEE NOTES 1, 2, 4, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED *Charles S. Harlow*  
PRINCIPAL ENGINEER  
2012.06.05 15:52:38-04'00"

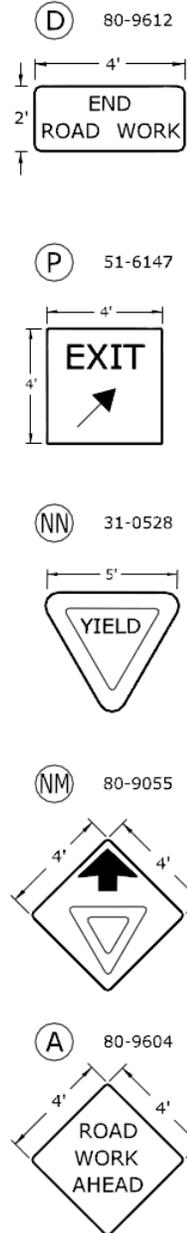
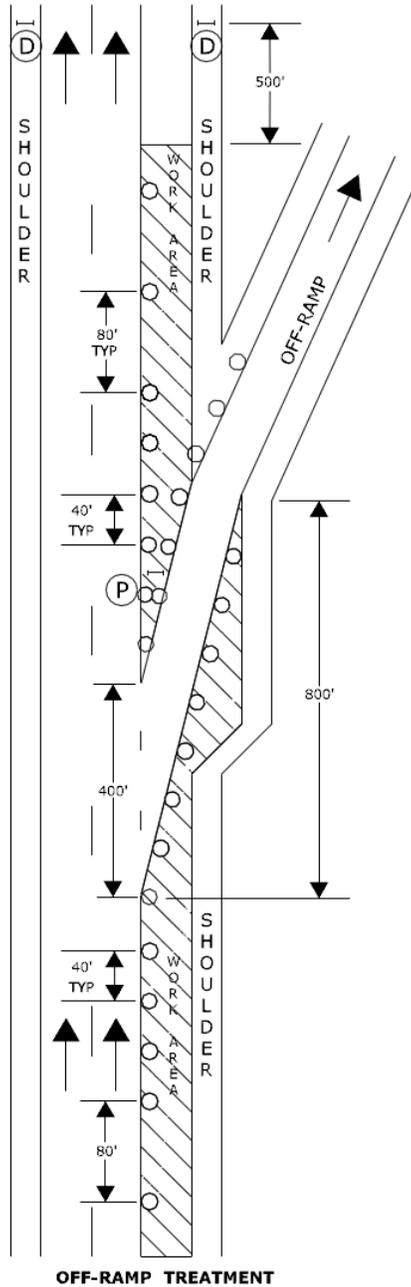
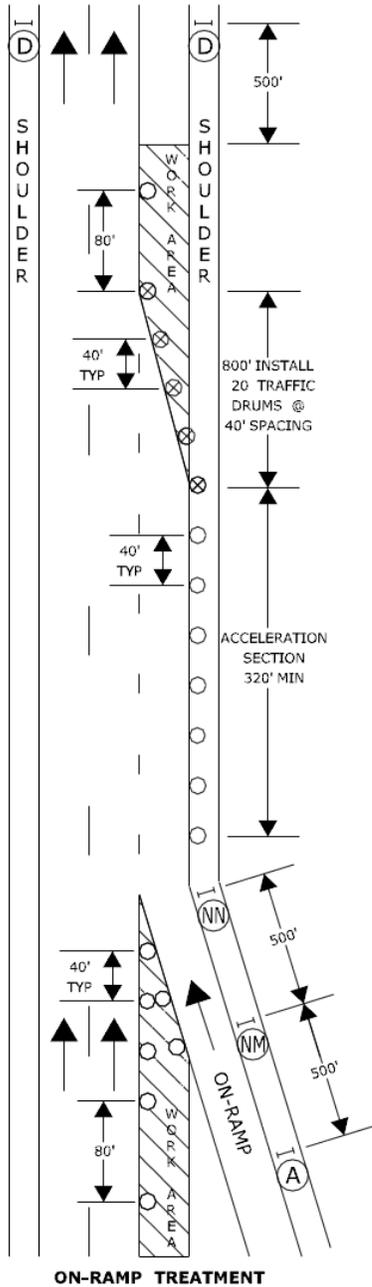


CONNECTICUT DEPARTMENT OF TRANSPORTATION  
 BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED *Charles S. Harlow*  
 PRINCIPAL ENGINEER  
Charles S. Harlow  
 2012.06.05 15:53:03-0400

## TYPICAL RAMP TREATMENTS FOR MAINLINE LANE CLOSURE - MULTILANE HIGHWAY

SIGN FACE  
SQ. FT VARIES



USE TRAFFIC CONTROL PLAN 1 TO CLOSE THE RIGHT LANE

- TRAFFIC CONE **OR** TRAFFIC DRUM
- ✱ OPTIONAL ⊗ TRAFFIC DRUM — PORTABLE SIGN SUPPORT
- ◀ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW



SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

### PLAN 8

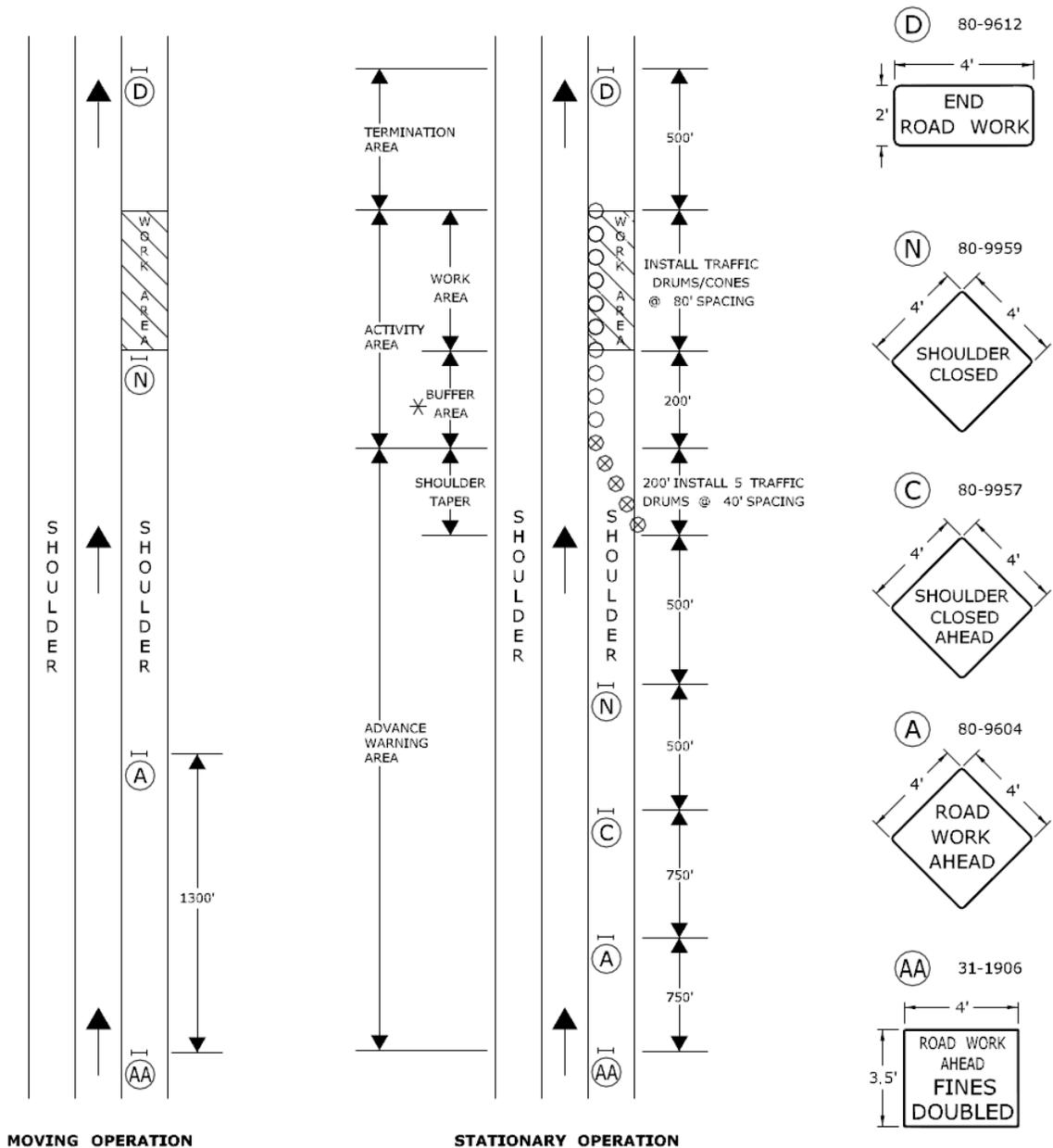
SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9, 10

CONNECTICUT DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED *Charles S. Harlow* Charles S. Harlow  
2012.06.05 15:53:31-0400  
PRINCIPAL ENGINEER

WORK IN SHOULDER AREA - TURNING ROADWAYS / RAMPS

SIGN FACE  
70 SQ. FT (MIN.)



- TRAFFIC CONE **OR** TRAFFIC DRUM
- \* OPTIONAL ⊗ TRAFFIC DRUM — PORTABLE SIGN SUPPORT
- ◀ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW



SCALE: NONE

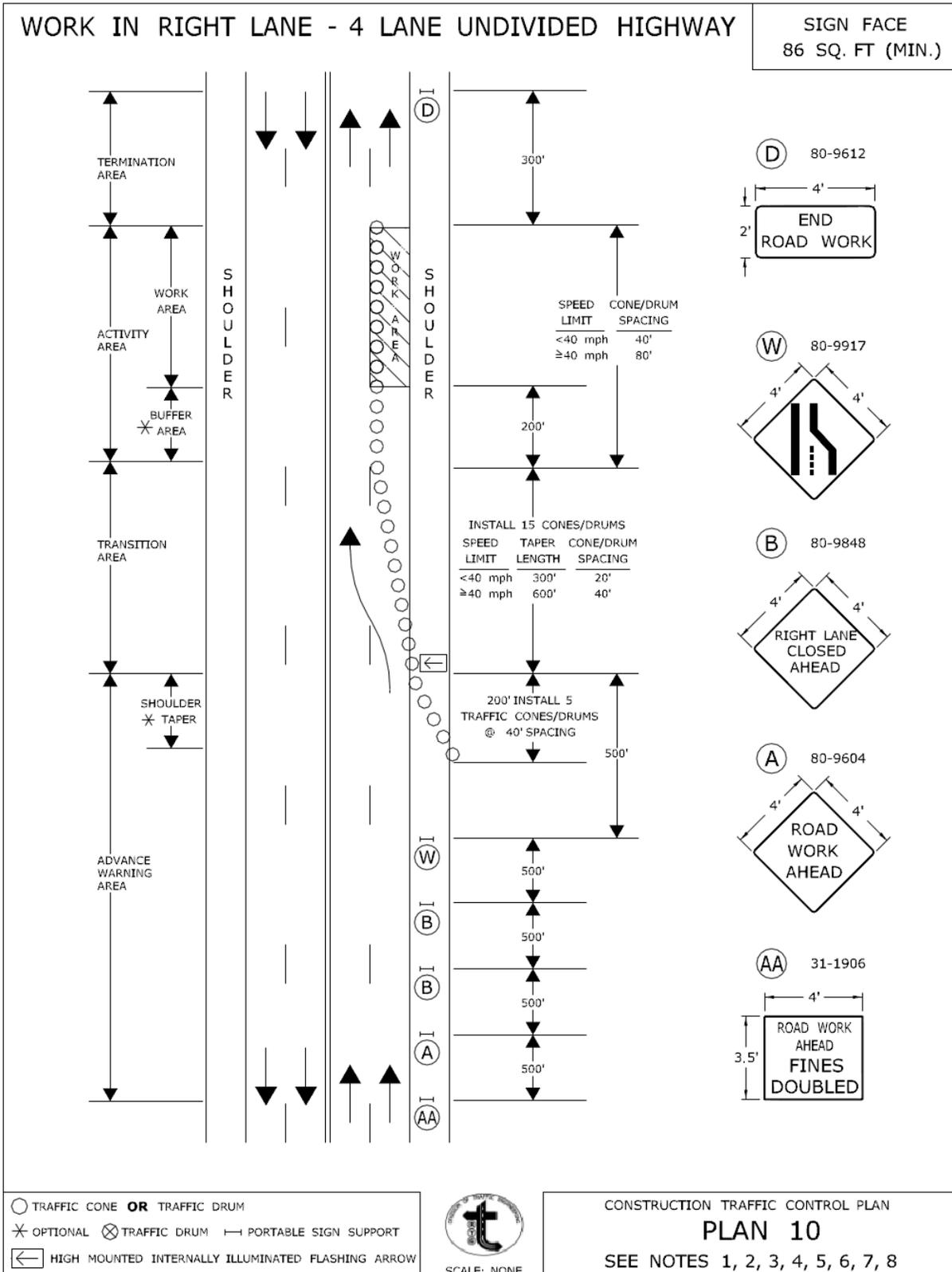
CONSTRUCTION TRAFFIC CONTROL PLAN

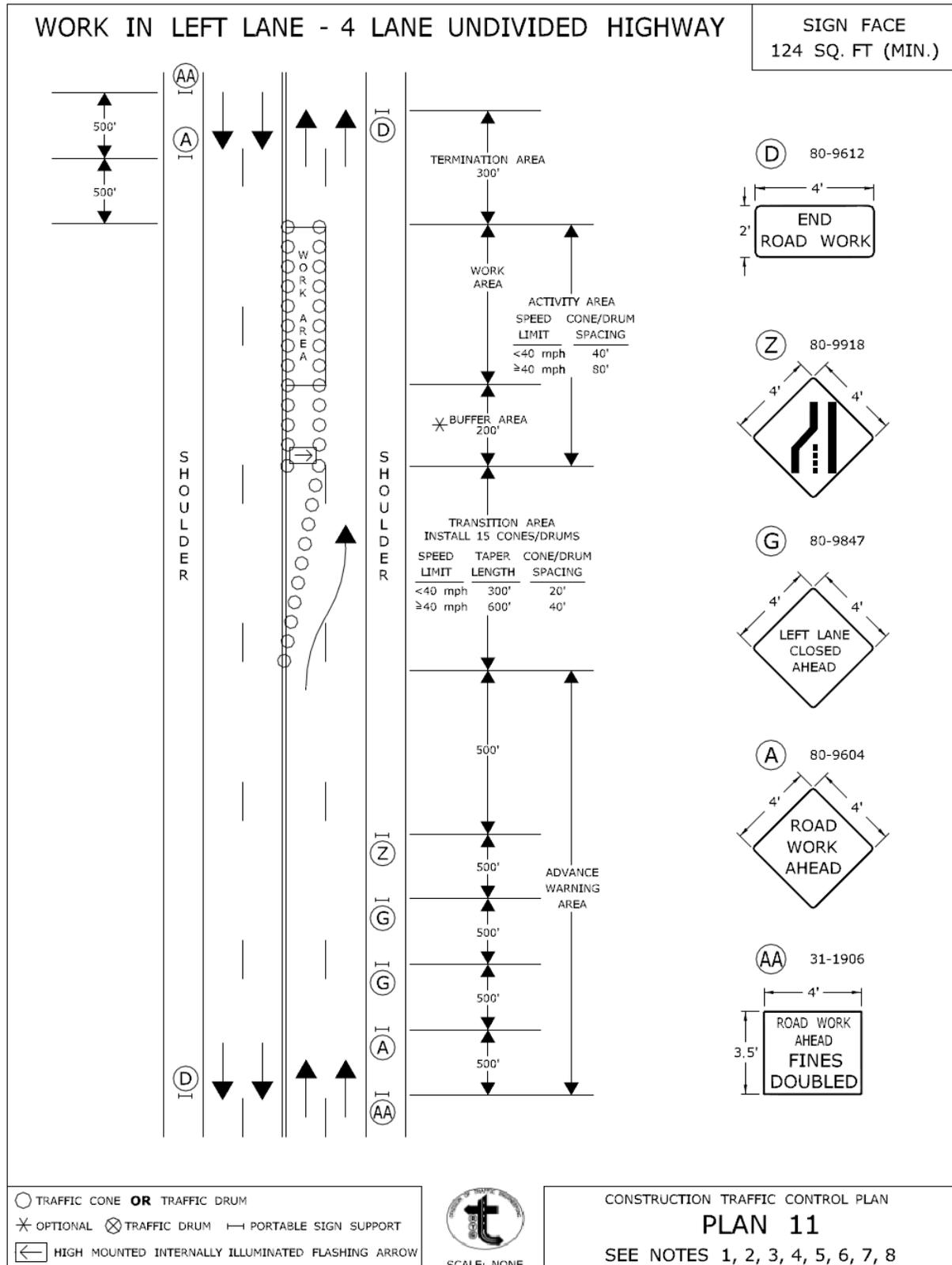
PLAN 9

SEE NOTES 1, 2, 4, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED *Charles S. Harlow*  
PRINCIPAL ENGINEER  
Charles S. Harlow  
2012.06.05 15:53:03-0400'





- TRAFFIC CONE **OR** TRAFFIC DRUM
- ✱ OPTIONAL ⊗ TRAFFIC DRUM — PORTABLE SIGN SUPPORT
- ◀ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW



SCALE: NONE

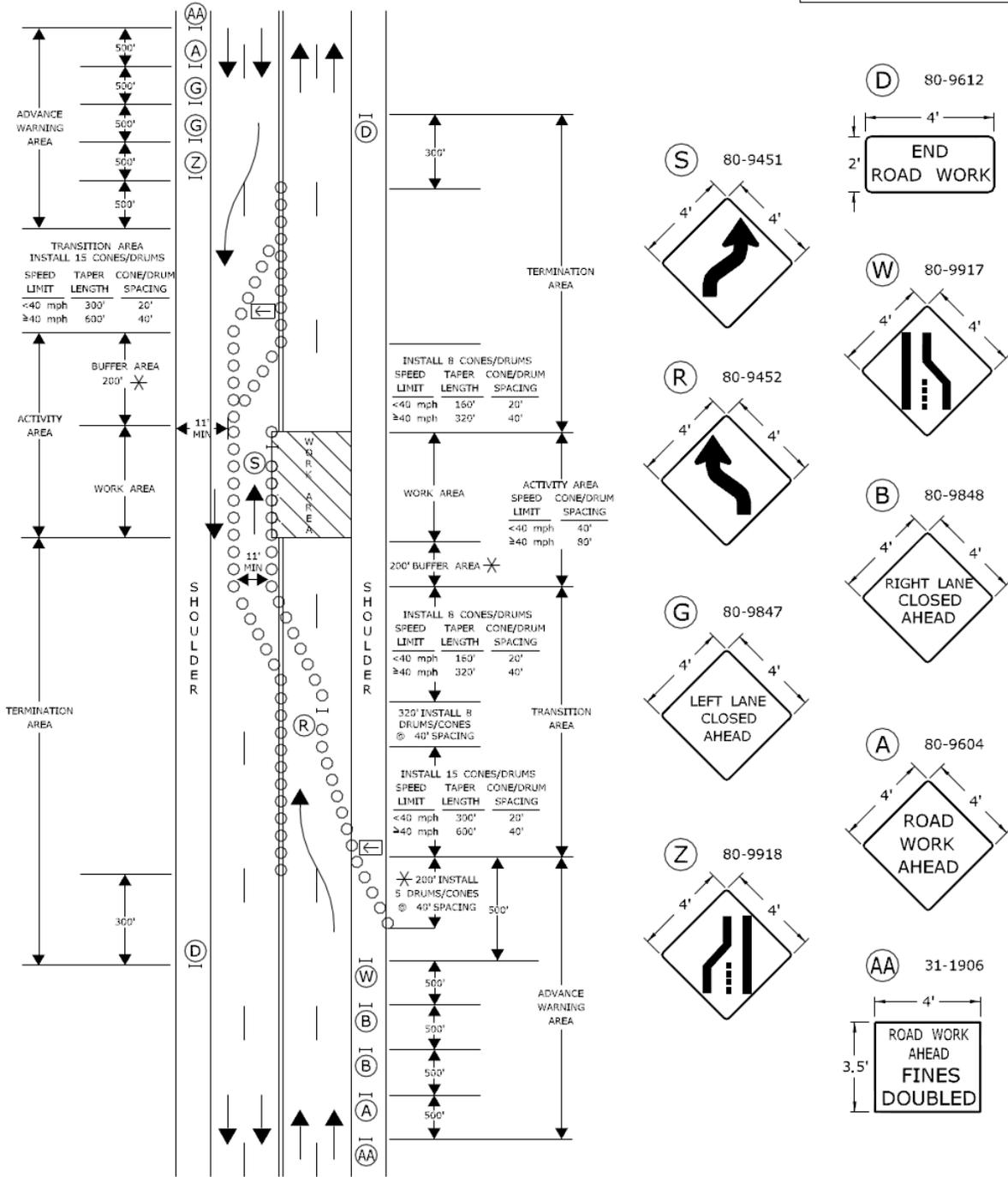
CONSTRUCTION TRAFFIC CONTROL PLAN  
**PLAN 11**  
SEE NOTES 1, 2, 3, 4, 5, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED *Charles S. Harlow*  
PRINCIPAL ENGINEER  
Charles S. Harlow  
2012.08.05 15:54:36-0400'

# WORK IN BOTH LANES - 4 LANE UNDIVIDED HIGHWAY

SIGN FACE  
204 SQ. FT. (MIN.)



- TRAFFIC CONE **OR** TRAFFIC DRUM
- ✱ OPTIONAL ⊗ TRAFFIC DRUM — PORTABLE SIGN SUPPORT
- ← HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

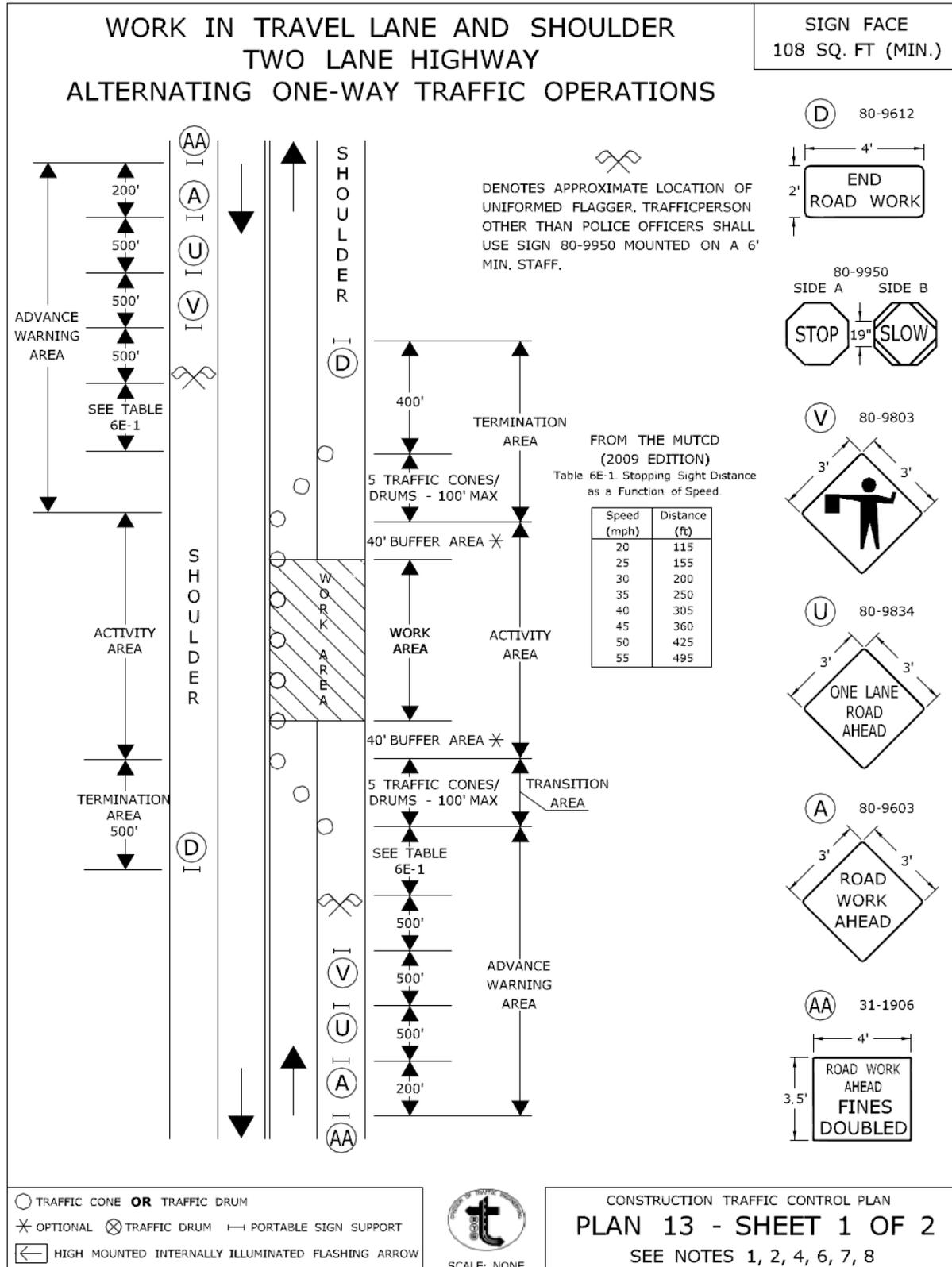


CONSTRUCTION TRAFFIC CONTROL PLAN  
**PLAN 12**  
SEE NOTES 1, 2, 3, 4, 5, 6, 7, 8

SCALE: NONE

CONNECTICUT DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED *Charles S. Harlow*  
PRINCIPAL ENGINEER  
Charles S. Harlow  
2012.06.05 15:55:01-0400'



CONNECTICUT DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING & CONSTRUCTION



CONSTRUCTION TRAFFIC CONTROL PLAN  
**PLAN 13 - SHEET 1 OF 2**  
SEE NOTES 1, 2, 4, 6, 7, 8

APPROVED *Charles S. Harlow* Charles S. Harlow  
2012.06.05 15:55:23-04'00"  
PRINCIPAL ENGINEER

# WORK IN TRAVEL LANE AND SHOULDER TWO LANE HIGHWAY ALTERNATING ONE-WAY TRAFFIC OPERATIONS

SIGN FACE  
108 SQ. FT (MIN.)

## HAND SIGNAL METHODS TO BE USED BY UNIFORMED FLAGGERS

THE FOLLOWING METHODS FROM SECTION 6E.07, FLAGGER PROCEDURES, IN THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES," SHALL BE USED BY UNIFORMED FLAGGERS WHEN DIRECTING TRAFFIC THROUGH A WORK AREA. THE STOP/SLOW SIGN PADDLE (SIGN NO. 80-9950) SHOWN ON THE TRAFFIC STANDARD SHEET TR-1220 01 ENTITLED, "SIGNS FOR CONSTRUCTION AND PERMIT OPERATIONS" SHALL BE USED.

**A. TO STOP TRAFFIC**

TO STOP ROAD USERS, THE FLAGGER SHALL FACE ROAD USERS AND AIM THE STOP PADDLE FACE TOWARD ROAD USERS IN A STATIONARY POSITION WITH THE ARM EXTENDED HORIZONTALLY AWAY FROM THE BODY. THE FREE ARM SHALL BE HELD WITH THE PALM OF THE HAND ABOVE SHOULDER LEVEL TOWARD APPROACHING TRAFFIC.



**B. TO DIRECT TRAFFIC TO PROCEED**

TO DIRECT STOPPED ROAD USERS TO PROCEED, THE FLAGGER SHALL FACE ROAD USERS WITH THE SLOW PADDLE FACE AIMED TOWARD ROAD USERS IN A STATIONARY POSITION WITH THE ARM EXTENDED HORIZONTALLY AWAY FROM THE BODY. THE FLAGGER SHALL MOTION WITH THE FREE HAND FOR ROAD USERS TO PROCEED.



**C. TO ALERT OR SLOW TRAFFIC**

TO ALERT OR SLOW TRAFFIC, THE FLAGGER SHALL FACE ROAD USERS WITH THE SLOW PADDLE FACE AIMED TOWARD ROAD USERS IN A STATIONARY POSITION WITH THE ARM EXTENDED HORIZONTALLY AWAY FROM THE BODY. TO FURTHER ALERT OR SLOW TRAFFIC, THE FLAGGER HOLDING THE SLOW PADDLE FACE TOWARD ROAD USERS MAY MOTION UP AND DOWN WITH THE FREE HAND, PALM DOWN.



- TRAFFIC CONE **OR** TRAFFIC DRUM
- ✱ OPTIONAL    ⊗ TRAFFIC DRUM    ⇨ PORTABLE SIGN SUPPORT
- ⇨ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

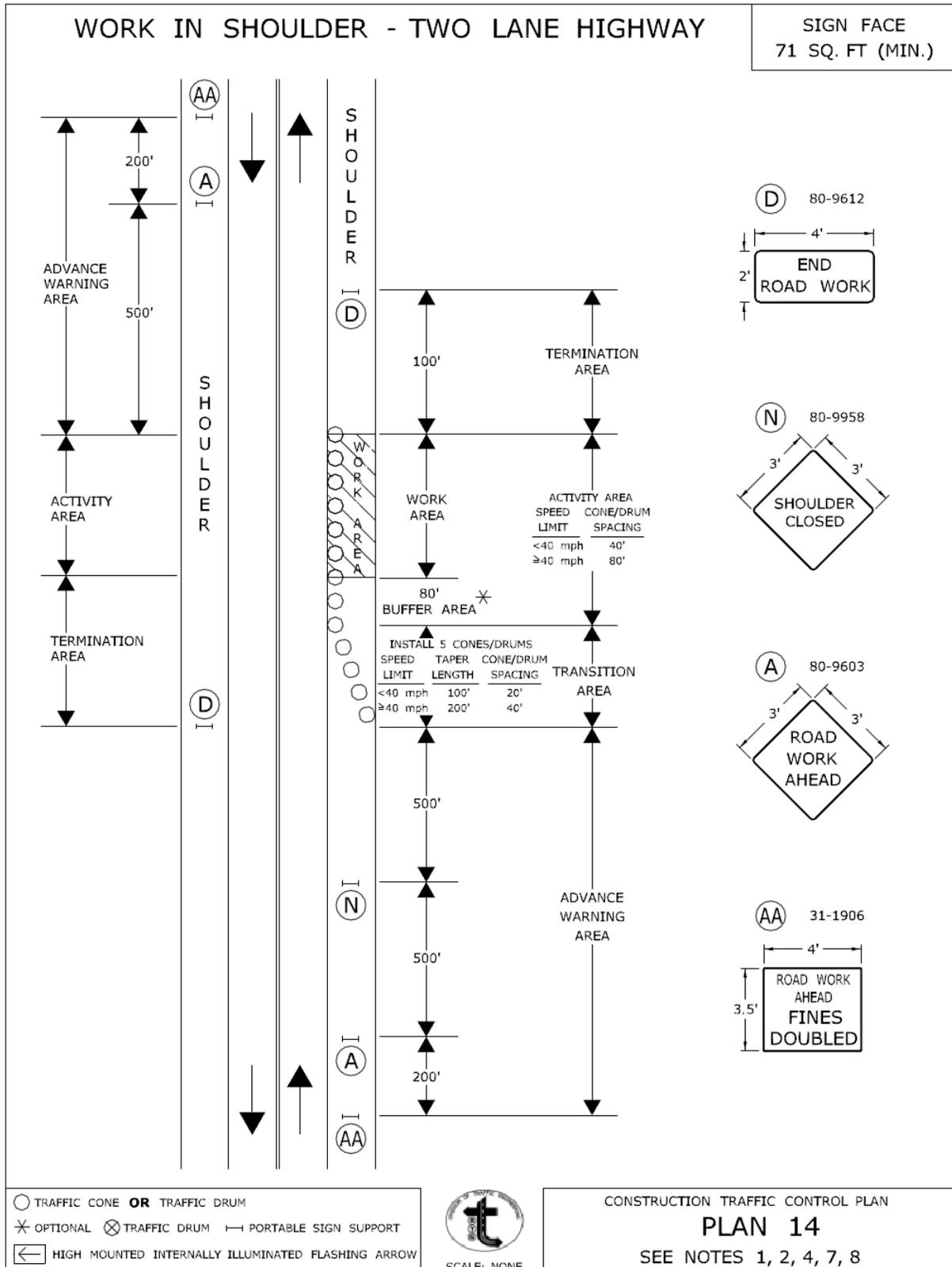


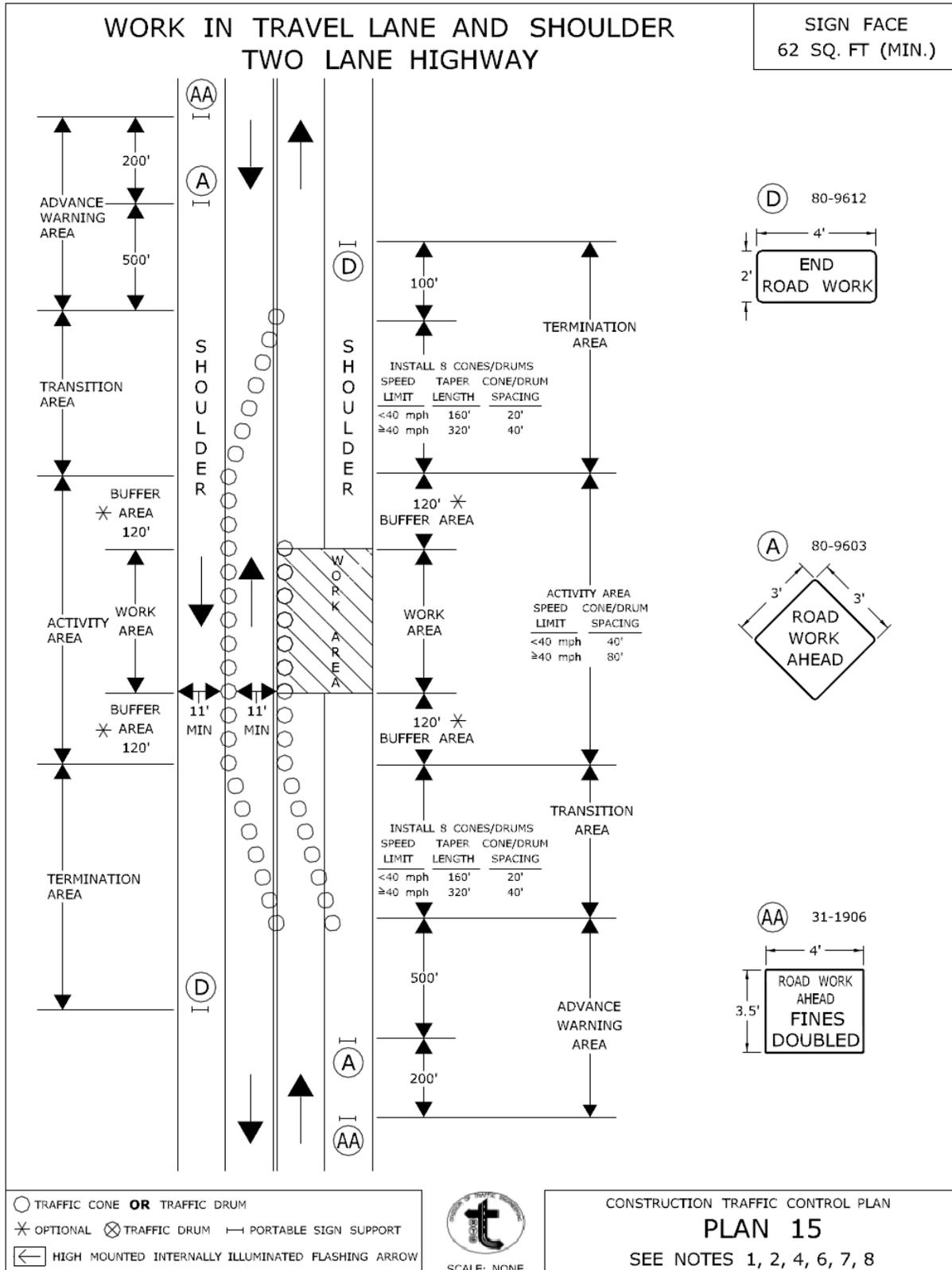
SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN  
**PLAN 13 - SHEET 2 OF 2**  
SEE NOTES 1, 2, 4, 6, 7, 8

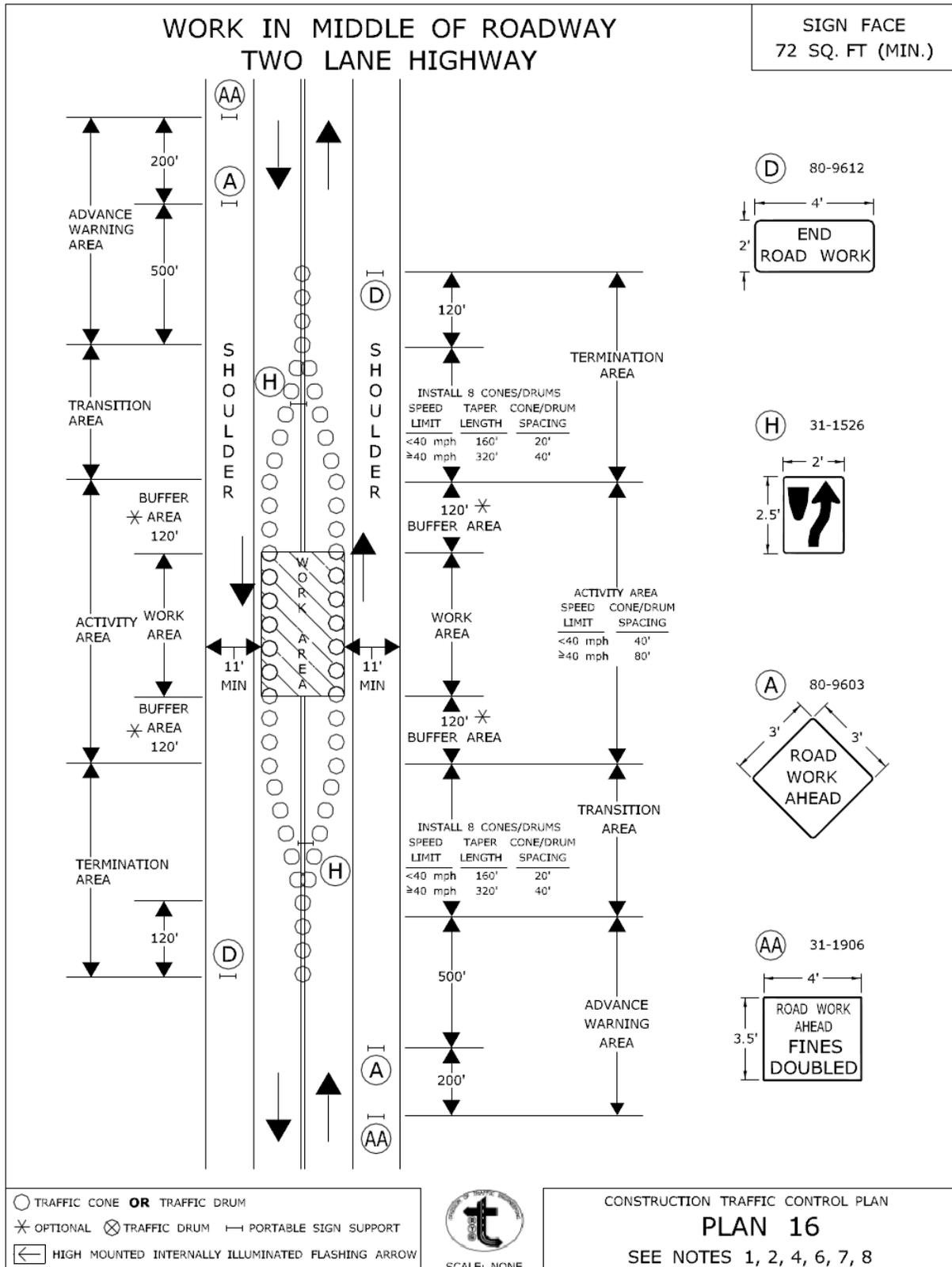
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BUREAU OF ENGINEERING & CONSTRUCTION

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2012.06.05 15:55:45-04'00'  
PRINCIPAL ENGINEER



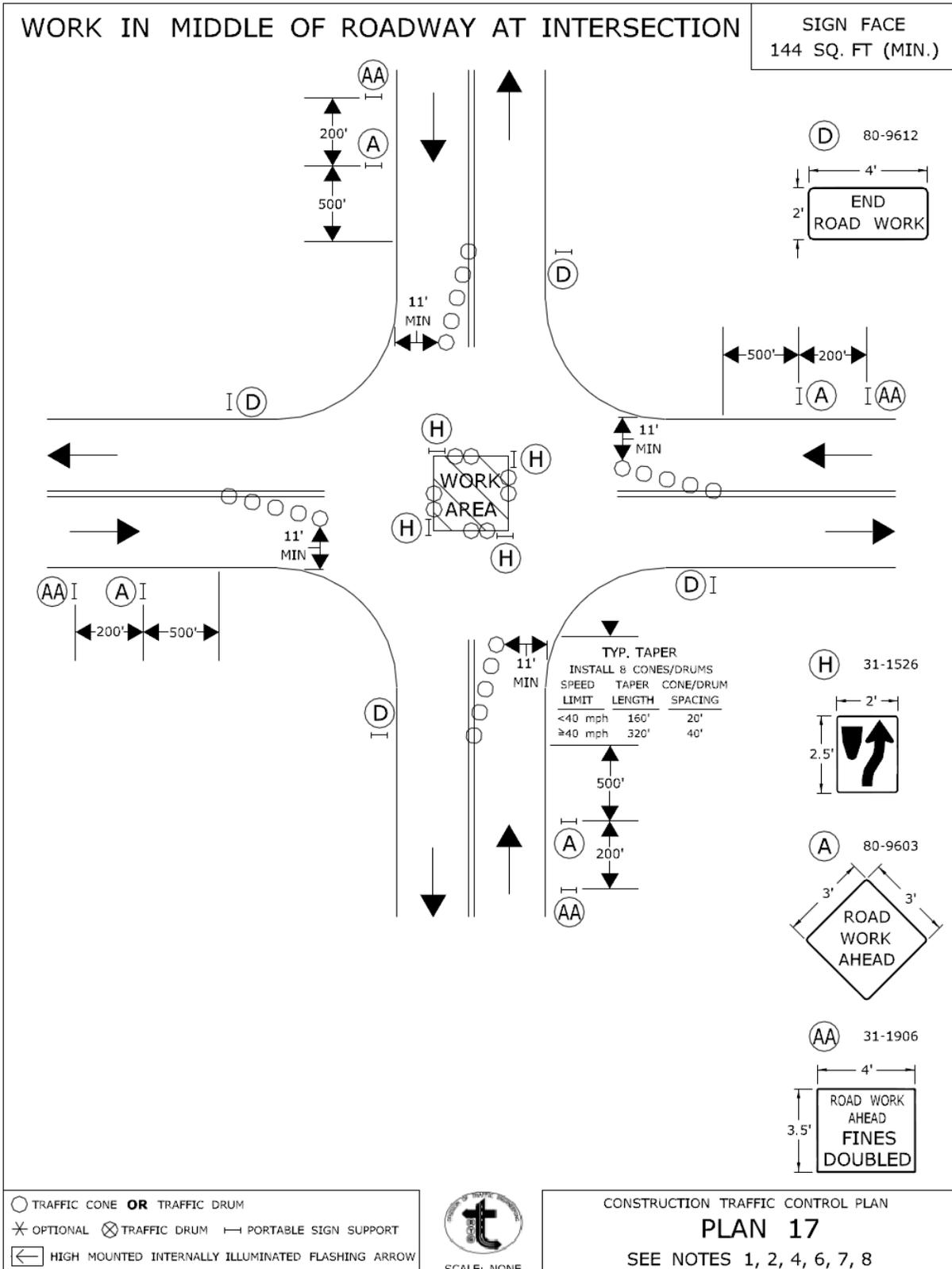


APPROVED *Charles S. Harlow* Charles S. Harlow  
2012.06.05 15:56:29-04'00"  
PRINCIPAL ENGINEER



CONNECTICUT DEPARTMENT OF TRANSPORTATION  
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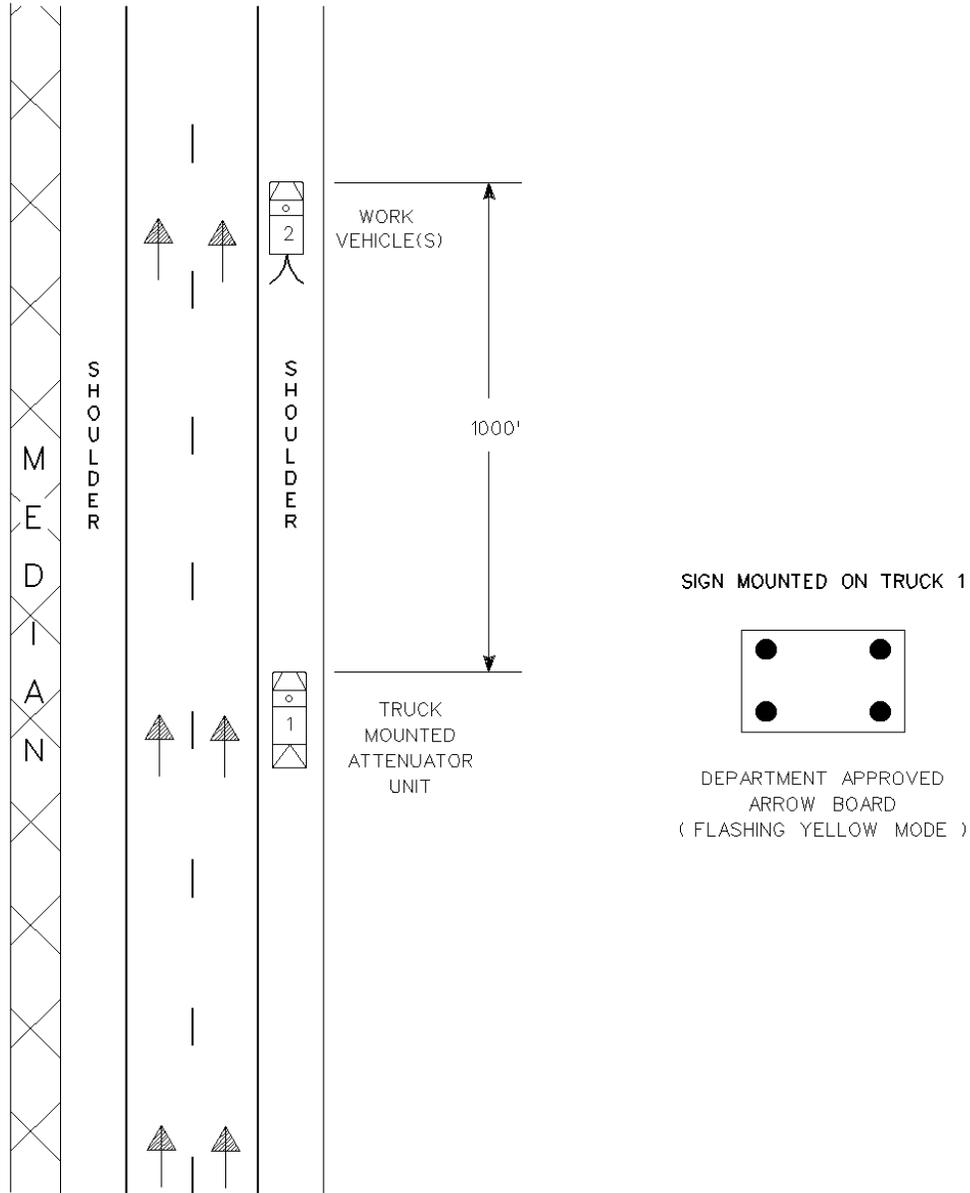
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PRINCIPAL ENGINEER  
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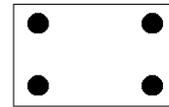
CONNECTICUT DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED *Charles S. Harlow*  
PRINCIPAL ENGINEER  
2012.08.05 15:57:16-04'00"

### MOVING OPERATION ON RIGHT SHOULDER MULTILANE HIGHWAY & SECONDARY ROADWAYS



SIGN MOUNTED ON TRUCK 1



DEPARTMENT APPROVED  
ARROW BOARD  
( FLASHING YELLOW MODE )

REV'D 1-02



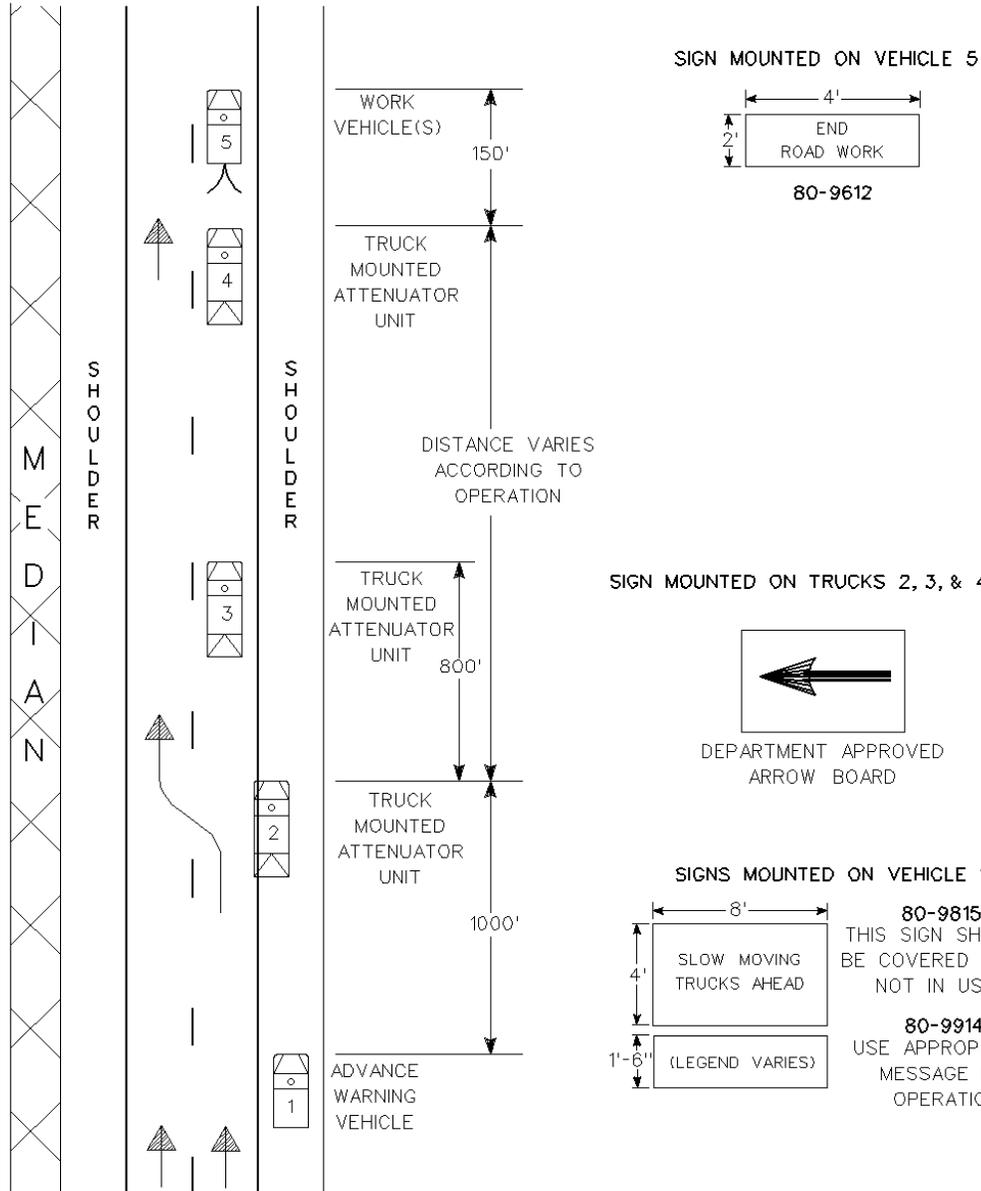
CONNECTICUT  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING &  
HIGHWAY OPERATIONS  
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION  
TRAFFIC CONTROL PLAN  
PLAN 19

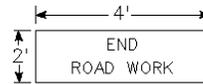
SCALE NONE

APPROVED J. McCall DATE 1-30-02  
PRINCIPAL ENGINEER

MOVING OPERATION IN RIGHT LANE  
AND OUTSIDE SHOULDER AT THE SAME TIME  
MULTILANE HIGHWAY

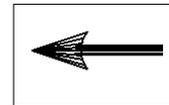


SIGN MOUNTED ON VEHICLE 5



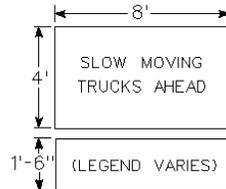
80-9612

SIGN MOUNTED ON TRUCKS 2, 3, & 4



DEPARTMENT APPROVED  
ARROW BOARD

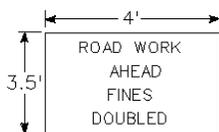
SIGNS MOUNTED ON VEHICLE 1



**80-9815**  
THIS SIGN SHOULD  
BE COVERED WHEN  
NOT IN USE.

**80-9914**  
USE APPROPRIATE  
MESSAGE FOR  
OPERATION.

SIGN MOUNTED ON VEHICLE 2



31-1906

REV'D 1-02

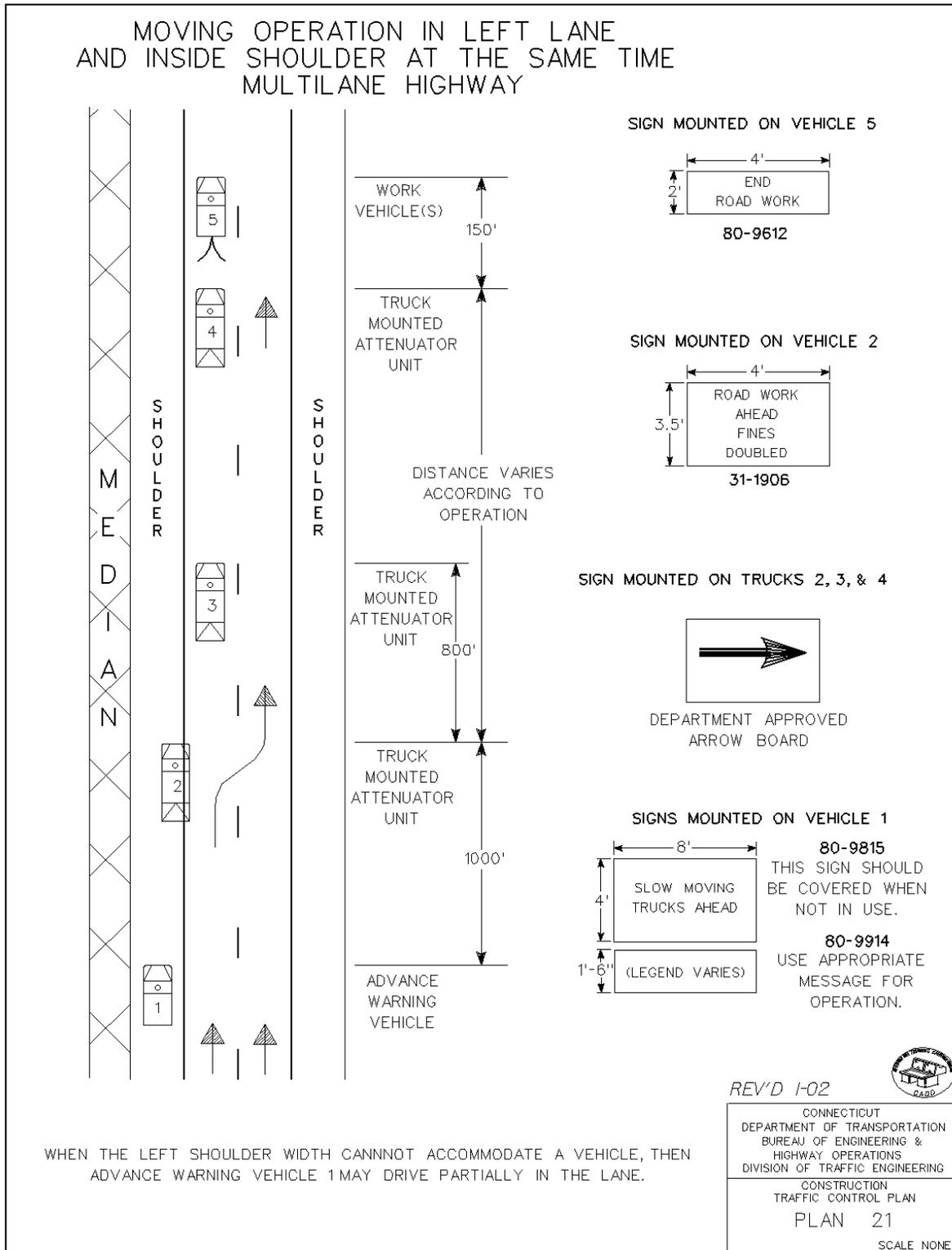


CONNECTICUT  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF ENGINEERING &  
HIGHWAY OPERATIONS  
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION  
TRAFFIC CONTROL PLAN  
PLAN 20

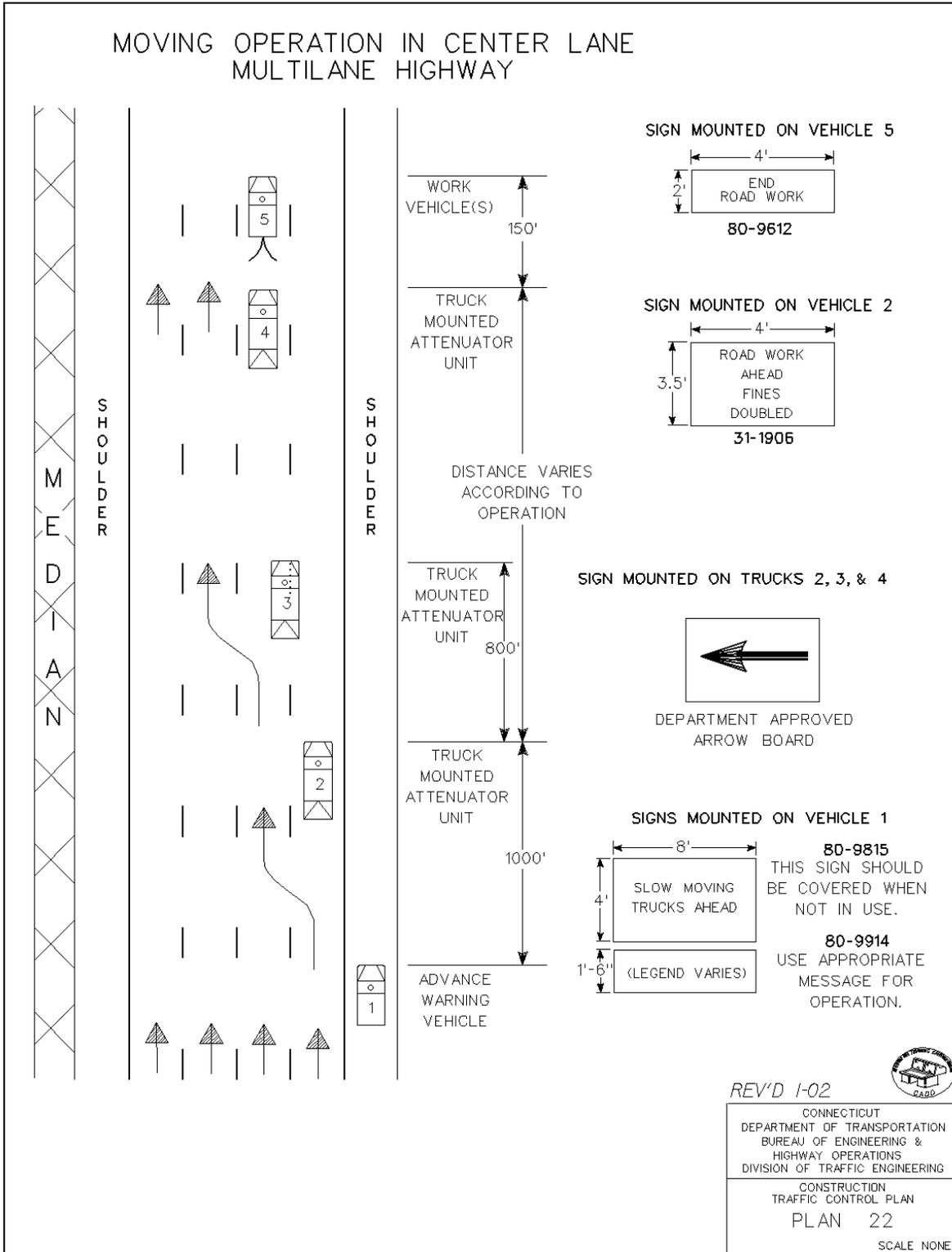
SCALE NONE

APPROVED John D. McCall DATE 1-30-02  
PRINCIPAL ENGINEER



APPROVED John D. McCall DATE 1-30-02  
 PRINCIPAL ENGINEER

### MOVING OPERATION IN CENTER LANE MULTILANE HIGHWAY



REV'D 1-02

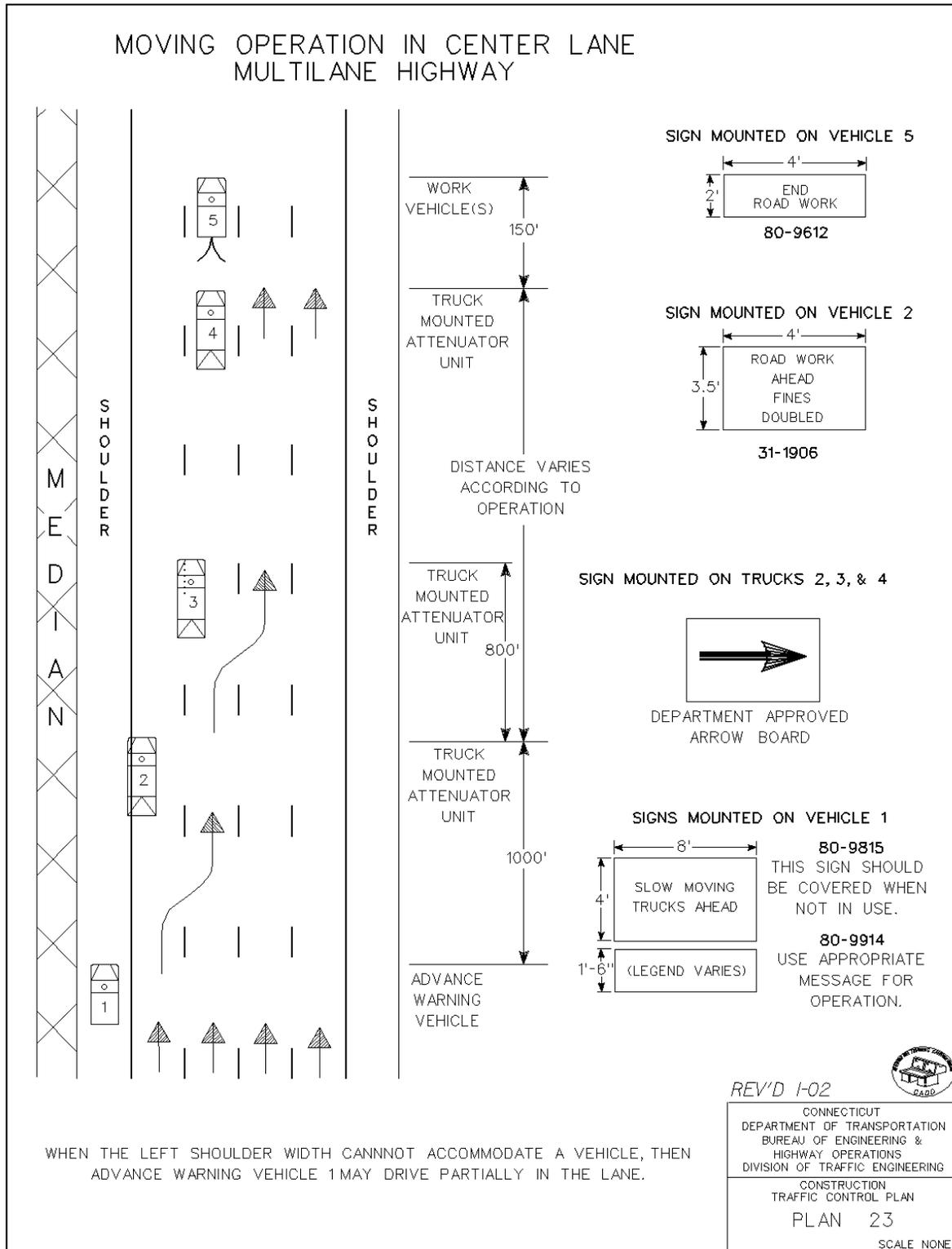
CONNECTICUT  
 DEPARTMENT OF TRANSPORTATION  
 BUREAU OF ENGINEERING &  
 HIGHWAY OPERATIONS  
 DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION  
 TRAFFIC CONTROL PLAN  
 PLAN 22

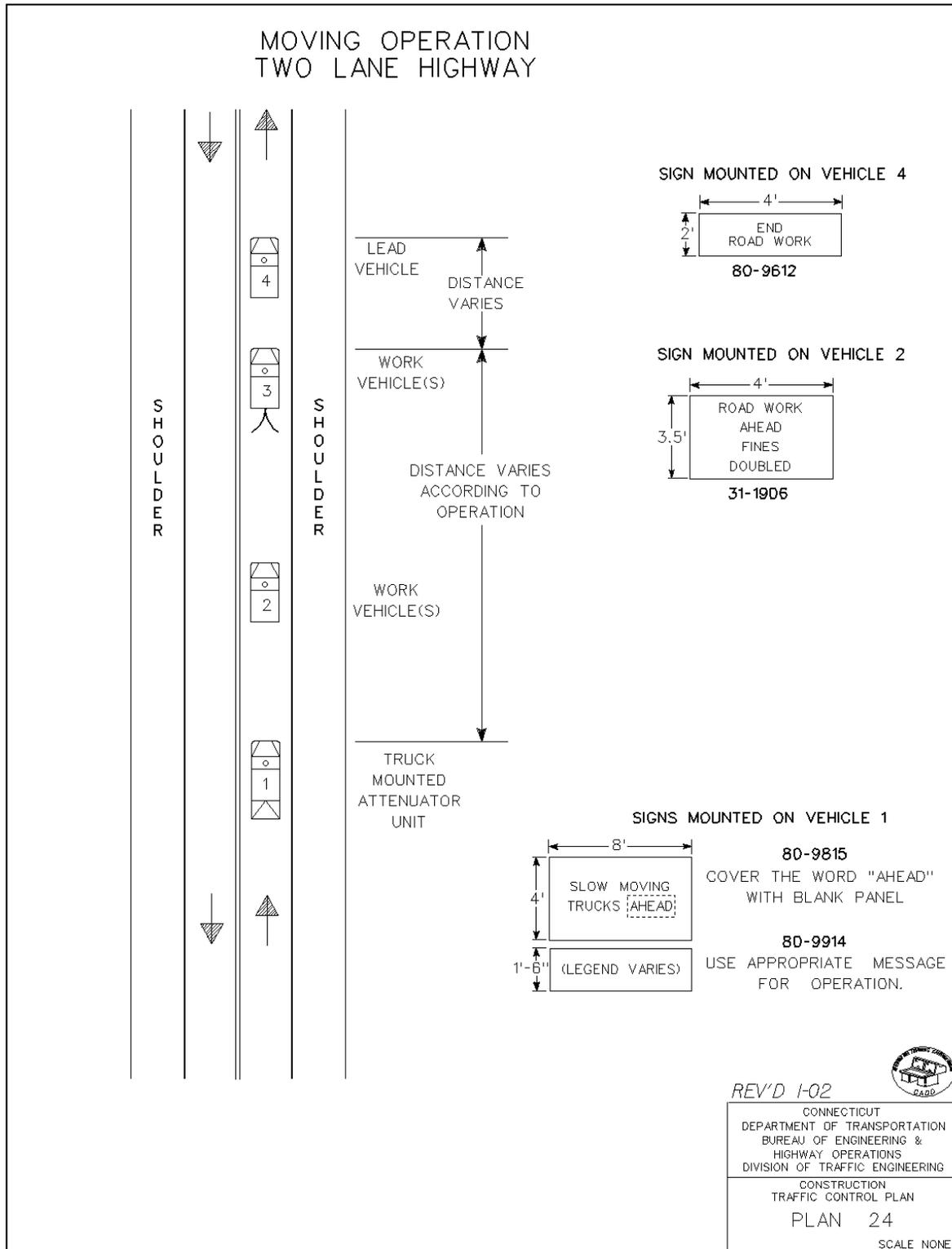
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APPROVED John D. McCall DATE 1-30-02  
 PRINCIPAL ENGINEER

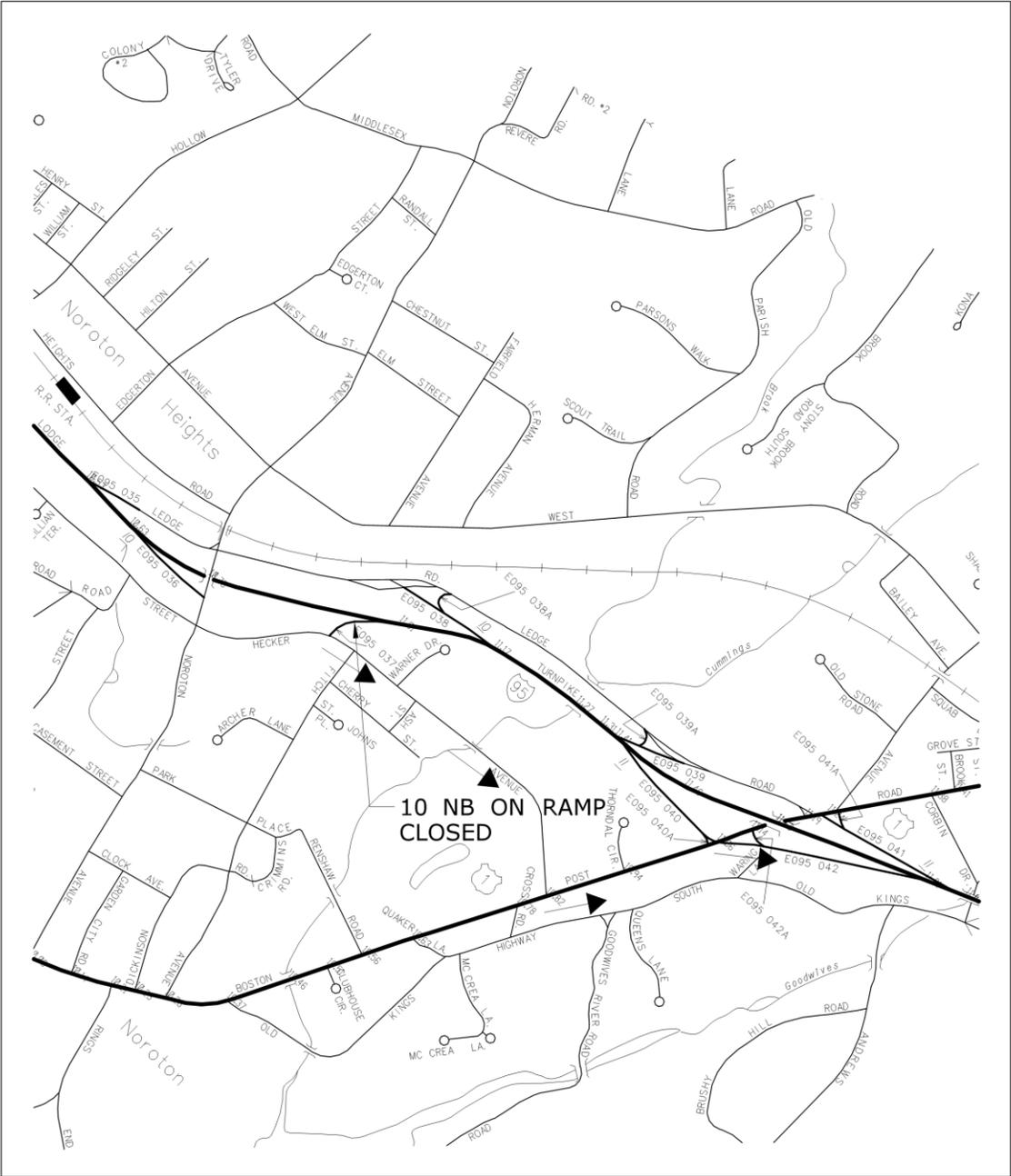
### MOVING OPERATION IN CENTER LANE MULTILANE HIGHWAY



APPROVED John D. Micall DATE 1-30-02  
PRINCIPAL ENGINEER



APPROVED John D. McCall DATE 1-30-02  
PRINCIPAL ENGINEER



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



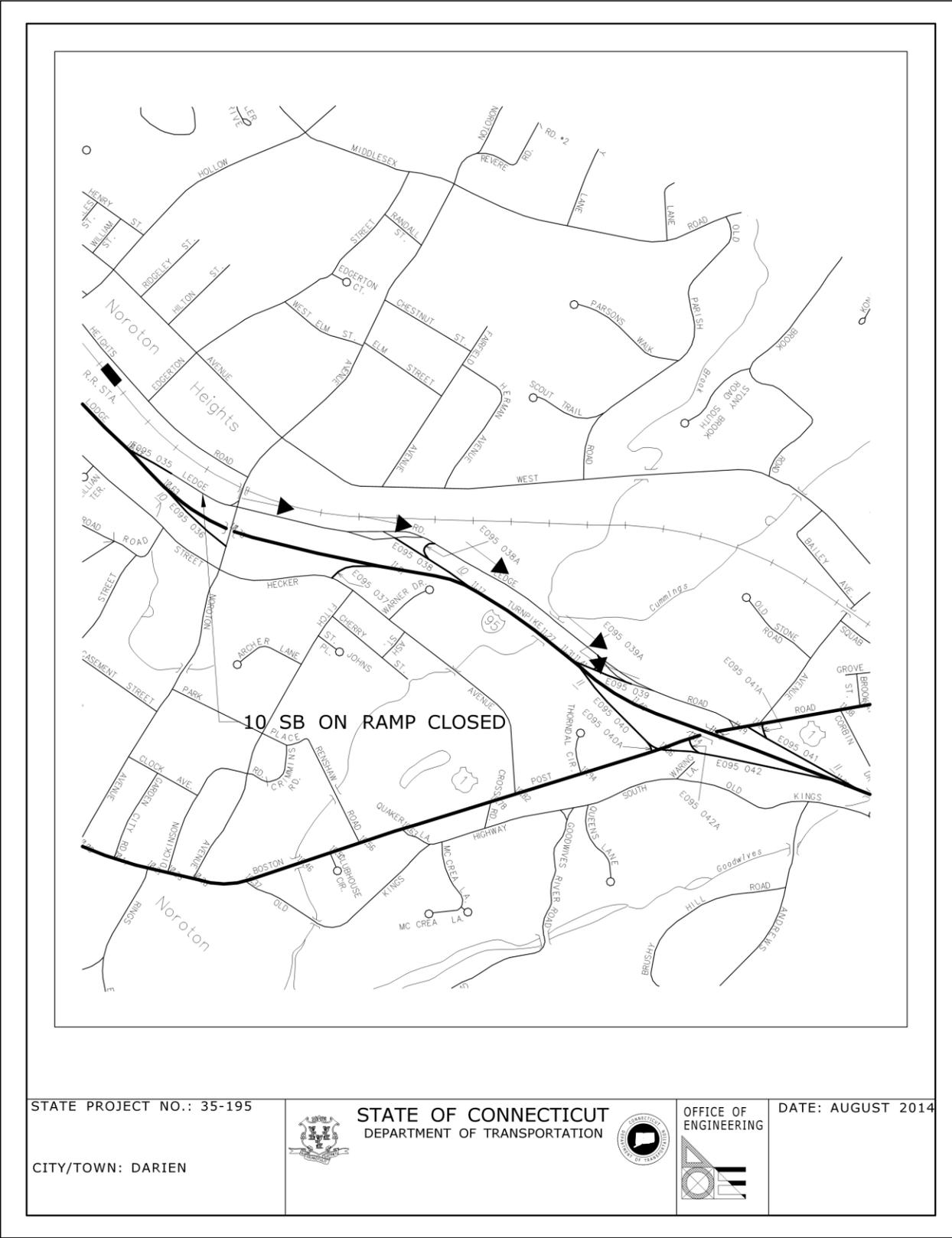
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



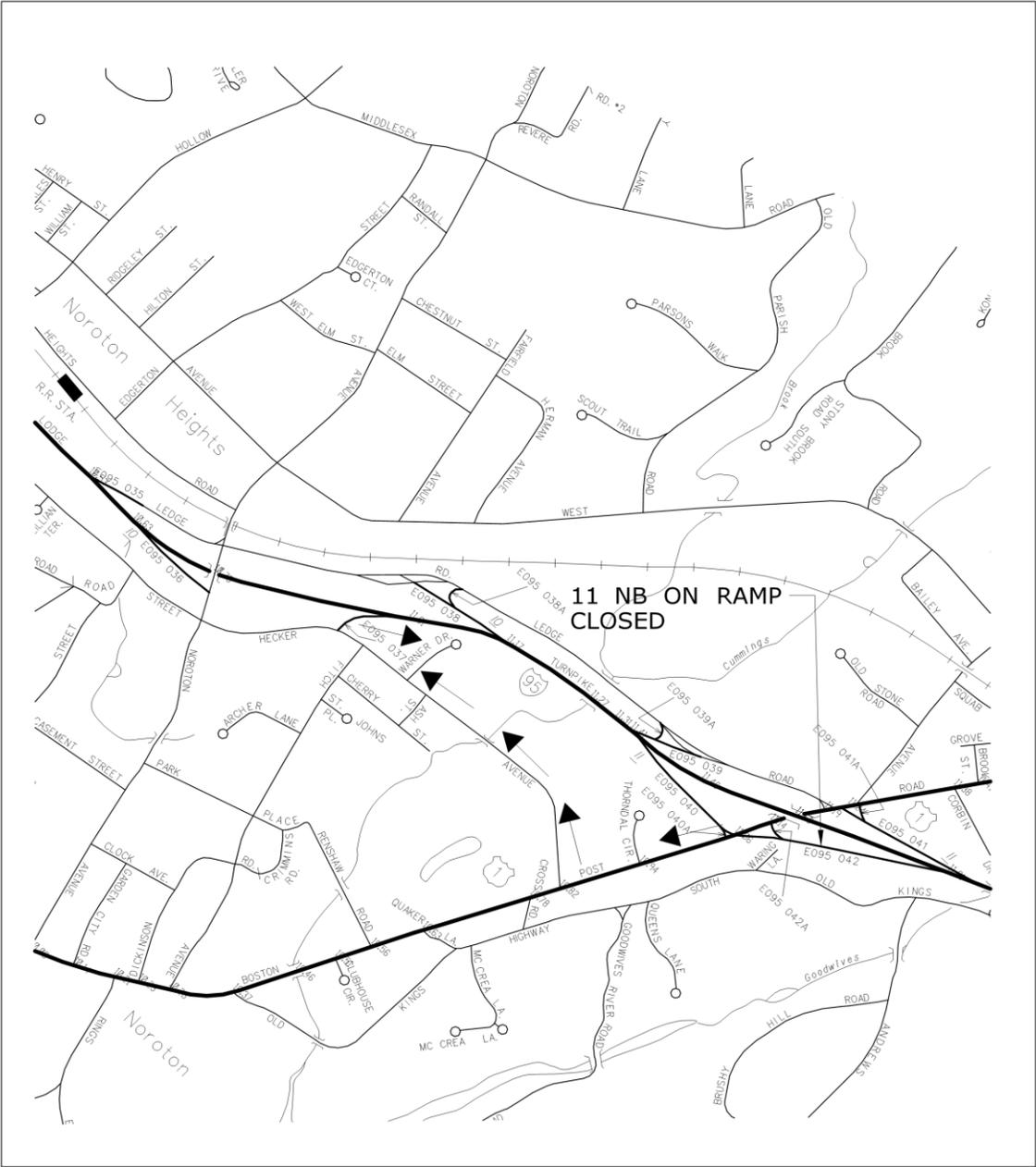
**STATE OF CONNECTICUT**  
 DEPARTMENT OF TRANSPORTATION



OFFICE OF  
 ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



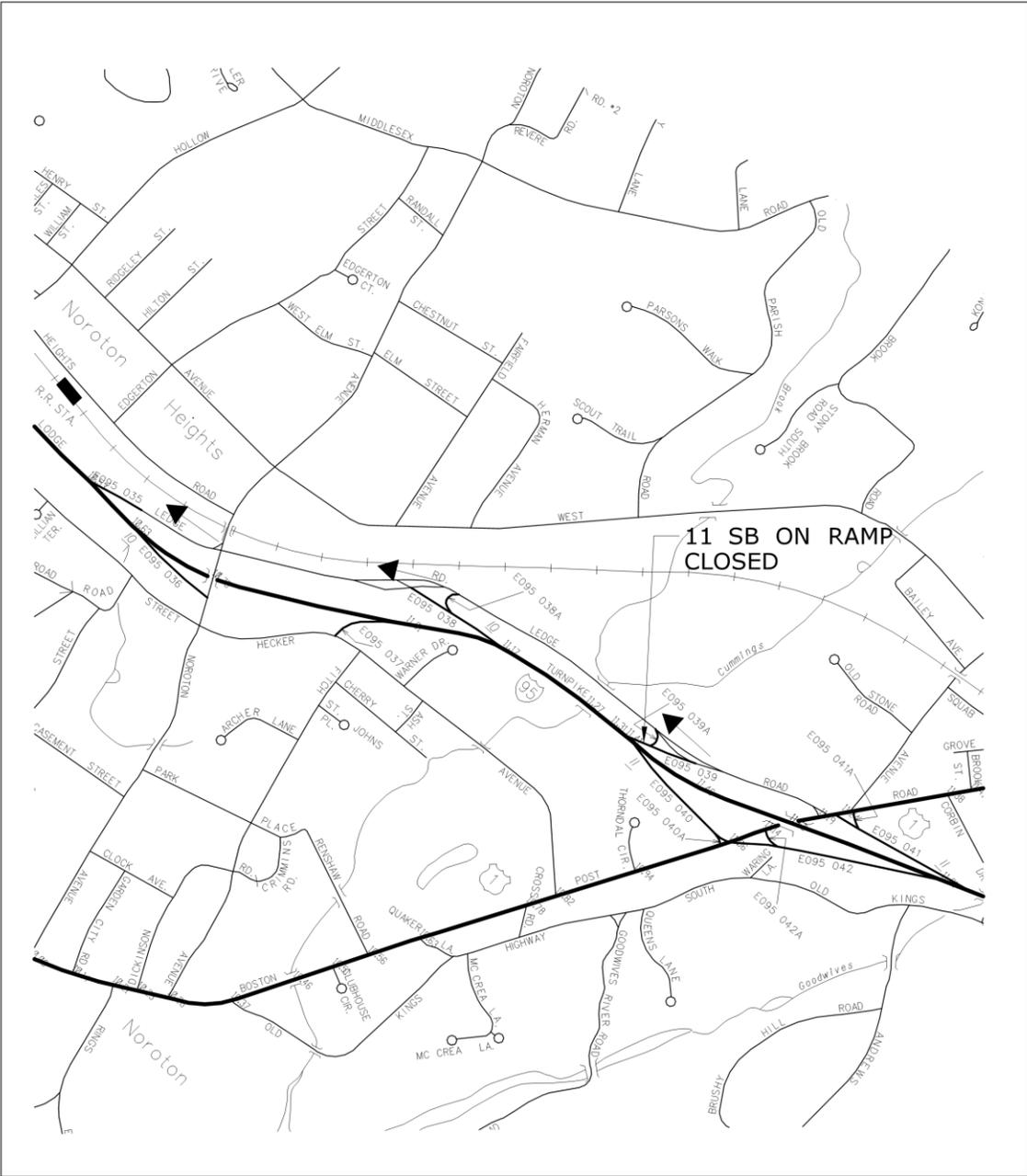
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



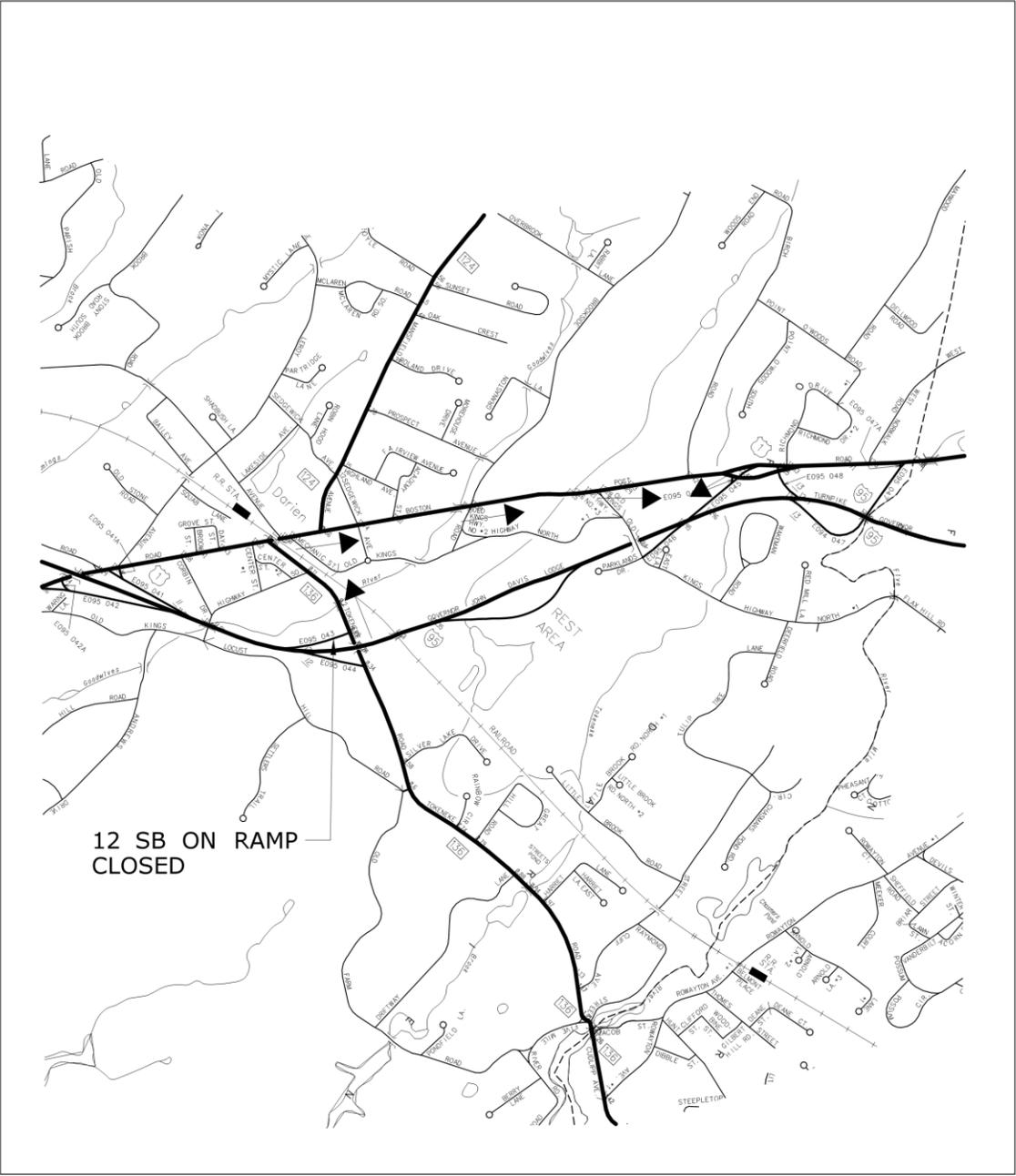
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



OFFICE OF  
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DATE: AUGUST 2014



12 SB ON RAMP  
CLOSED

STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



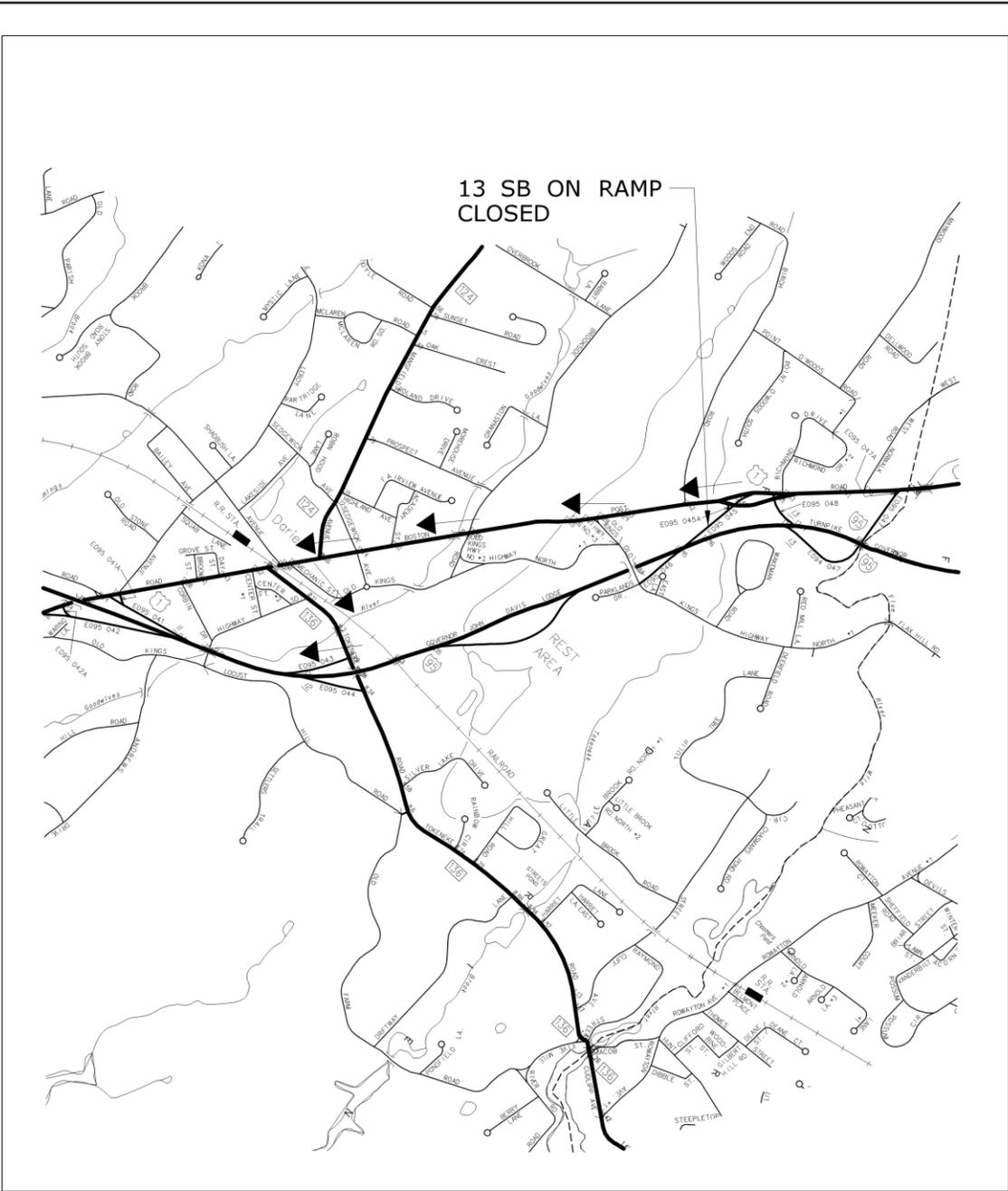
STATE OF CONNECTICUT  
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OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



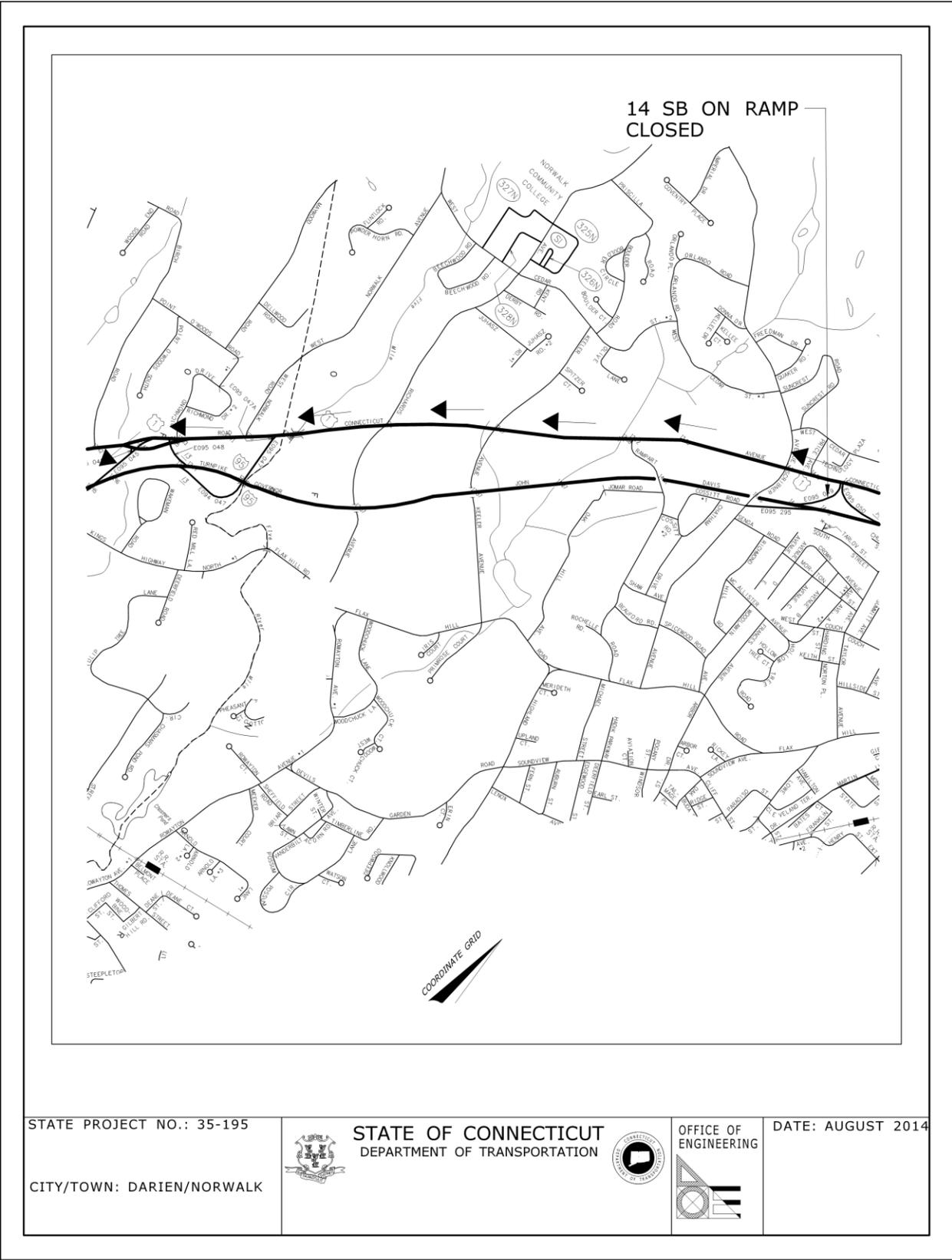
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN/NORWALK



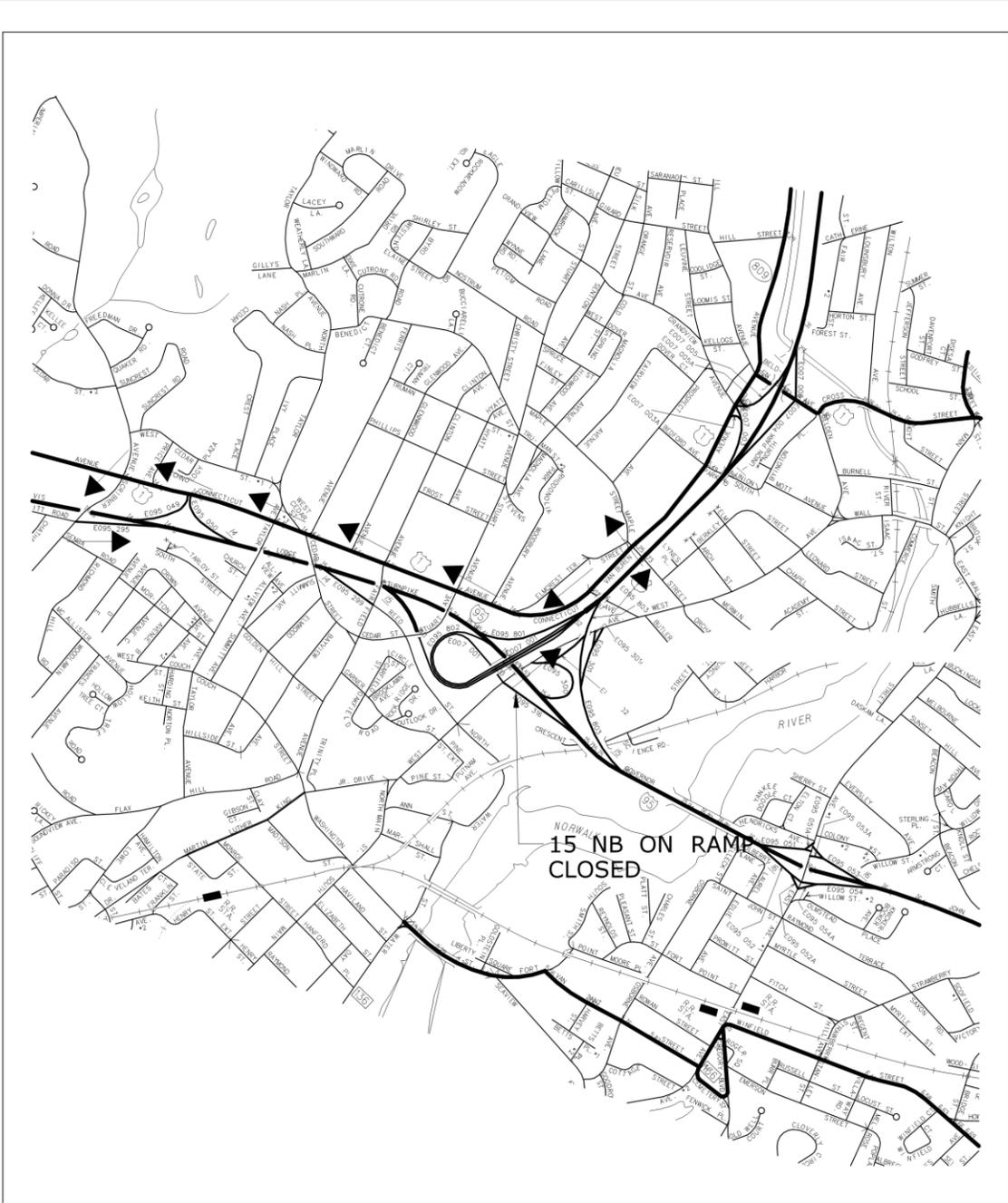
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DEPARTMENT OF TRANSPORTATION



OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: NORWALK



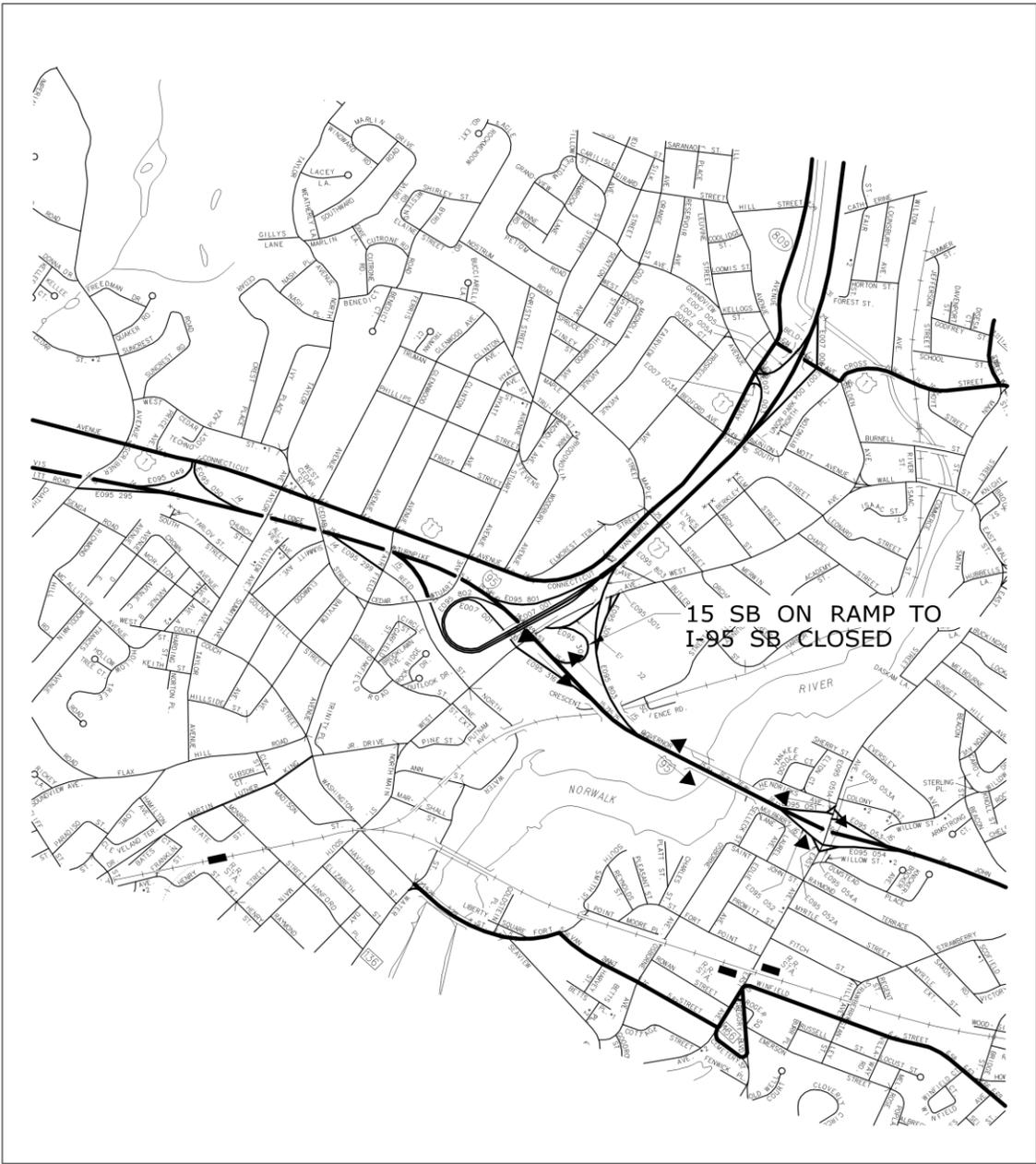
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: NORWALK



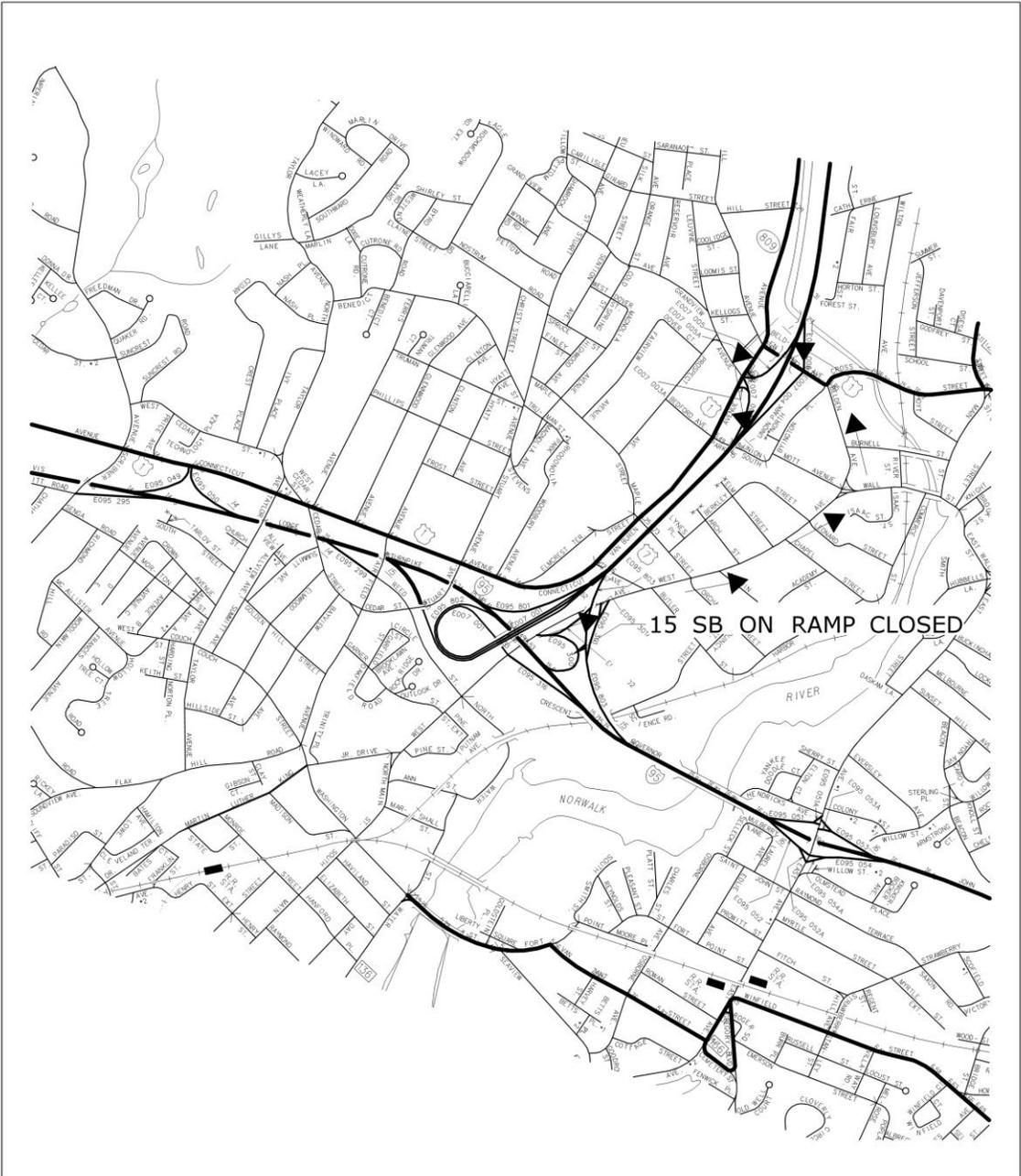
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: NORWALK



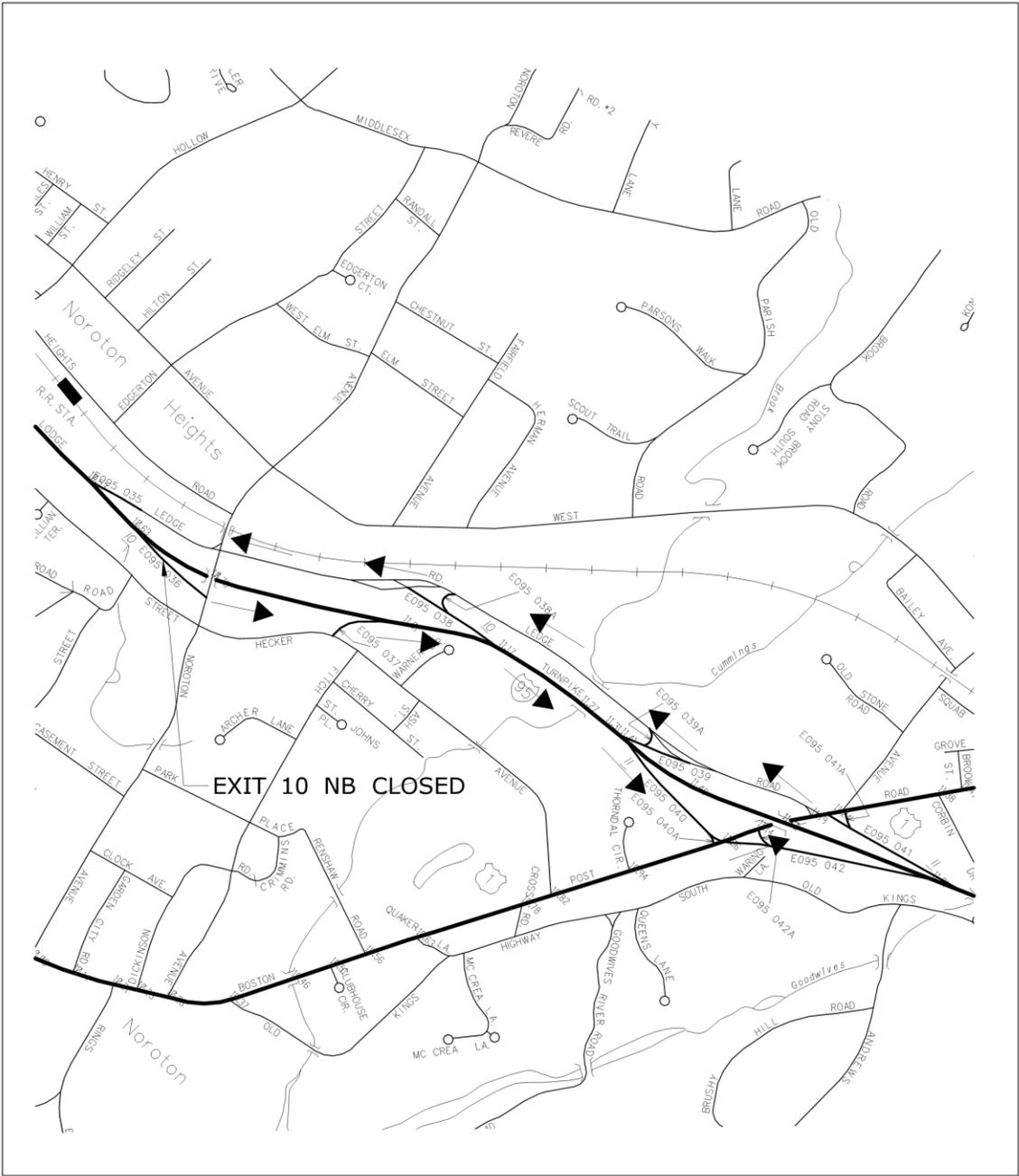
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



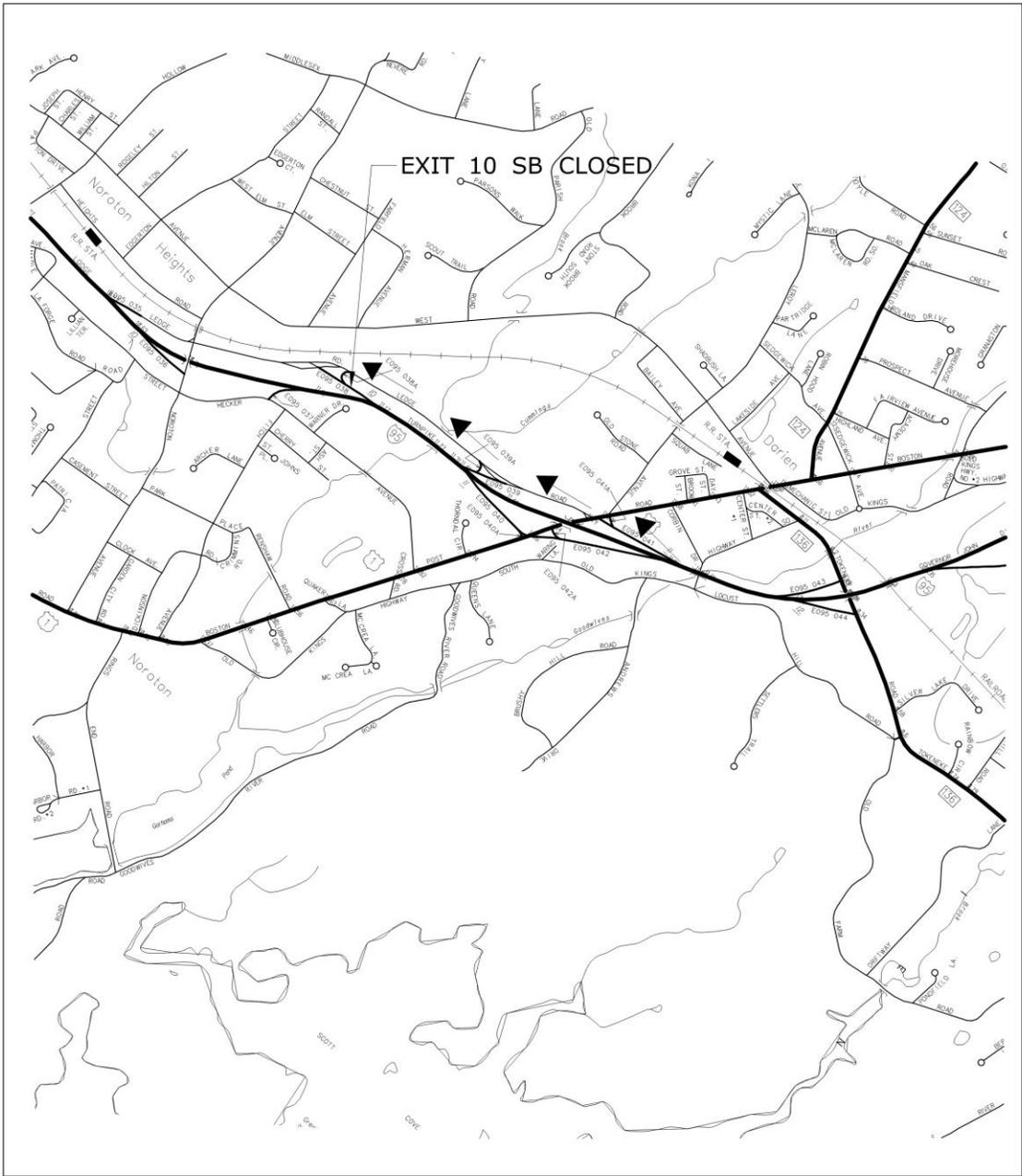
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



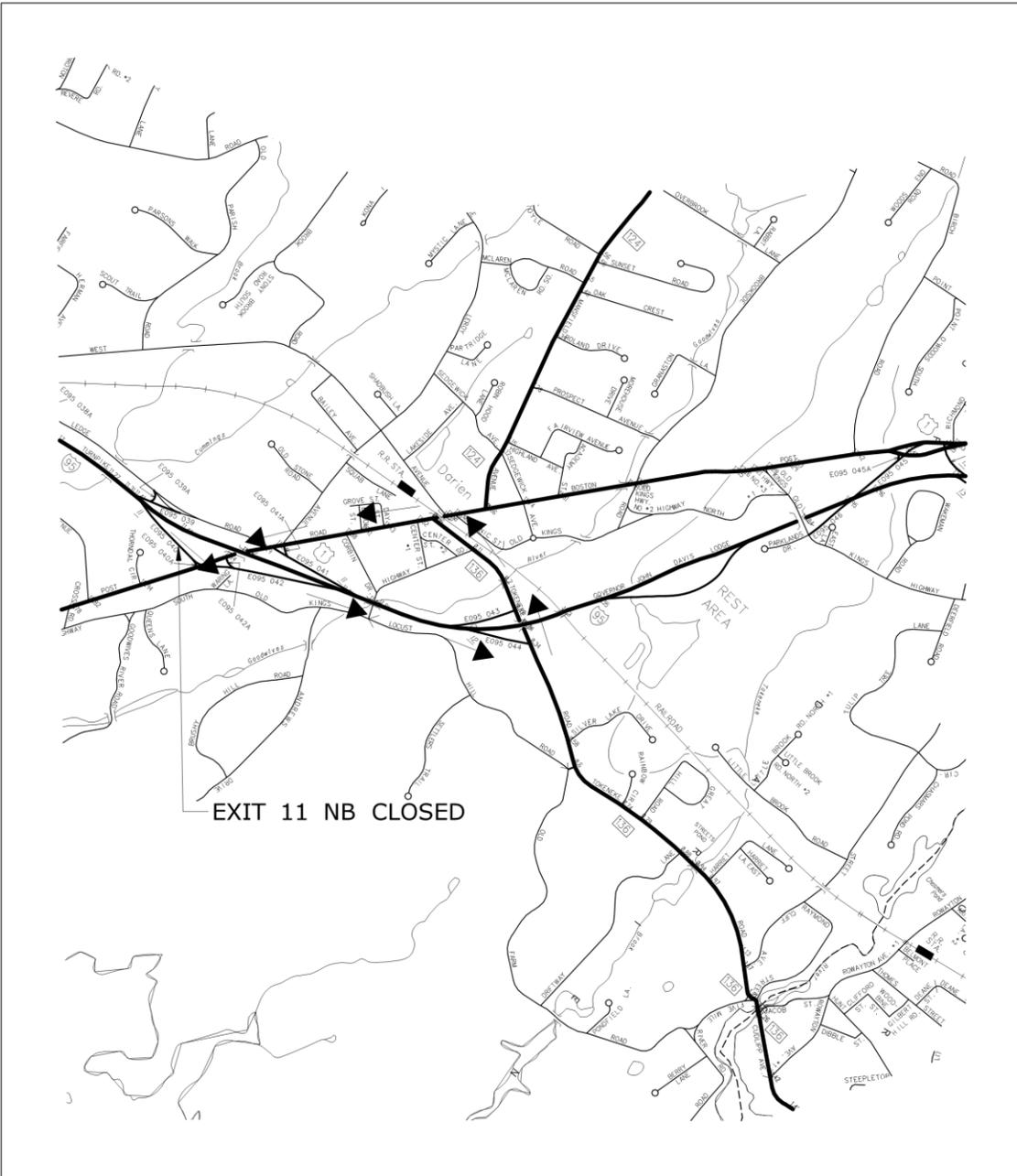
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



OFFICE OF  
ENGINEERING



DATE: AUGUST 2014



EXIT 11 NB CLOSED

STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



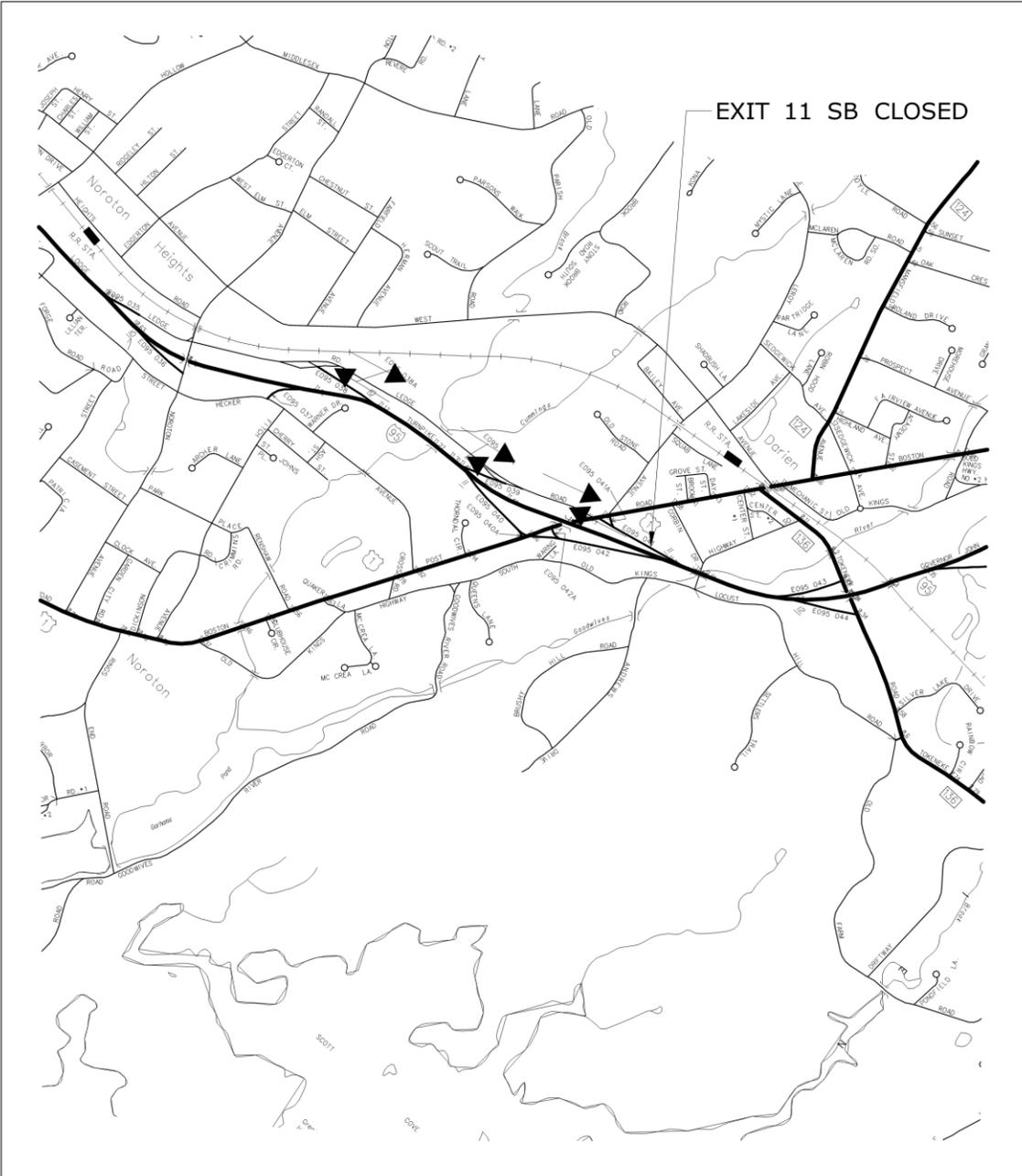
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DEPARTMENT OF TRANSPORTATION



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DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



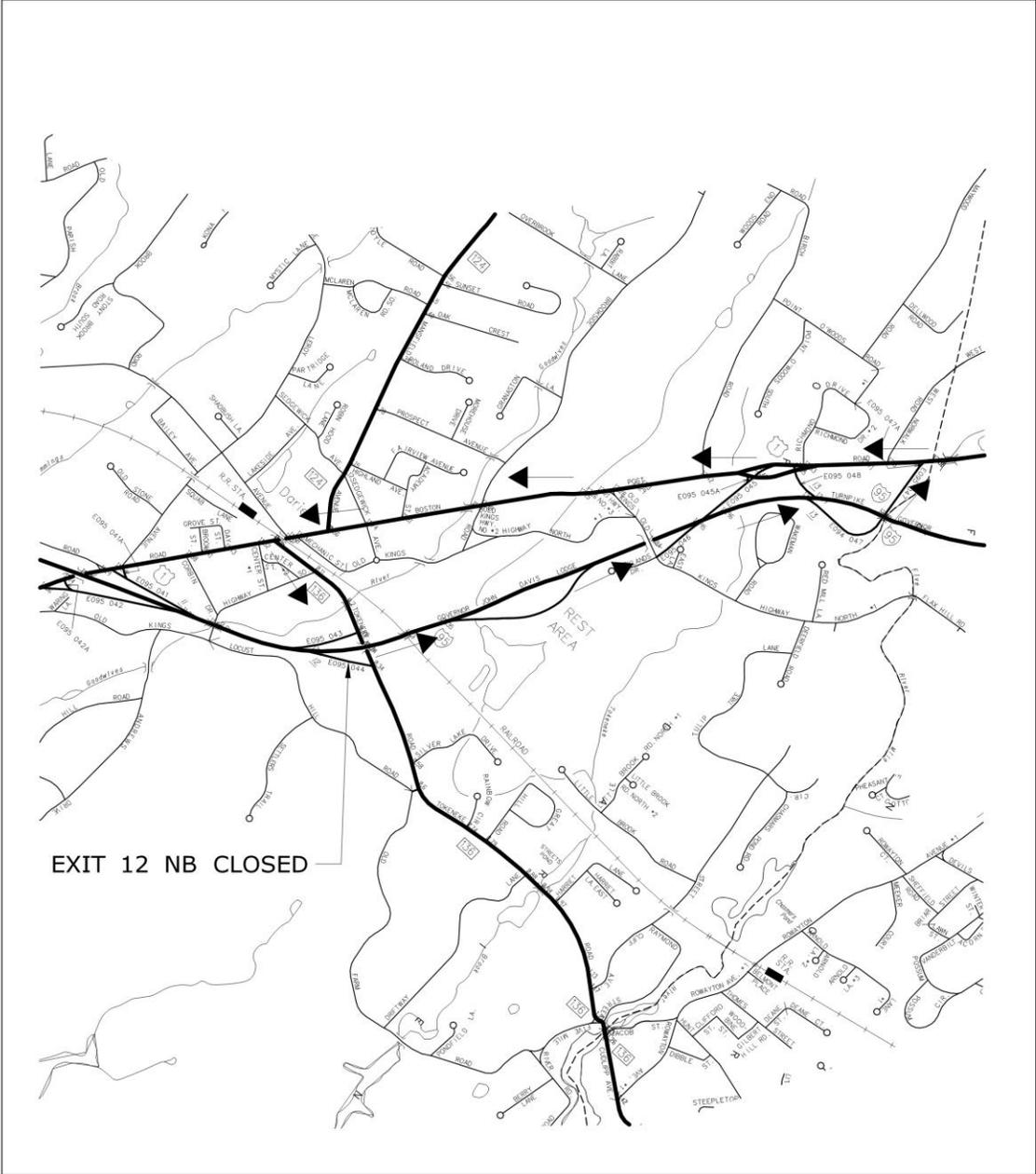
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ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



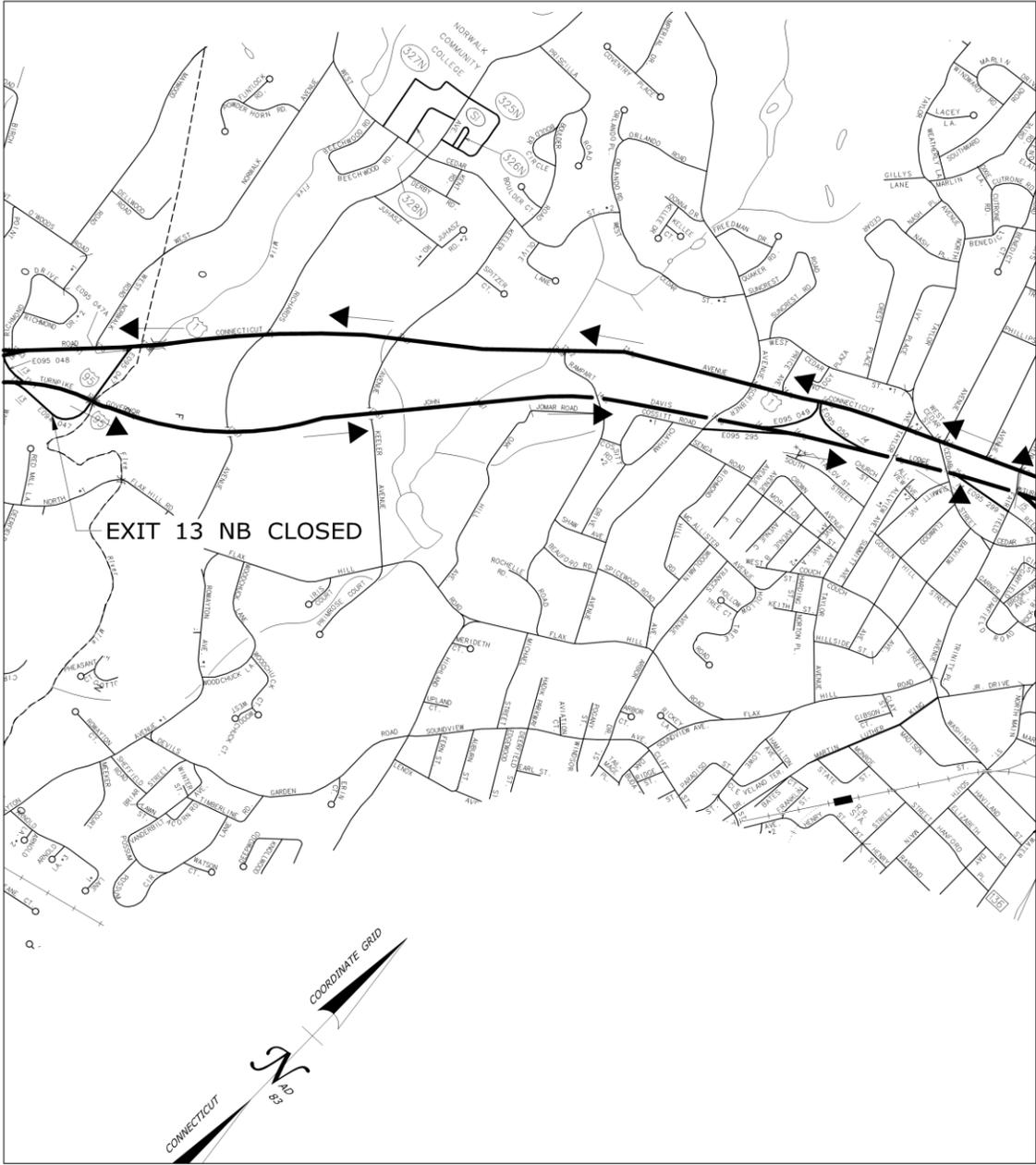
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



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DATE: AUGUST 2014



EXIT 13 NB CLOSED

STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN/NORWALK



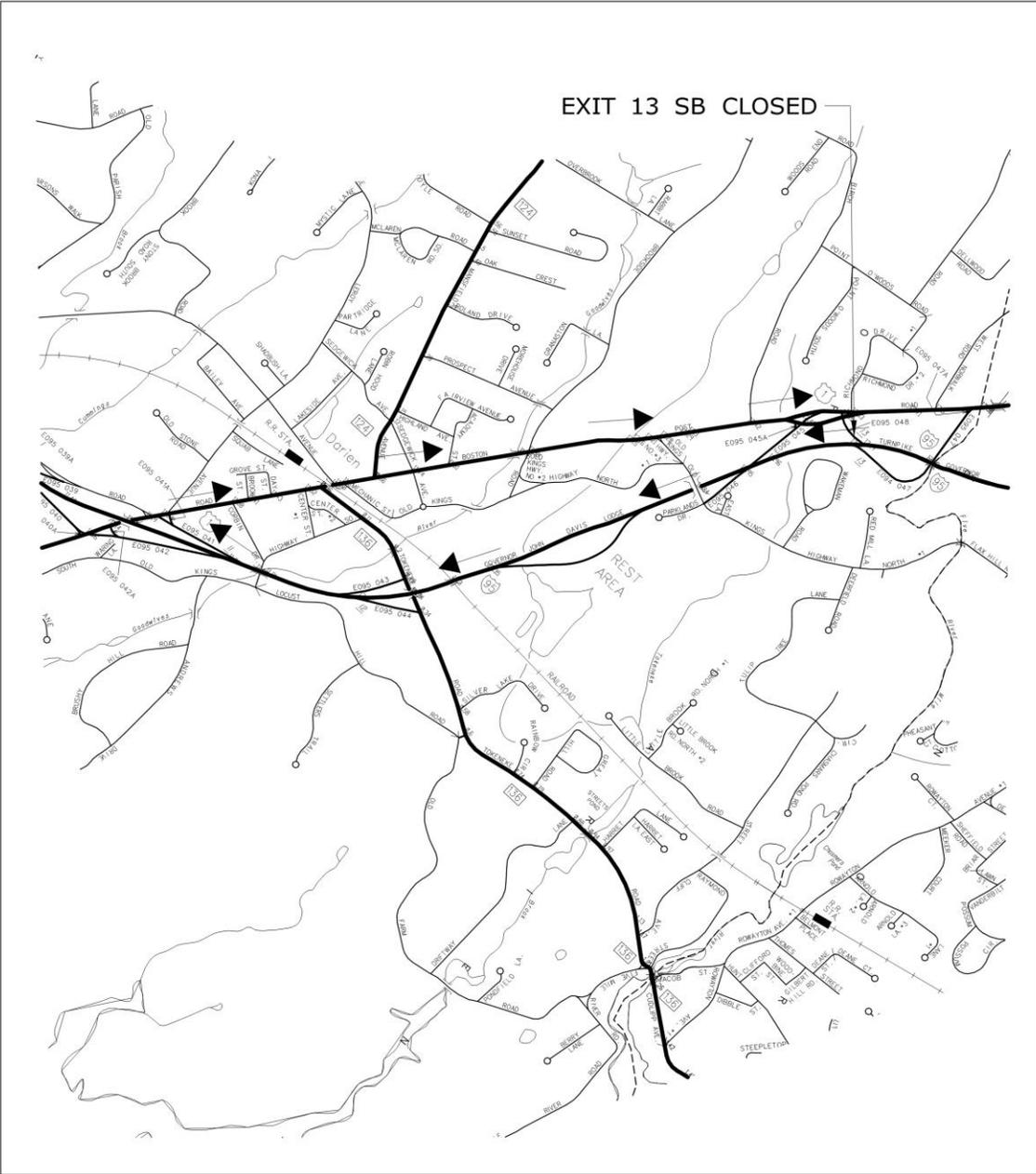
STATE OF CONNECTICUT  
DEPARTMENT OF TRANSPORTATION



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ENGINEERING



DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: DARIEN



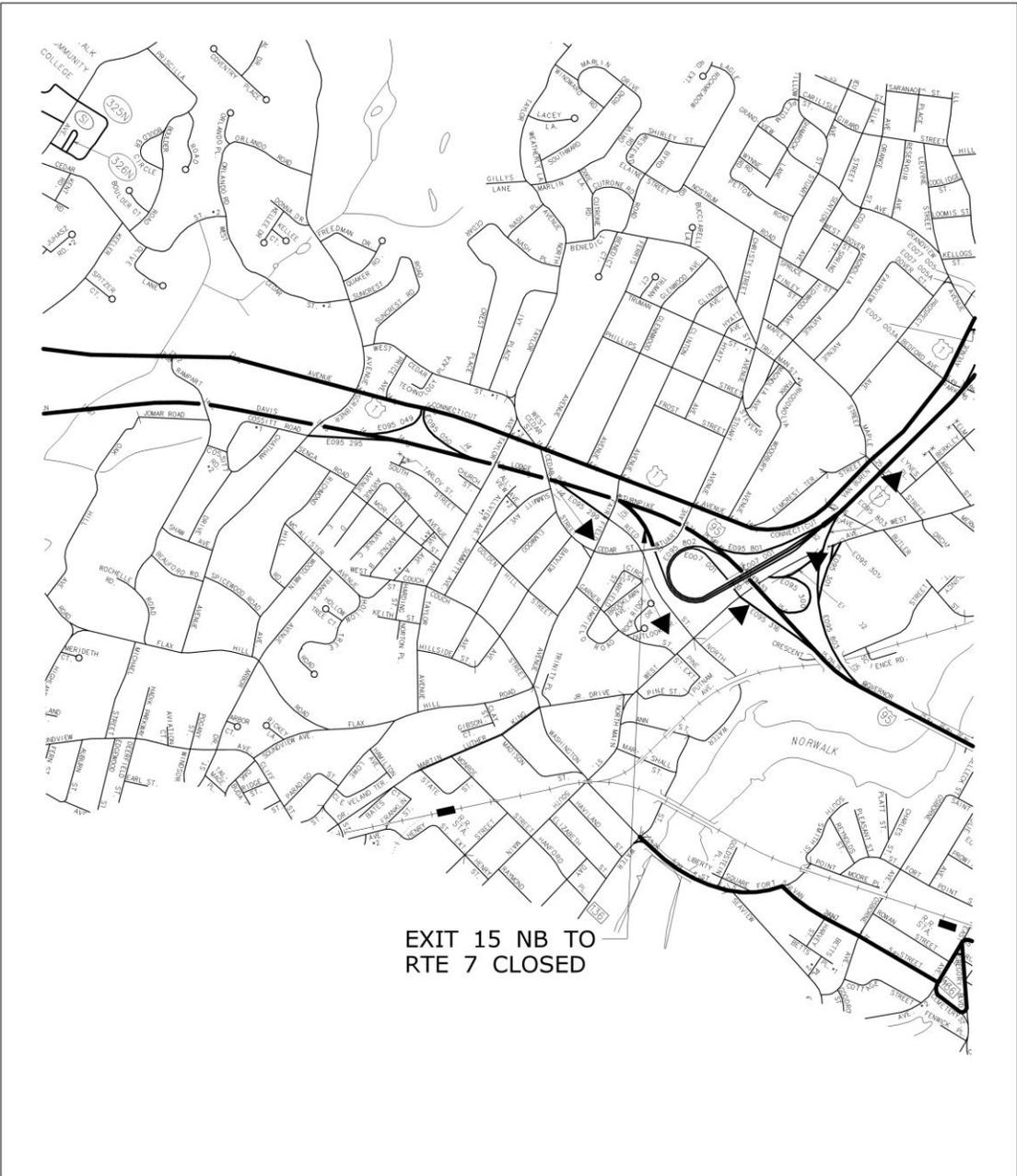
**STATE OF CONNECTICUT**  
 DEPARTMENT OF TRANSPORTATION



OFFICE OF ENGINEERING



DATE: AUGUST 2014



EXIT 15 NB TO  
RTE 7 CLOSED

STATE PROJECT NO.: 35-195



STATE OF CONNECTICUT  
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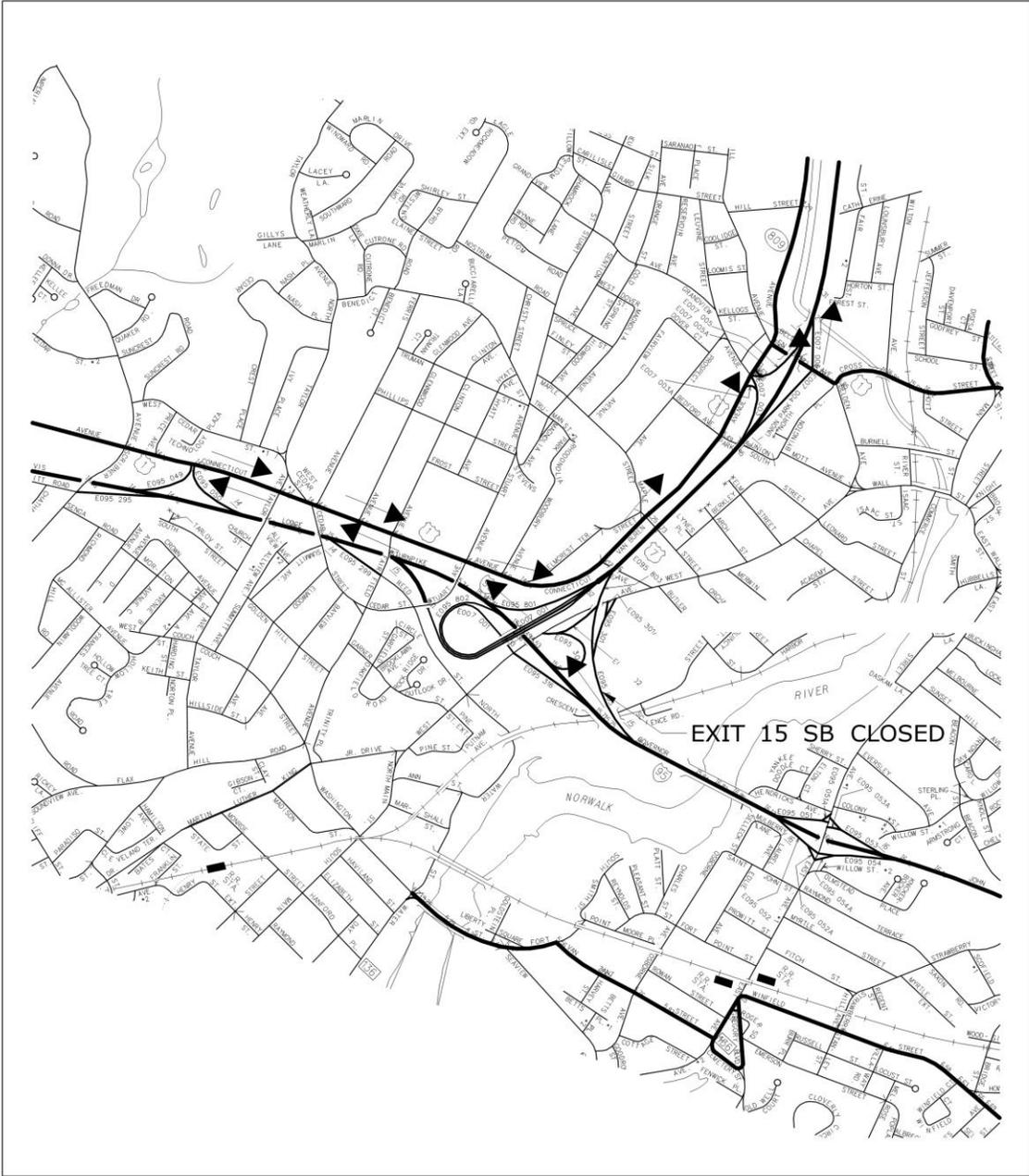


OFFICE OF  
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DATE: AUGUST 2014

CITY/TOWN: NORWALK





STATE PROJECT NO.: 35-195

CITY/TOWN: NORWALK



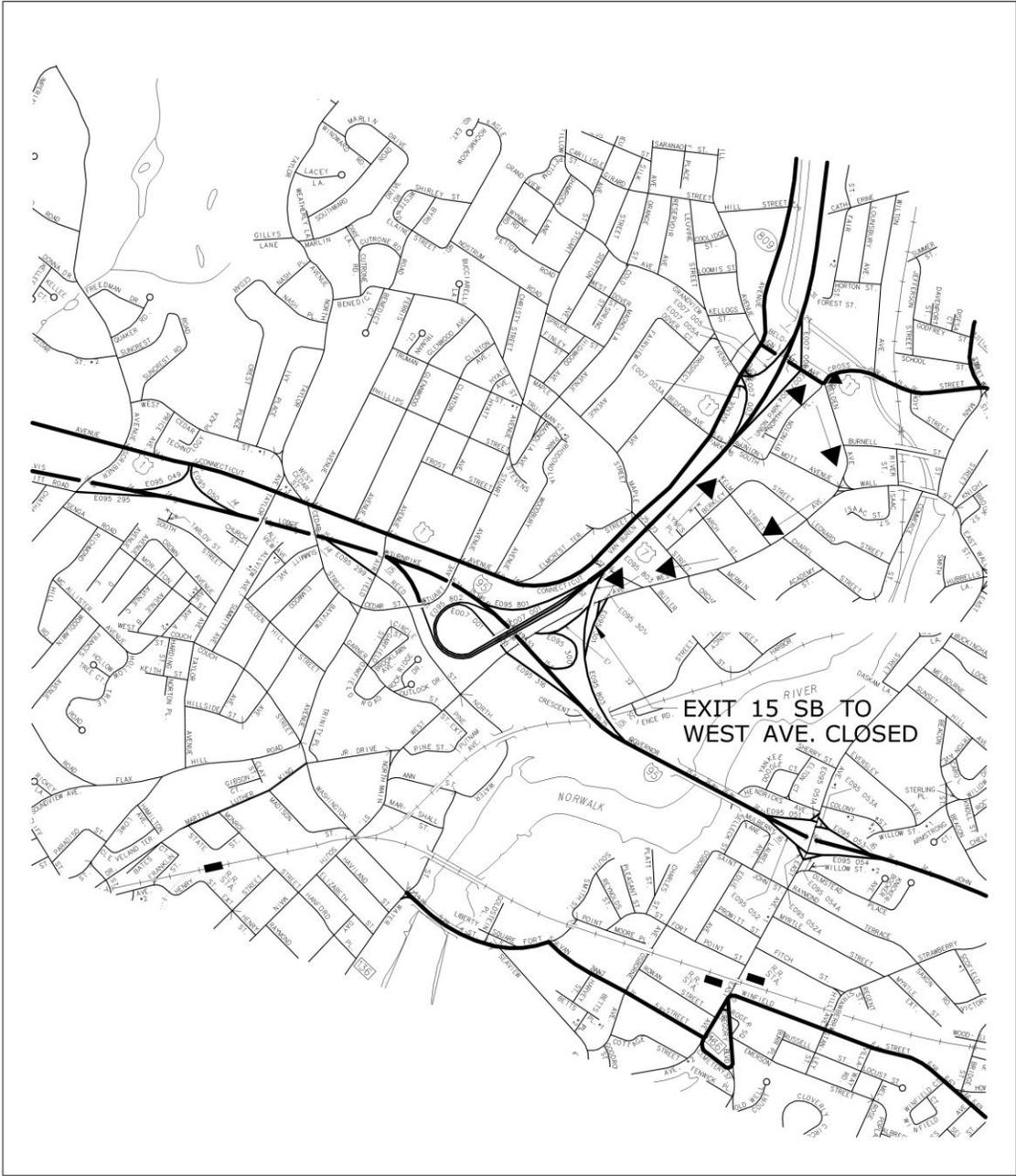
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DEPARTMENT OF TRANSPORTATION



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DATE: AUGUST 2014



STATE PROJECT NO.: 35-195

CITY/TOWN: NORWALK



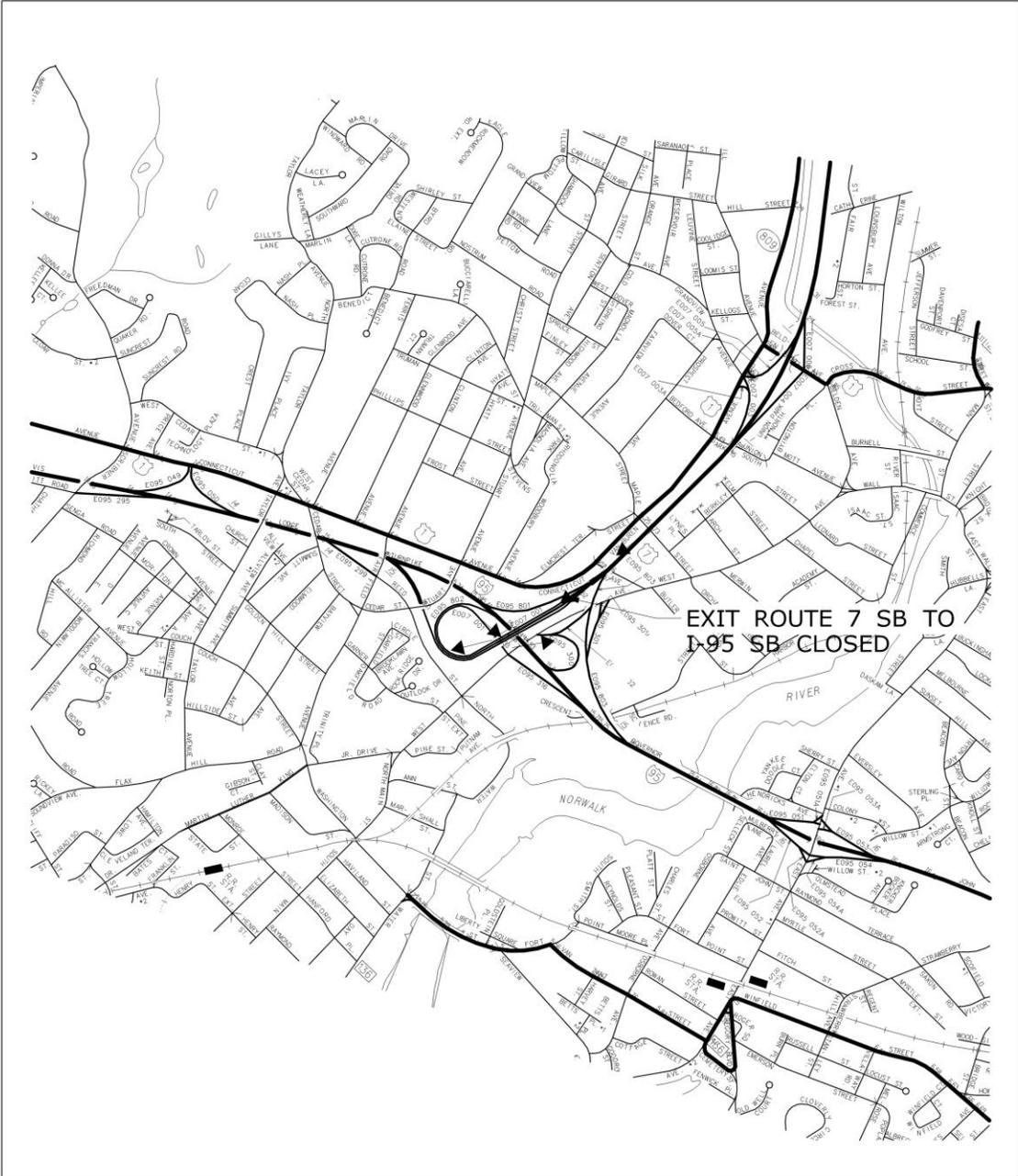
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STATE PROJECT NO.: 35-195

CITY/TOWN: NORWALK



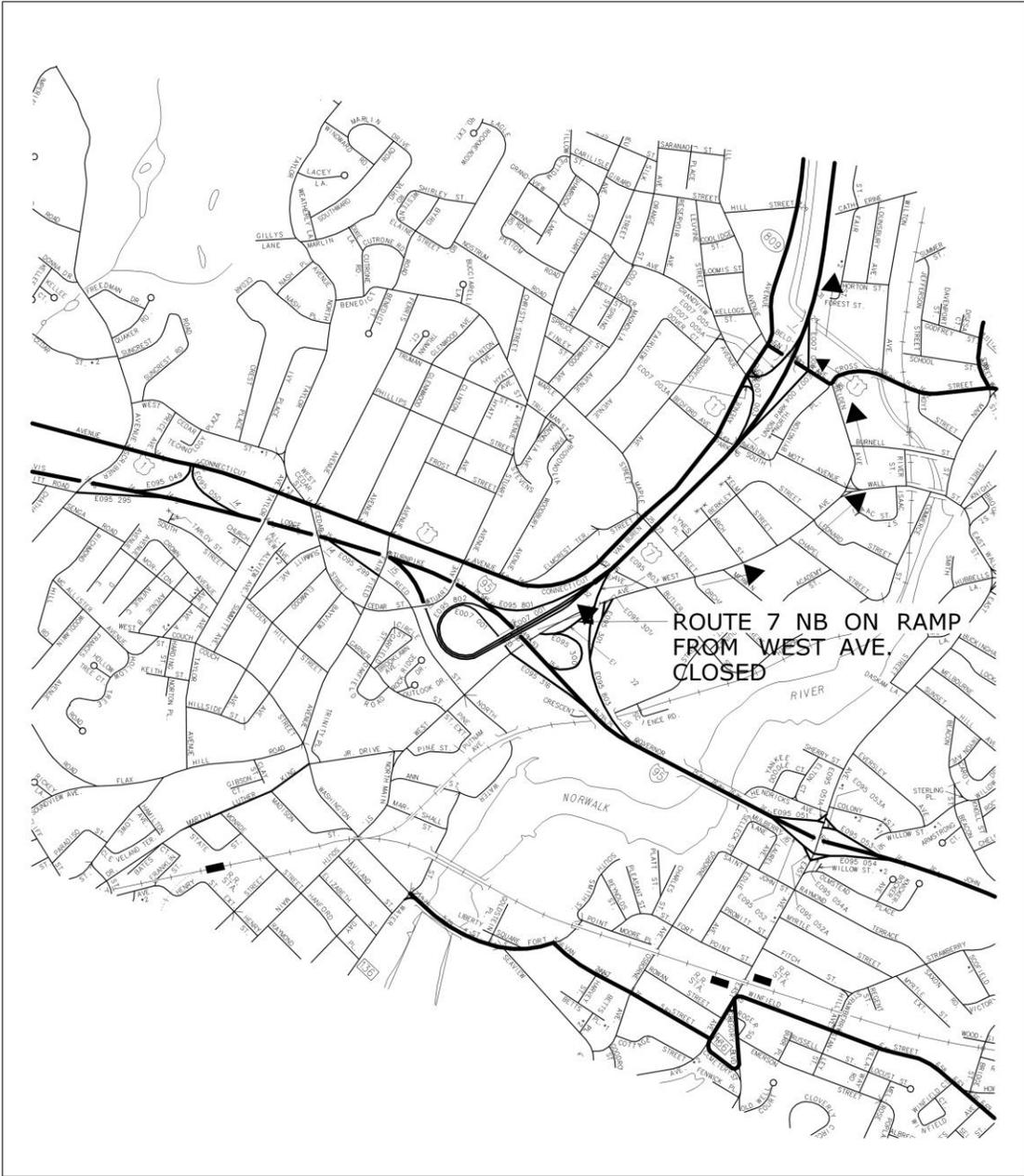
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STATE PROJECT NO.: 35-195

CITY/TOWN: NORWALK



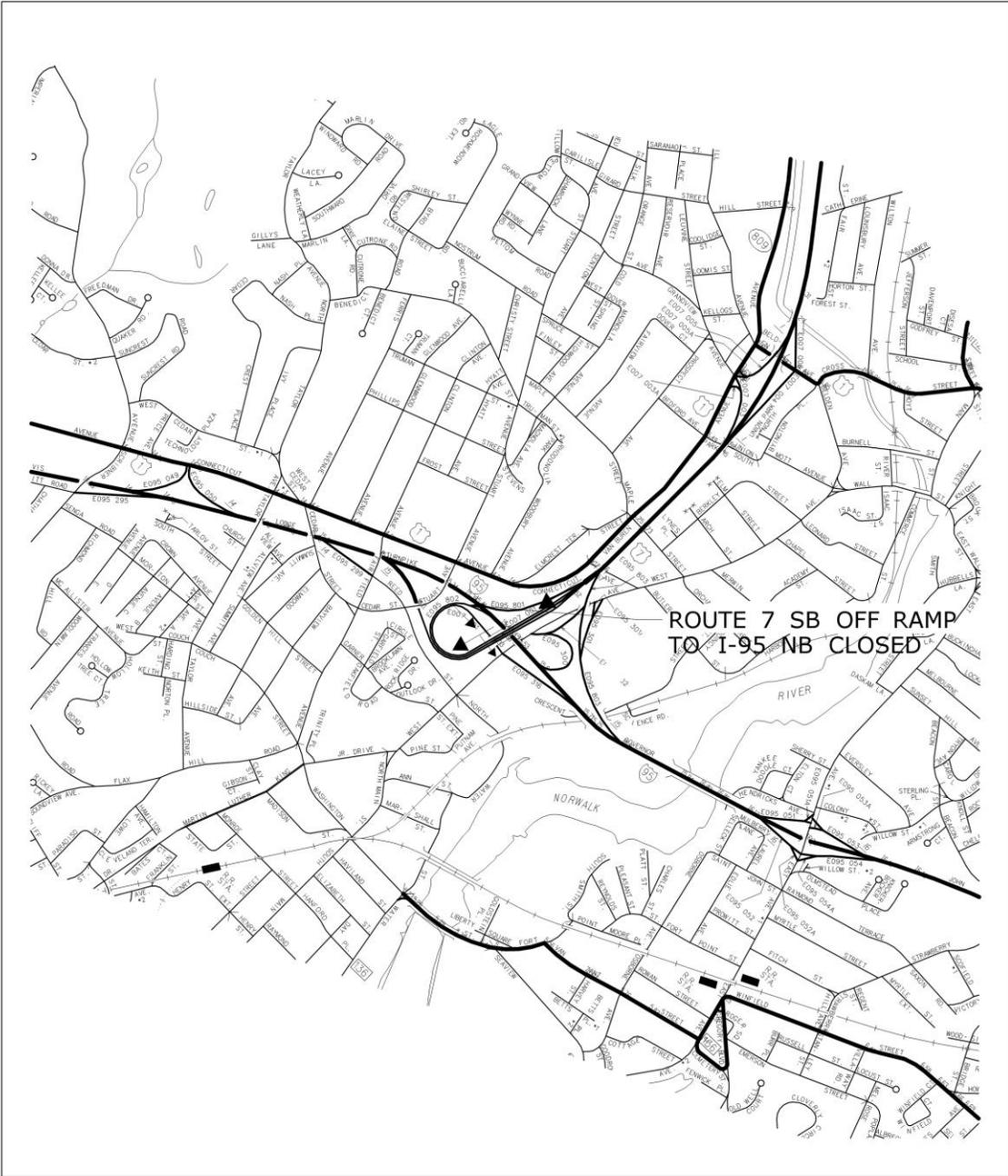
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DATE: AUGUST 2014



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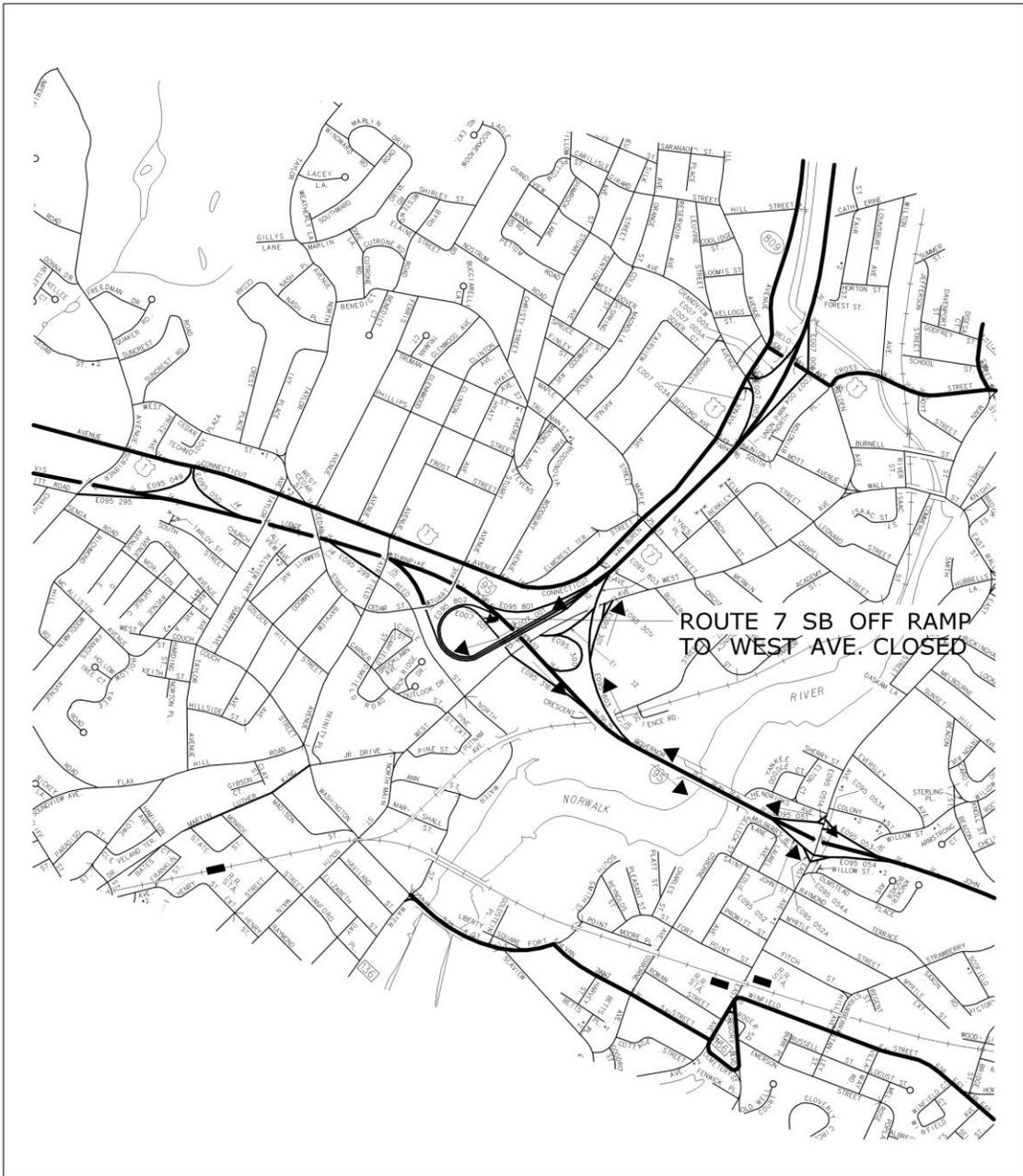
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OFFICE OF  
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**Article 9.71.05 – Basis of Payment is supplemented by the following:**

The temporary relocation of signs and supports, and the furnishing, installation and removal of any temporary supports shall be paid for under the item “Maintenance and Protection of Traffic”. Temporary overhead sign supports and foundations shall be paid for under the appropriate item(s).

**ITEM #0979003A – CONSTRUCTION BARRICADE TYPE III**

**Article 9.79.01 – Description:** The Contractor shall furnish construction barricades to conform to the requirements in National Cooperative Highway Research Program (NCHRP) Report 350 or the AASHTO Manual for Assessing Safety Hardware (MASH) and to the requirements stated in Article 9.71 “Maintenance and Protection of Traffic,” as shown on the plans and/or as directed by the Engineer.

**Article 9.79.02 – Materials:** Prior to using the construction barricades, the Contractor shall submit to the Engineer a copy of the Letter of Acceptance issued by the FHWA to the manufacturer documenting that the devices have been crash tested and have approval in writing from FHWA conforming to the requirements in National Cooperative Highway Research Program (NCHRP) Report 350 or the AASHTO Manual for Assessing Safety Hardware (MASH), as appropriate.

Alternate stripes of white and orange Type III or Type VI reflective sheeting shall be applied to the horizontal members as shown on the plans. Application of the reflective sheeting shall conform to the requirements specified by the reflective sheeting manufacturer. Only one type of sheeting shall be used on a barricade and all barricades furnished shall have the same type of reflective sheeting. Reflective sheeting shall conform to the requirements of Article M.18.09.01.

Construction barricades shall be designed and fabricated so as to prevent them from being blown over or displaced by the wind from passing vehicles. Construction barricades shall be approved by the Engineer before they are used.

**Article 9.79.03 – Construction Methods:** Ineffective barricades, as determined by the Engineer and in accordance with the ATSSA guidelines contained in “Quality Standards for Work Zone Traffic Control Devices”, shall be replaced by the Contractor at no cost to the State.

Barricades that are no longer required shall be removed from the project and shall remain the property of the Contractor.

**Article 9.79.04 – Method of Measurement:** Construction Barricade Type III will be measured for payment by the number of construction barricades required and used.

**Article 9.79.05 – Basis of Payment:** “Construction Barricade Type III” required and used will be paid for at the Contract unit price per each. Each barricade will be paid for once, regardless of the number of times it is used.

<b>Pay Item</b>	<b>Pay Unit</b>
Construction Barricade Type III	EA.

## **ITEM #0980001A – CONSTRUCTION STAKING**

**9.80.01—Description:** The work under this item shall consist of construction layout and reference staking necessary for the proper control and satisfactory completion of all work on the project, except property lines, highway lines, or non-access lines.

**9.80.02—Materials:** All stakes used for control staking shall be of the same quality as used by the Department for this purpose. For slope limits, pavement edges, gutter lines, etc., where so-called "green" or "working" stakes are commonly used, lesser quality stakes will be acceptable, provided the stakes are suitable for the intended purpose.

**9.80.03—Construction Methods:** The Department will furnish the Contractor such control points, bench marks, and other data as may be necessary for the construction staking and layout by qualified engineering or surveying personnel as noted elsewhere herein.

The Contractor shall be responsible for the placement and preservation of adequate ties to all control points, necessary for the accurate re-establishment of all base lines, center lines, and all critical grades as shown on the plans.

All stakes, references, and batter boards which may be required for construction operations, signing and traffic control shall be furnished, set and properly referenced by the Contractor. The Contractor shall be solely and completely responsible for the accuracy of the line and grade of all features of the work. Any errors or apparent discrepancies found in previous surveys, plans, specifications or special provisions shall be called to the Engineer's attention immediately for correction or interpretation prior to proceeding with the work.

During roadway construction (or site work), the Contractor shall provide and maintain for the periods needed, as determined by the Engineer, reference stakes at 100 foot intervals outside the slope limits. Further, the Contractor shall provide and maintain reference stakes at 50 foot intervals immediately prior to and during the formation of subgrade and the construction of all subsequent pavement layers. These stakes shall be properly marked as to station, offset and shall be referenced to the proposed grade, even if laser or GPS machine controls are used.

The Contractor shall provide and maintain reference stakes at drainage structures, including reference stakes for the determination of the structure alignments as may be needed for the proper construction of the drainage structure. The reference stakes shall be placed immediately prior to and maintained during the installation of the drainage structure. These stakes shall be properly marked as to station, offset and shall be referenced to the proposed grade.

The Contractor shall furnish copies of data used in setting and referencing stakes and other layout markings used by the Contractor after completion of each operation.

The Contractor shall provide safe facilities for convenient access by Department forces to control points, batter boards, and references.

All staking shall be performed by qualified engineering or surveying personnel who are trained, experienced and skilled in construction layout and staking of the type required under the contract. Prior to start of work, the Contractor shall submit for review and comment the qualifications of personnel responsible for construction staking on the project. On all projects with an original contract value greater than \$25 million and bridge rehabilitation and reconstruction projects greater than \$10 million, surveying shall be performed under the direct supervision of a Professional Surveyor licensed in the State of Connecticut. The submission shall

include a description of the experience and training which the proposed staff possesses and a list of state projects the personnel have worked on previously. All field layout and staking required for the project shall be performed under the direct supervision of a person, or persons, of engineering background experienced in the direction of such work and acceptable to the Engineer. If the personnel responsible for construction staking change during the course of the project, then a revised submittal will be required.

The Department may check the control of the work, as established by the Contractor, at any time as the work progresses. The Contractor will be informed of the results of these checks, but the Department by so doing in no way relieves the Contractor of responsibility for the accuracy of the layout work. The Contractor shall correct or replace, at the Contractor's own expense, any deficient layout and construction work which may be the result of the inaccuracies in the Contractor's staking operations or the failure to report such inaccuracies, or the Contractor's failure to report inaccuracies found in work done by the Department or by others. If, as a result of these inaccuracies, the Department is required to make further studies, redesign, or both, all expenses incurred by the Department due to such inaccuracies will be deducted from any monies due the Contractor.

The Contractor shall furnish all necessary personnel, engineering equipment and supplies, materials, transportation, and work incidental to the accurate and satisfactory completion of this work.

**For roadways where the existing pavement markings need to be reestablished:**

Prior to any resurfacing or obliteration of existing pavement markings, the Contractor and a representative of the Engineer must establish and document pavement marking control points from the existing markings. These control points shall be used to reestablish the positions of the lanes, the beginnings and endings of tapers, channelization lines for on and off ramps, lane use arrows, stop bars, and any lane transitions in the project area. The Contractor shall use these control points to provide appropriate premarking prior to the installation of the final markings.

The Contractor shall provide and maintain reference stakes and/or markings at 100 foot intervals immediately off the edge of pavement to be used to reestablish the existing pavement markings. The Contractor shall also provide and maintain reference stakes and/or markings at any point where there is a change in pavement markings to reestablish the existing pavement markings.

**For non-limited access roadways**

On non-limited access roadways it may be necessary to adjust the final locations of the pavement markings to accommodate pedestrians and bicyclists where feasible. Prior to any resurfacing or obliteration of existing pavement markings, the Contractor, a representative of the Engineer, and a representative of the Division of Traffic Engineering must establish and document pavement marking control points from the existing markings as described above. The control points at that time may be adjusted to provide minimum shoulder widths of 4 to 5 feet wherever possible while maintaining travel lane widths of no less than 11 feet and no more than 12 feet.

**9.80.04—Method of Measurement:** Construction staking will be at the Contract lump sum for construction staking.

When no price for "Construction Staking" is asked for on the proposal form, the cost of the work described above shall be included in the general cost of the work and no direct payment for "Construction Staking" will be made.

**9.80.05—Basis of Payment:** Construction staking will be paid for at the Contract lump sum price for "Construction Staking," which price shall include all materials, tools, equipment, labor and work incidental thereto. A schedule of values for payment shall be submitted to the Department for review and comment prior to payment.

Pay Item	Pay Unit
Construction Staking	l.s.

**ITEM #1008901A – REMOVE CONDUIT**

**DESCRIPTION:** This item shall consist of removing existing conduit from handholes and in trench where indicated on the plans. All removed conduit, conductors and hardware shall remain the property of the Contractor.

**CONSTRUCTION METHODS:** The Contractor shall remove existing conduit from handholes and in trench with associated hardware where indicated on the plans. Existing conduit in trench to be removed shall be accessed through the trench opened for the installation of the new conduit. The Contractor shall disconnect and remove existing conductors along with conduit to be removed. All removed conduit, conductors and hardware shall be properly disposed of by the Contractor.

**METHOD OF MEASUREMENT:** This work will be measured for payment by the number of linear feet of conduit removed and disposed of, complete and accepted.

**BASIS OF PAYMENT:** This work will be paid for at the contract unit price per linear foot for “Remove Conduit” complete, which price shall include removal and disposal of conduit, conductors, fittings, and all associated hardware, and all equipment, materials, tools, labor and work incidental thereto.

**ITEM #1010060A – CLEAN EXISTING CONCRETE HANDHOLE**

**DESCRIPTION:**

Clean all debris from an existing concrete handhole where shown on the plans or as directed.

**MATERIAL:**

- Insulated Bonding Bushings:
  - Specification Grade
  - Threaded
  - Malleable Iron or Steel
  - Galvanized
  - UL listed
- Bonding Wire:
  - M.15.13
- Grout:
  - M.03.05

**CONSTRUCTION METHODS:**

Remove to a level even with the bottom of the handhole all sand, silt and other debris. Remove any material that is accessible from the ends of conduit. Place approximately 4” (100) of ¾” (19) crushed stone in bottom of handhole using care not to allow crushed stone to enter conduits. Grout around conduits to prevent future entrance of dirt and silt. Properly dispose all removed debris. Inspect bonding bushings. Tighten loose bushings. Secure loose bond connections. Install new bonding bushings on spare conduits and bond to other conduits.

**METHOD OF MEASUREMENT:**

This work will be measured for payment by the number of concrete handholes cleaned, complete and accepted.

**BASES OF PAYMENT:**

This work will be paid for at the contract unit price each for "Clean Existing Concrete Handhole", which price shall include the removal and disposal of debris from handhole and associated conduit, crushed stone, grout, bonding bushings, bonding wire, and all equipment and work incidental thereto.

<u>Pay Item</u>	<u>Pay Unit</u>
Clean Existing Concrete Handhole	Each (Ea)

## **ITEM #1014901A – REMOVE CABLE**

**DESCRIPTION:** This item shall consist of removing loop wires, 14/2 cables, piezo sensor cables, and No. 8 bare copper grounding wires from existing conduit, handholes, junction boxes, and cabinet where indicated on the plans or as directed by the Engineer and in accordance with these specifications. The removed wires and cables shall remain the property of the Contractor.

**CONSTRUCTION METHODS:** The Contractor shall remove all loop wires, 14/2 cables, piezo sensor cables, and No. 8 bare copper grounding wires from existing conduit, handholes, junction boxes, and cabinet at the location where new loop wires, 14/2 cables, piezo sensor cables, and No. 8 bare copper grounding wires are to be installed. Prior to installing the new wires and cables, all existing wires and cables to be removed shall have been removed, neatly coiled, tied, and the conduit cleaned of all obstructions, sand, silt, and debris. The removed wires and cables shall be disposed of by the Contractor. Where the existing wires and cables are removed from rigid metal conduit, the Contractor shall also remove the existing bonding bushings from the conduit ends located in handholes, and install new insulated bonding bushings.

**METHOD OF MEASUREMENT:** This work will be measured for payment by the actual number of linear feet of conduit from which all wires and cables are removed, including the length of handholes, junction boxes, and cabinet.

**BASIS OF PAYMENT:** This work will be paid for at the contract unit price per linear foot for “Remove Cable” which price shall include the removal of wires, cables, and bushings, the cleaning of the conduit, the furnishing and installation of new insulated bonding bushings, the proper disposal of the removed wires, cables, and bushings, and all equipment, labor and work incidental thereto.

**ITEM #1111201A – TEMPORARY DETECTION (SITE NO. 1)**

**ITEM #1111202A – TEMPORARY DETECTION (SITE NO. 2)**

**ITEM #1111203A – TEMPORARY DETECTION (SITE NO. 3)**

**ITEM #1111204A – TEMPORARY DETECTION (SITE NO. 4)**

**Description:**

Provide a Temporary Detection (TD) system at signalized intersections throughout the duration of construction, as noted on the contract plans or directed by the Engineer. TD is intended to provide an efficient traffic-responsive operation which will reduce unused time for motorists travelling through the intersection. A TD system shall consist of all material, such as pedestrian pushbutton, conduit, handholes, cable, messenger, sawcut, loop amplifier, microwave detector, Video Image Detection System (VIDS), Self Powered Vehicle Detector (SPVD), etc. that is needed to achieve an actuated traffic signal operation.

**Materials:**

Material used for TD is either owned by the Contractor that is good working condition or existing material that will be removed upon completion of the contract. Approval by the Engineer is needed prior to using existing material that will be incorporated into the permanent installation. New material that will become part of the permanent installation is not included or paid for under TD.

**Construction Methods:**

This item includes furnishing, installation, relocating, realigning, and maintaining the necessary detection systems as to provide vehicle detection during each phase of construction. If not shown on the plan, program the TD modes (pulse or presence) as the existing detectors or as directed by the Engineer. If the TD method (loops [saw cut or preformed], SPVD, microwave, VIDS, or other) is not shown on the contract plan it may be the Contractor's choice. The method chosen for TD must be indicated on the TD Plan submission.

The traffic signal plan-of-record, if not in the controller cabinet will be provided upon request. Ensure the controller phase mode (recall, lock, non-lock) and phase timing are correct for the TD. Adjust these settings as needed or as directed by the Engineer.

At least 30 days prior to implementation of each phase of construction submit a TD proposal to the Engineer for approval. Submit the TD proposal at the same time as the Temporary Signalization plan. Indicate the following information for each intersection approach:

- Phase Mode
- Temporary Detection Method
- Area of Detection
- Detector Mode

Submit the proposed temporary phase timing settings and the TD installation schedule with the TD proposal. See the example below.

## Example Proposed Temporary Detection and Timing

**Site 1**

Warren, Rt. 45 at Rt. 341, Location #149-201

Approach	Phase	Phase Mode	TD Method	Area of Detection	Det Mode
<i>Rt. 45 NB</i>	<i>2</i>	<i>Min Recall</i>	<i>VIDS</i>	<i>150' from Stop Bar</i>	<i>Pulse</i>
<i>Rt. 45 SB</i>	<i>2</i>	<i>Min Recall</i>	<i>SPVD</i>	<i>150' from Stop Bar</i>	<i>Pulse</i>
<i>Rt. 341</i>	<i>4</i>	<i>Lock</i>	<i>Microwave</i>	<i>30' from Stop Bar</i>	<i>Pulse</i>

Temporary Phase Timing Settings:

Phase	Min	Ped	Ped Clr	Ext	Max 1	Max2	Yel	Red
<i>2</i>	<i>20</i>	<i>0</i>	<i>0</i>	<i>6</i>	<i>45</i>	<i>60</i>	<i>4</i>	<i>1</i>
<i>4</i>	<i>14</i>	<i>7</i>	<i>9</i>	<i>3</i>	<i>27</i>	<i>35</i>	<i>3</i>	<i>1</i>

Scheduled TD: *July 4, 2011***Site 2**

Scotland, Rt. 14 at Rt. 97, Location #123-201

Approach	Phase	Phase Mode	TD Method	Area of Detection	Det Mode
<i>Rt. 15 WB Left Turn</i>	<i>1</i>	<i>Non-Lock</i>	<i>VIDS</i>	<i>5' in front to 10' Behind Stop Bar</i>	<i>Presence</i>
<i>Rt. 14 EB</i>	<i>2</i>	<i>Min Recall</i>	<i>Existing Loop</i>	<i>150' from Stop Bar</i>	<i>Pulse</i>
<i>Rt. 14 WB</i>	<i>6</i>	<i>Min Recall</i>	<i>VIDS</i>	<i>150' from Stop Bar</i>	<i>Pulse</i>
<i>Rt. 97</i>	<i>4</i>	<i>Lock</i>	<i>Loop, Pre- formed</i>	<i>20' from Stop Bar</i>	<i>Pulse</i>

Temporary Phase Timing Settings:

Phase	Min	Ped	Ped Clr	Ext	Max 1	Max2	Yel	Red
<i>1</i>	<i>5</i>	<i>0</i>	<i>0</i>	<i>2</i>	<i>12</i>	<i>18</i>	<i>3</i>	<i>0</i>
<i>2 &amp; 6</i>	<i>24</i>	<i>0</i>	<i>4</i>	<i>4</i>	<i>26</i>	<i>36</i>	<i>4</i>	<i>1</i>
<i>4</i>	<i>14</i>	<i>7</i>	<i>9</i>	<i>3</i>	<i>27</i>	<i>35</i>	<i>3</i>	<i>1</i>

Scheduled TD: *July 4, 2011*

When at any time during construction the existing vehicle detection becomes damaged, removed, or disconnected, install TD to actuate the affected approaches. Install TD sensors and make operational prior to removing existing detection. TD must be operational throughout all construction phases.

Provide to the Engineer a list of telephone numbers of personnel who will be responsible for the TD. If the TD malfunctions or is damaged, notify the Engineer and place the associated phase on max recall. Respond to TD malfunctions by having a qualified representative at the site within three (3) hours. Restore detection to the condition prior to the malfunction within twenty-four (24) hours.

If the Engineer determines that the nature of a malfunction requires immediate attention and the Contractor does not respond within three (3) hours following the initial contact, then an alternative maintenance service will be called to restore TD. Expenses incurred by the State for alternative service will be deducted from monies due to the Contractor with a minimum deduction of \$500.00 for each service call. The alternate maintenance service may be the traffic signal owner or another qualified Contractor.

TD will terminate when the detection is no longer required. This may be either when the temporary signal is taken out of service or when the permanent detectors are in place and fully operational.

Any material and equipment supplied by the Contractor specifically for TD will remain the Contractor's property. Existing material not designated as scrap or salvage will become the property of the Contractor. Return and deliver to the owner all existing equipment used as TD that is removed and designated as salvage.

**Method of Measurement:**

Temporary Detection is measured as a percentage of the contract Lump Sum price. Fifty percent (50%) shall be paid when Temporary Detection is initially set up, approved, and becomes fully operational. Fifty percent (50%) shall be paid when Temporary Detection terminates and all temporary equipment is removed to the satisfaction of the Engineer.

**Basis of Payment:**

This work will be paid at the contract Lump Sum price for "Temporary Detection (Site No.)". The price includes furnishing, installing, relocating, realigning, and maintaining the necessary detection systems and all incidental material, labor, tools, and equipment. This price also includes any detector mode setting changes, timing or program modifications to the controller that are associated with TD. All Contractor supplied material that will remain the Contractor's property will be included in the contract Lump Sum price for "Temporary Detection (Site No.)". Any items installed for TD that will become part of the permanent installation will not be paid for under this item but are paid for under the bid item for that work.

<u>Pay Item</u>	<u>Pay Unit</u>
Temporary Detection (Site No.)	L. S.

## **ITEM #1111420A – PIEZO CABLE SENSOR (TYPE 1)**

**DESCRIPTION:** Work under this item shall consist of furnishing and installing a piezo sensor of the type specified, all lead in cable from the sensor to the traffic control cabinet, and all saw cut needed to install the piezo sensor and piezo sensor cable, where specified on the plans or directed by the Engineer.

**MATERIALS:** All materials must be compatible with the “Diamond Phoenix” Traffic Recorder, “Peek ADR” Traffic Recorder and “ITC Tel-WIM” Traffic Recorder.

The piezo sensors shall operate within specification in both asphalt and portland cement concrete pavements, constructed on all commonly encountered sub-base materials and soil. The system is required to operate in through traffic lanes of interstate and principal highways covering the full range of traffic volumes and truck percentages to be found in the United States. The system shall function within specification over the temperature range -40 °F to 160 °F.

Piezo cable sensor type 1 shall be a Class I sensor approximately 11-1/2’ in length with an output uniformity less than  $\pm 7\%$ . Sensor shall consist of a 16 gauge, flat, braided, silver plated, copper wire, a highly compressed piezoelectric copolymer, and a 0.016” thick brass outer sheath conforming to CDA-260 and ASTM B587-88. Sensor shall be approximately 0.260” wide x 0.063” thick and have a linear capacitance of 1.1 nF/ft,  $\pm 20\%$ . Insulation resistance shall be greater than 500 megohm, and piezoelectric coefficient shall be greater than or equal to 20 pC/N.

Each sensor shall be supplied with enough sensor cable to go from the piezo sensor to the cabinet unspliced. Sensor cable shall be RG 58 C/U type with a high density polyethylene outer jacket rated for direct burial and a nominal capacitance of 27 pF/ft.

Epoxy for piezo sensor installation shall be one of the following:

ECM P5G  
IRD AS-475  
IRD-Pat America PU200

Polyester resin compound for sealing sensor cable saw cut shall be:

- Two part polyester which to cure, requires a liquid hardener.
- Use of a respirator not necessary when applied in an open air environment.
- Cure time dependent on amount of hardener mixed.
- Flow characteristics to guarantee encapsulation of sensor cables.
- Viscosity: 4000 CPS to 7000 CPS at 77 degrees Fahrenheit.
- Form a tack-free skin within 25 minutes and full-cure within 60 minutes at 77 degrees Fahrenheit.

- When cured, resist effects of weather, vehicular abrasion, motor oil, gasoline, antifreeze, brake fluid, de-icing chemicals, salt, acid, hydrocarbons, and normal roadway encounters.
- When cured, maintain physical characteristics throughout the ambient temperature ranges experienced within the State of Connecticut.
- When cured, bonds (adheres) to all types of road surfaces.
- Weight per Gallon: 11 lbs  $\pm$  1 lb
- Show no visible signs of shrinkage after curing.
- 12 month shelf life of unopened containers when stored under manufacturers specified conditions.
- Cured testing requirements:
  - Gel time at 77 degrees F: 15 - 20 minutes, ASTM C881, D-2471
  - Shore D Hardness at 24 hours: 55-78, ASTM D-2240
  - Tensile Strength: > 1000 psi, ASTM D-638
  - Elongation: 18 - 20 %, ASTM D-638
  - Adhesion to steel: 700 - 900 psi, ASTM D-3163
  - Absorption of water, sodium chloride, oil, and gasoline: < 0.2%, ASTM D-570
- Include in the Certificate of Compliance:
  - Manufacturer's confirmation of the uncured and cured physical properties stated above.
  - Material Safety Data Sheet (MSDS) stating sealant may be applied without a respirator in an open air environment.
- Designed to allow clean-up without the use of solvent that is harmful to the workers and the environment.

**CONSTRUCTION METHODS:** The Contractor performing the work shall have had previous experience installing piezo sensors. Experience shall be understood to mean the foreman/crew leader having installed piezo sensors of the type specified. Contractors not meeting the experience requirements shall receive training from the sensor manufacturer, or have a manufacturer's representative present for training and supervision during installation of the sensors at the first site. Documentation of experience or training shall be submitted to the Engineer for approval 30 days prior to the start of work.

The Contractor shall follow the manufacturer's recommended installation procedure. The Contractor shall submit installation procedure along with catalog cuts for approval. Outlined below is a sample of an acceptable installation procedure.

Work shall be organized so that roadway closings are kept at a minimum and as specified in Maintenance and Protection of Traffic.

Using the location shown on the plans and details, carefully mark out the piezo sensor slot perpendicular to the flow of traffic and the cable run on the roadway using crayons and pavement paint.

Cut the sensor slot 3/4" wide ( $\pm$ 1/16") and 1" minimum deep and approximately 6" longer than the sensor length (including lead attachment) using a 3/4" wide diamond blade or blades ganged together to get a single 3/4" wide cut. Drop blade an extra 1/2" down on both ends. The slot shall be wet cut to minimize damage to the road.

Cut the sensor cable home run slot 1/4" minimum wide and 1-3/4" - 2" deep. The slot shall be wet cut to minimize damage to the road. Cable lead out shall be centered on the piezo sensor slot.

Chisel out any material in the center between the two sensor saw cuts.

Power wash and sweep all slots. All slots and the pavement 5" on all sides must be very clean.

Dry all slots with compressed air. All slots and the pavement 1' on all sides must be completely dry.

Place a strip of duct tape along the pavement 1/8" from both sides of the slot for the full length of the slot.

Remove the sensor from the container, check for damage, visually inspect the sensor to ensure it is straight without any twists and curls and verify that the sensor cable is of sufficient length to reach the cabinet without splicing.

Test the sensor for capacitance, dissipation factor and resistance according to the manufacturer's directions. Capacitance and dissipation factor shall be within  $\pm 20\%$  of the enclosed data sheet. Resistance shall be greater than 20 megohm. Test results, serial number and location of sensor shall be recorded on data sheet and a copy left in the cabinet.

Lay the sensor on the tape next to the slot. Ensure that the sensor is straight and flat. From this point on, handle the sensor with latex gloves.

Clean the sensor with steel wool or emery pad and wipe down with alcohol and lint-free cloth.

Place the installation brackets on the sensor every 6" for the length of the sensor.

Bend the end of the sensor downward at a 30 degree angle. Bend the lead attachment end down at a 15 degree angle and then 15 degrees back up until level, forming a lazy Z.

Place the sensor in the slot with the top of the brass element 3/8" below the road surface, and the top of the brackets 1/8" below the road surface. The end of the sensor shall be at least 2" from the end of the slot, and the tip shall not touch the bottom of the slot. The lead attachment shall also not touch the bottom or sides of the slot. The brackets shall fit snugly against the sides of the slot.

Visually inspect the length of the sensor to ensure it is level and at uniform depth.

Route the piezo sensor cable through the home run slot. The sensor cable shall be protected by a PVC sleeve where it crosses a joint in or adjacent to pavement. Place backer rod under and over

the sensor cable inside the slot 3” from the lead attachment to prevent the epoxy from running out into the home run slot.

Premix the epoxy for 2 minutes or until smooth using a low speed mixing drill (450 rpm) and a mixing paddle. Add the hardener to the epoxy and mix according to the manufacturer’s instructions. Ensure the mixing paddle is not lifted out of the epoxy while the mixing head is spinning, which could trap excessive air in the material.

Immediately pour the epoxy into the slot using a small bead to facilitate the flow of the epoxy under the sensor, eliminating air pockets. Start at the end of the sensor and pour towards the lead attachment utilizing several passes to completely fill the slot full of epoxy.

Using a trowel or putty knife, lightly spread the epoxy smooth along the length of the slot, ensuring the epoxy does not have a trough on top. The epoxy should be slightly higher than the tape as the epoxy will shrink while curing.

Remove the tape on the sides of the sensor as soon as the epoxy begins to set.

Remove the backer rod from the slot and fill the home run slot with polyester compound. Polyester compound shall fully encapsulate the sensor cable, be flush with the road surface and provide a minimum cover of 1” between the top of the sensor cable and road surface.

Grind the top of the epoxy flat and even with the road surface using an angle grinder after the epoxy is fully cured.

Clean up the site. When the epoxy is fully cured, it may be opened to traffic. Time of cure should be specified by manufacturer and is dependent on the temperature. Failure to wait for the epoxy to fully cure may ruin the installation and cause it to fail prematurely.

After installation, the piezo sensor shall be tested a second time for capacitance, dissipation factor and resistance. In addition, the sensor shall be tested for voltage output using an oscilloscope by measuring the signal generated by vehicles of various size and weight driving over the sensor and applying an external pressure. An acceptable installation shall consist of the sensor having a capacitance and dissipation within  $\pm 20\%$  of the enclosed data sheet, a resistance greater than 20 megohm and a minimum voltage output of 100 mV for a light car. Test results shall be recorded on the enclosed data sheet and a copy left in the cabinet.

**METHOD OF MEASUREMENT:** Piezo sensors shall be measured for payment by the number of piezo sensors of the type specified, complete, operational, and accepted in place.

**BASIS OF PAYMENT:** This work will be paid for at the contract unit price each for “Piezo Cable Sensor (Type 1)” which price shall include the sensor, sensor cable, installation brackets, saw cut, epoxy, polyester compound, liquidtight flexible nonmetallic conduit, PVC sleeves, spade lugs, all materials, labor, tools, necessary fittings, required training and supervision by piezo manufacturer, testing, equipment, and work incidental thereto.

## **ITEM #1111451A – LOOP DETECTOR SAWCUT**

### **11.11.02 – Materials:**

Replace Article M.16.12 with the following:

Sawcut:

(a) Wire in sawcut:

- International Municipal Signal Association (IMSA) Specification 51-7, single conductor cross-linked polyethylene insulation inside polyethylene tube.
- # 14 AWG

(b) Sealant:

(1) Polyester Resin Compound

- Two part polyester which to cure, requires a liquid hardener.
- Use of a respirator not necessary when applied in an open air environment.
- Cure time dependent on amount of hardener mixed.
- Flow characteristics to guarantee encapsulation of loop wires.
- Viscosity: 4000 CPS to 7000 CPS at 77 degrees Fahrenheit (25° C).
- Form a tack-free skin within 25 minutes and full-cure within 60 minutes at 77 degrees Fahrenheit (25° C).
- When cured, resist effects of weather, vehicular abrasion, motor oil, gasoline, antifreeze, brake fluid, de-icing chemicals, salt, acid, hydrocarbons, and normal roadway encounters.
- When cured, maintain physical characteristics throughout the ambient temperature ranges experienced within the State of Connecticut.
- When cured, bonds (adheres) to all types of road surfaces.
- Weight per Gallon (3.8 l): 11 lbs ± 1 lb (5kg ± .45kg)
- Show no visible signs of shrinkage after curing.
- 12 month shelf life of unopened containers when stored under manufacturers specified conditions.
- Cured testing requirements:
  - Gel time at 77 degrees F (25° C): 15 - 20 minutes, ASTM C881, D-2471
  - Shore D Hardness at 24 hours: 55-78, ASTM D-2240
  - Tensile Strength: > 1000 psi (6895 kPa), ASTM D-638
  - Elongation: 18 - 20 %, ASTM D-638
  - Adhesion to steel: 700 - 900 psi (4826 - 6205 kPa), ASTM D-3163
  - Absorption of water, sodium chloride, oil, and gasoline: < 0.2%, ASTM D-570
- Include in the Certificate of Compliance:
  - Manufacturer's confirmation of the uncured and cured physical properties stated above.
  - Material Safety Data Sheet (MSDS) stating sealant may be applied without a respirator in an open air environment.
- Designed to allow clean-up without the use of solvent that is harmful to the workers and the environment.

(2) Elastosmeric Urethane Compound:

- One part urethane which to cure, does not require a reactor initiator, or a source of thermal energy prior to or during its installation.
- Use of a respirator not necessary when applied in an open air environment.

- Cure only in the presence of moisture.
- Flow characteristics to guarantee encapsulation of loop wires.
- Viscosity such that it does not run out of the sawcut in sloped pavement during installation; 5000 CPS to 85,000 CPS.
- Form a tack-free skin within 24 hours and 0.125 inch (0.33mm) cure within 30 hours at 75 degrees Fahrenheit (24° C).
- When cured, resist effects of weather, vehicular abrasion, motor oil, gasoline, antifreeze, brake fluid, de-icing chemicals, salt, acid, hydrocarbons, and normal roadway encounters.
- When cured, maintain physical characteristics throughout the ambient temperature ranges experienced within the State of Connecticut.
- Show no visible signs of shrinkage after curing.
- Shelf life when stored under manufacturers specified conditions:
  - Caulk type cartridges: minimum 9 months
  - Five gallon containers: minimum 12 months
- Designed for application when the pavement surface temperature is between 40 and 100 degrees Fahrenheit (4° and 38° C).
- Uncured testing requirements:
  - Weight/Gallon: ASTM D-1875
  - Determination of Non-volatile Content: ASTM D-2834
  - Viscosity: ASTM D-1048B
  - Tack-free Time: ASTM D-1640
- Cured testing requirements:
  - Hardness: ASTM D-2240
  - Tensile Strength & Elongation: ASTM D-412A
- Include in the Certificate of Compliance:
  - Manufacturer's confirmation of the uncured and cured physical properties stated above.
  - Material Safety Data Sheet (MSDS) stating sealant may be applied without a respirator in an open air environment.
- Designed to allow clean-up without the use of solvent that is harmful to the workers and the environment.

### 3. Miscellaneous:

#### (a) Liquidtight Flexible Nonmetallic Conduit

- UL listed for direct burial
- UL 1660
- Smooth polyvinyl chloride inner surface

#### (b) Water Resistant Pressure Type Wire Connector

- UL listed for direct burial and wet locations
- UL 486D

### 11.11.03 - Construction methods:

#### 2. Loop Detector Sawcut

- Loop size, number of turns, and location is shown on the intersection plan.
- Do not cut through a patched trench, damaged or poor quality pavement without the approval of the Engineer.
- Wet-cut pavement with a power saw using a diamond blade  $\frac{3}{8}$  inch (9.5mm) wide. Dry-cut is not allowed.
- Ensure slot depth is between 1  $\frac{3}{4}$  inch to 2.0 inch (45mm to 50mm).
- Overlap corners to ensure full depth of cut.

- To prevent wire kinking and insulation damage, chamfer inside of corners that are  $\leq 120$  degrees.
- Clean all cutting residue and moisture from slot with oil-free compressed air. Ensure slot is dry before inserting wire and sealing sawcut.
- Cut home-run, from loop to curb or edge-of-road, as shown on the typical installation sheet.
- To prevent cross-talk and minimize electrical interference, twist home-run wires, from edge of road to handhole, with at least 5 turns per foot (16 turns per meter). Tape together twisted home-run wires at 2 foot (0.6 meter)  $\pm$  intervals.
- In new or resurfaced pavement, install loops in the wearing course. If the wearing course is not scheduled for immediate placement (within 24 hours) after the base course, provide temporary detection when directed by the Engineer. Temporary detection may be sawcut loops, preformed loops, microwave sensor, video, or other method approved by the Engineer.
- Splice(s) not allowed anywhere in loop wire either in loop or in home-run.
- Ensure wires are held in place at bottom of slot by inserting at 2 foot (0.6 m) intervals, 1 inch sections of foam backer rod or wedges formed from 1 inch (25mm) sections of the polyethylene tubing. Loop detectors with wires that have floated to the top of the sealant will not be accepted.
- To create a uniform magnetic field in the detection zone, wind adjacent loops in opposite directions.
- Use **polyester compound** as the sealant unless another type is allowed by the Engineer.
- Mix hardening agent into polyester resin with a power mixer or in an application machine designed for this type of sealant in accordance with the manufacturer's instructions.
- Apply the loop sealant in accordance with the manufacturer's instructions and the typical installation sheet. Do not apply sealant when pavement temperature is outside the manufacturers recommended application range.
- Solder splice the loop wires to the lead-in cable and install water resistant connector as shown on the typical installation sheet.
- Test the loop circuit resistance, inductance, and amplifier power-interruption as shown on the typical installation sheet. Document all test results.

### 3. Damaged, Patched, or Excessively Worn Pavement

- Where the existing pavement is damaged, patched or excessively worn and is found to be not suitable for reliable loop detection, notify the Engineer.
- When directed by the Engineer, remove and replace an area of pavement to allow the proper installation of the loop.
- Remove a minimum of 3 inches (75mm) depth.
- Comply with the applicable construction methods of Section 2.02 Roadway Excavation, Formation Of Embankment and Disposal of Surplus Material, and Section 4.06 Bituminous Concrete, such as:
  - Cut Bituminous Concrete
  - Material for Tack Coat
  - Bituminous Concrete Class 1

### 4. Re-surface/Overlay Project

- Prior to disconnecting the existing loop confirm that the amplifier is operating properly and is programmed according to plan. Document loop operation. Report any discrepancies and malfunctions to Engineer.
- Remove all abandoned sawcut home-run wire from handhole.
- Sawcut new loop according to plan.

- Solder splice new loop wires to the existing lead-in cable and install new water resistant twist connectors as shown on the typical installation sheet. Do not re-use the removed connectors.
- Test the loop circuit resistance and inductance. Document results.
- Ensure the existing loop amplifier has re-tuned to the new loop and is operating according to plan.

**11.11.04 – Method of Measurement:**

Loop Detector Sawcut is measured by the number of linear feet (meters) of installed, tested, operating, and accepted sawcut only where there is loop wire. Over-cuts at corners that do not contain wire are not measured.

**11.11.05 – Basis of Payment:**

Loop Detector Sawcut is paid at the contract unit price per linear foot (meter). The price includes sawcut, loop wire, sealant, liquidtight flexible nonmetallic conduit, duct seal, water resistant splice connectors, testing, incidental material, equipment, and labor.

Pay Item  
Loop Detector Sawcut

Pay Unit  
l.f. (m)

# CONSTRUCTION NOTES

INTERSECTION # 35-207

PROJECT # 035-195

ALL TRAFFIC SIGNAL EQUIPMENT IS EXISTING, EXCEPT AS NOTED.

CONTRACTOR TO VERIFY OPERATION OF LOOP DETECTOR AMPLIFIERS PRIOR TO MILLING, PAVING AND LOOP REPLACEMENT.

INSTALL LOOP DETECTORS CENTERED IN LANE AND 8' APART UNLESS OTHERWISE SPECIFIED.

INSTALL ONLY LOOP DETECTORS SHOWN. ALL OTHERS EXISTING TO REMAIN.

SERIES SPLICE SEGMENTED LOOPS PER LANE.

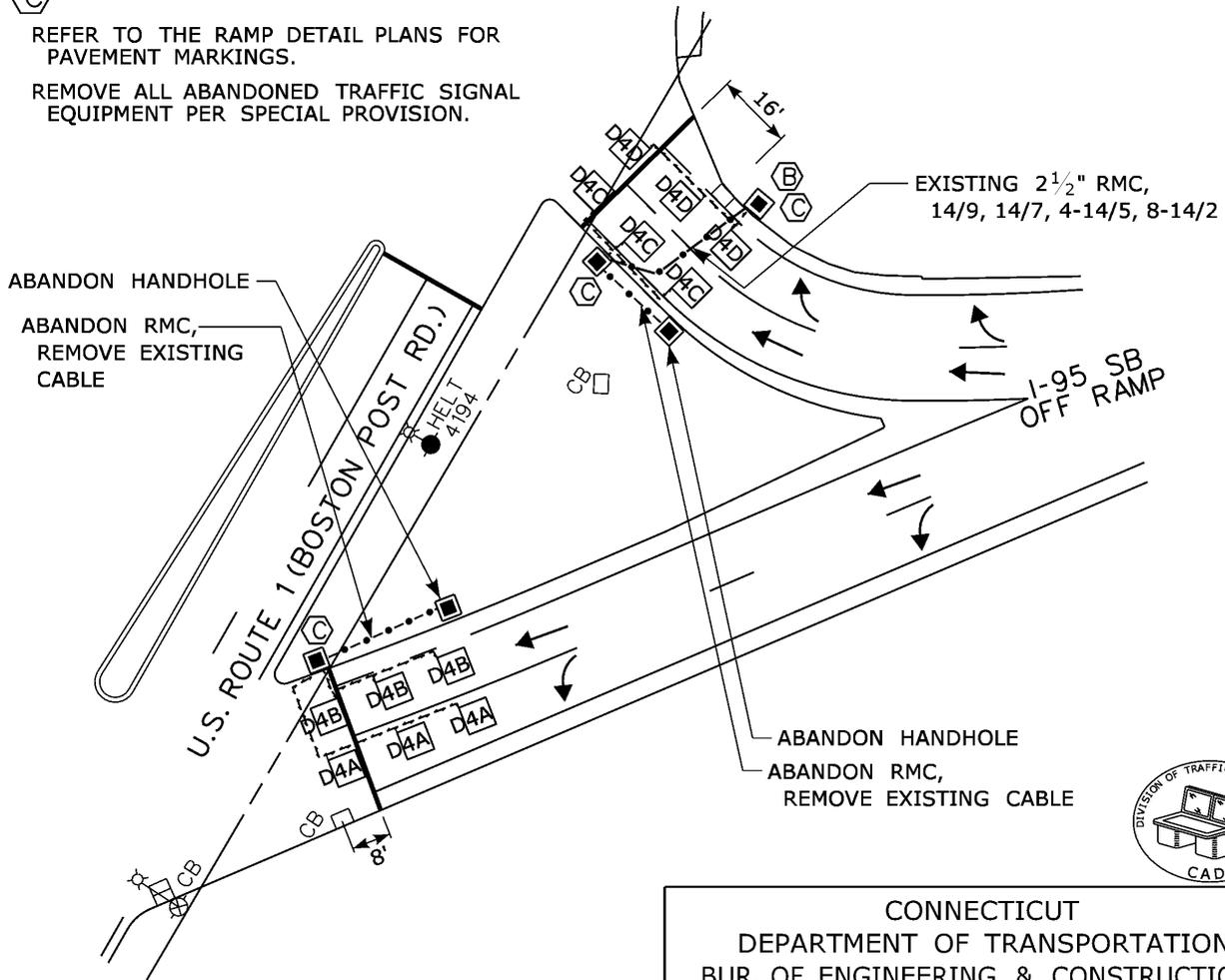
COORDINATE THIS REVISION WITH CONNECTICUT D.O.T. SIGNAL LAB CONTACT MR. DONALD ASSARD (860) 258-0346 OR MR. MARK ZAMPINI (860) 258-0349 AT LEAST 48 HRS PRIOR TO REVISION.

**B** PULL BACK ONE (1) 14/2 CABLE TO SPLICE D4D SEGMENTED LOOPS IN EXISTING HANDHOLE.

**C** CLEAN EXISTING HANDHOLE TO BE PAID FOR UNDER ITEM #1010060A.

REFER TO THE RAMP DETAIL PLANS FOR PAVEMENT MARKINGS.

REMOVE ALL ABANDONED TRAFFIC SIGNAL EQUIPMENT PER SPECIAL PROVISION.



CONNECTICUT  
DEPARTMENT OF TRANSPORTATION  
BUR. OF ENGINEERING & CONSTRUCTION  
DIVISION OF TRAFFIC ENGINEERING

TRAFFIC CONTROL SIGNAL LAYOUT  
LOOP DETECTOR REPLACEMENT

TOWN OF DARIEN  
U.S. ROUTE 1 AT LEDGE ROAD,  
LEROY AVE, & I-95 SB OFF-RAMP

## DETECTORS

IDENT	SIZE (WXL)	TURNS	MODE
D4A	6' x 6'	3	PRESENCE
D4B	6' x 6'	3	PRESENCE
D4C	6' x 6'	3	PRESENCE
D4D	6' x 6'	3	PRESENCE

SCALE - NONE

## LEGEND:

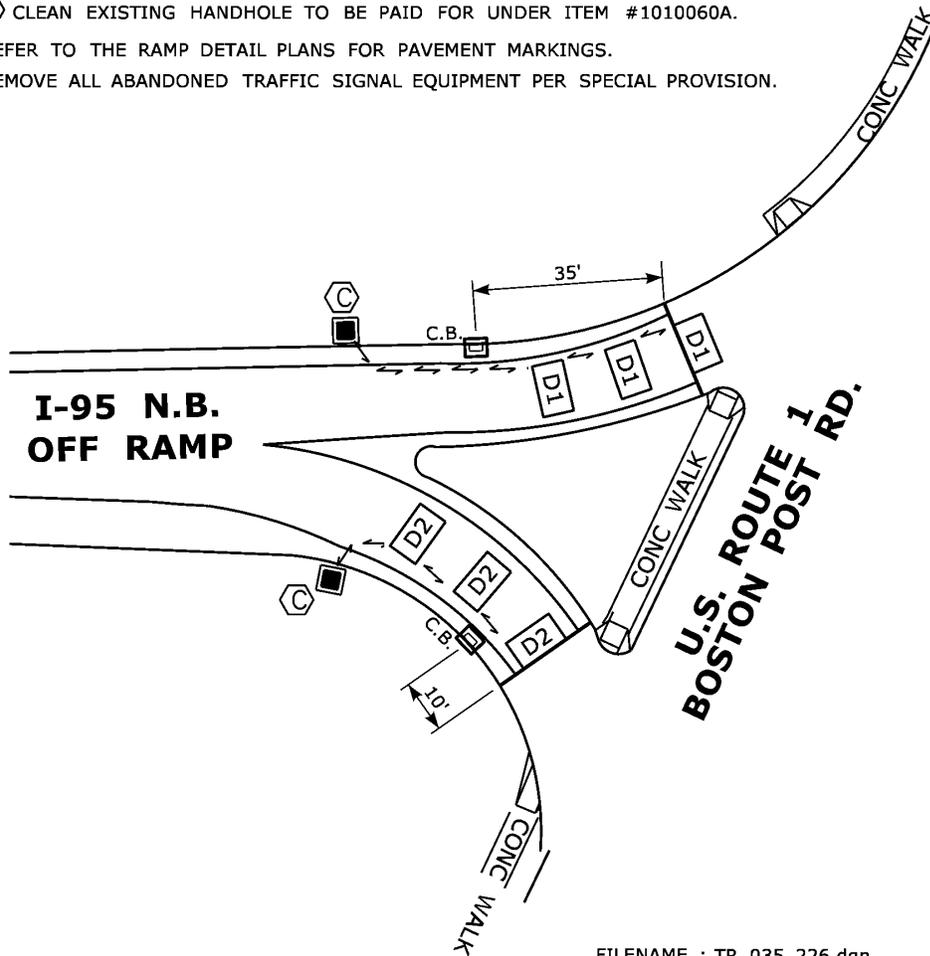
- LOOP DETECTOR
- EXISTING HANDHOLE
- DET. LEADS IN SAW CUT
- EXISTING RIGID METAL CONDUIT (RMC)

**CONSTRUCTION NOTES:**

ALL TRAFFIC SIGNAL EQUIPMENT IS EXISTING EXCEPT AS NOTED.  
 CONTRACTOR TO VERIFY OPERATION OF LOOP DETECTOR AMPLIFIERS PRIOR TO MILLING, PAVING AND LOOP REPLACEMENT.  
 INSTALL LOOP DETECTORS CENTERED IN LANE AND 8' APART UNLESS OTHERWISE SPECIFIED.  
 INSTALL ONLY LOOP DETECTORS SHOWN. ALL OTHER EXISTING TO REMAIN.  
 SERIES SPLICE SEGMENTED LOOPS PER LANE.  
 COORDINATE THIS REVISION WITH CONNECTICUT D.O.T. SIGNAL LAB CONTACT MR. DONALD ASSARD (860) 258-0346 OR MR. MARK ZAMPINI (860) 258-0349 AT LEAST 48 HRS PRIOR TO REVISION.  
 ☉ CLEAN EXISTING HANDHOLE TO BE PAID FOR UNDER ITEM #1010060A.  
 REFER TO THE RAMP DETAIL PLANS FOR PAVEMENT MARKINGS.  
 REMOVE ALL ABANDONED TRAFFIC SIGNAL EQUIPMENT PER SPECIAL PROVISION.

INTERSECTION #035-226

PROJECT #035-195



FILENAME : TR\_035\_226.dgn

STATE OF CONNECTICUT  
 DEPARTMENT OF TRANSPORTATION  
 BUREAU OF ENGINEERING & CONSTRUCTION  
 DIVISION OF TRAFFIC ENGINEERING

TRAFFIC CONTROL SIGNAL LAYOUT  
 LOOP DETECTOR REPLACEMENT

TOWN OF DARIEN  
 U.S. ROUTE 1 (BOSTON POST ROAD)  
 AND I-95 N.B. OFF RAMP

DETECTORS			
IDENT	SIZE (WXL)	TURNS	MODE
D1	10' X 6'	3	PRESENCE
D2	10' X 6'	3	PRESENCE

LEGEND:  
 □ LOOP DETECTOR  
 ■ EXIST HANDHOLE  
 → DET. LEADS IN SAW CUT

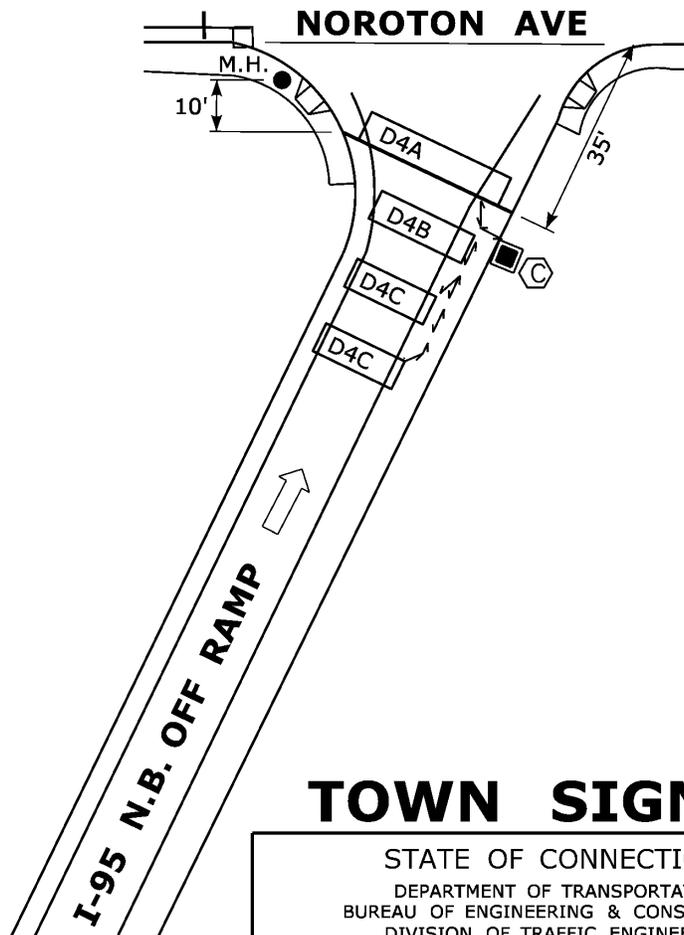
SCALE - NONE

**CONSTRUCTION NOTES:**

ALL TRAFFIC SIGNAL EQUIPMENT IS EXISTING EXCEPT AS NOTED.  
 CONTRACTOR TO VERIFY OPERATION OF LOOP DETECTOR AMPLIFIERS PRIOR TO MILLING, PAVING AND LOOP REPLACEMENT.  
 INSTALL LOOP DETECTORS CENTERED IN ROAD AND 8' APART UNLESS OTHERWISE SPECIFIED.  
 INSTALL ONLY LOOP DETECTORS SHOWN. ALL OTHER EXISTING TO REMAIN.  
 SERIES SPLICE SEGMENTED LOOPS PER LANE.  
 ☉ CLEAN EXISTING HANDHOLE TO BE PAID FOR UNDER ITEM #1010060A.  
 THE CONTRACTOR SHALL CONTACT MR. EDWARD L. GENTILE AT (203) 656-7346 PRIOR TO ANY EXCAVATION AND DELIVERY OF SALVAGE MATERIAL.  
 REFER TO THE RAMP DETAIL PLANS FOR PAVEMENT MARKINGS.  
 REMOVE ALL ABANDONED TRAFFIC SIGNAL EQUIPMENT PER SPECIAL PROVISION.

INTERSECTION #35-227

PROJECT #035-195



**TOWN SIGNAL**

STATE OF CONNECTICUT  
 DEPARTMENT OF TRANSPORTATION  
 BUREAU OF ENGINEERING & CONSTRUCTION  
 DIVISION OF TRAFFIC ENGINEERING

TRAFFIC CONTROL SIGNAL LAYOUT  
 LOOP DETECTOR REPLACEMENT

TOWN OF DARIEN  
 NOROTON AVENUE AT  
 I-95 N.B. OFF RAMP

FILENAME : TR\_035\_227.dgn

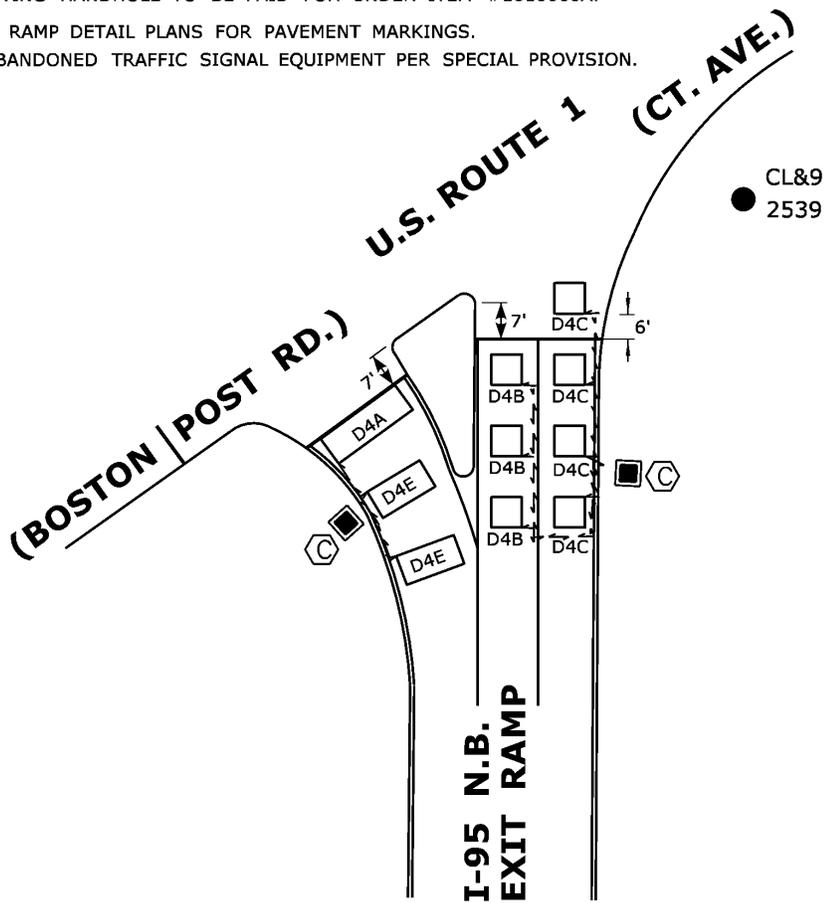
DETECTORS				LEGEND:
IDENT	SIZE (WXL)	TURNS	MODE	
D4A	30' x 6'	2	PRESENCE	☐ LOOP DETECTOR
D4B	20' x 6'	2	PRESENCE	■ EXIST HANDHOLE
D4C	18' x 6'	2	PRESENCE	← DET. LEADS IN SAW CUT
SCALE - NONE				

**CONSTRUCTION NOTES:**

- ALL TRAFFIC SIGNAL EQUIPMENT IS EXISTING EXCEPT AS NOTED.
- CONTRACTOR TO VERIFY OPERATION OF LOOP DETECTOR AMPLIFIERS PRIOR TO MILLING, PAVING AND LOOP REPLACEMENT.
- INSTALL LOOP DETECTORS CENTERED IN LANE AND 8' APART UNLESS OTHERWISE SPECIFIED.
- INSTALL ONLY LOOP DETECTORS SHOWN. ALL OTHER EXISTING TO REMAIN.
- SERIES SPLICE SEGMENTED LOOPS PER LANE.
- COORDINATE THIS REVISION WITH CONNECTICUT D.O.T. SIGNAL LAB CONTACT MR. DONALD ASSARD (860) 258-0346 OR MR. MARK ZAMPINI (860) 258-0349 AT LEAST 48 HRS PRIOR TO REVISION.
-  CLEAN EXISTING HANDHOLE TO BE PAID FOR UNDER ITEM #1010060A.
- REFER TO THE RAMP DETAIL PLANS FOR PAVEMENT MARKINGS.
- REMOVE ALL ABANDONED TRAFFIC SIGNAL EQUIPMENT PER SPECIAL PROVISION.

INTERSECTION #102-279

PROJECT #035-195



FILENAME : TR\_102\_279.dgn

STATE OF CONNECTICUT  
 DEPARTMENT OF TRANSPORTATION  
 BUREAU OF ENGINEERING & CONSTRUCTION  
 DIVISION OF TRAFFIC ENGINEERING

DETECTORS			
IDENT	SIZE (WXL)	TURNS	MODE
D4A	18X6	3	PRESENCE
D4B	6X6	3	PRESENCE
D4C	6X6	3	PRESENCE
D4E	12X6	3	PRESENCE

LEGEND:

-  LOOP DETECTOR
-  EXIST HANDHOLE
-  DET. LEADS IN SAW CUT

SCALE - NONE

TRAFFIC CONTROL SIGNAL LAYOUT  
 LOOP DETECTOR REPLACEMENT

TOWN OF NORWALK  
 U.S. ROUTE 1 AT RIVERPARK DR.  
 AND I-95 N.B. OFF RAMP

## **ITEM #1118012A – REMOVAL AND/OR RELOCATION OF TRAFFIC SIGNAL EQUIPMENT**

Section 11.18: Replace the entire section with the following:

### **11.18.01 – Description:**

Remove all abandon traffic signal equipment. Restore the affected area. Where indicated on the plans remove and reinstall existing traffic signal equipment to the location(s) shown.

### **11.18.02 – Materials:**

The related sections of the following specifications apply to all incidental and additional material required for the proper relocation of existing equipment and the restoration of any area affected by this work.

- Division III, “Materials Section” of the Standard Specifications.
- Current Supplemental Specifications to the Standard Specifications.
- Applicable Special Provisions to the Standard Specifications.
- Current Department of Transportation, Functional Specifications for Traffic Control Equipment.

### **Article 11.18.03 - Construction Methods:**

Schedule/coordinate the removal and/or relocation of existing traffic signal equipment with the installation of new equipment to maintain uninterrupted traffic signal control. This includes but is not limited to vehicle signals and detectors, pedestrian signals and pushbuttons, co-ordination, and pre-emption.

#### **Abandoned Equipment**

The contract traffic signal plan usually does not show existing equipment that will be abandoned. Consult the existing traffic signal plan for the location of abandoned material especially messenger strand, conduit risers, and handholes that are a distance from the intersection. A copy of the existing plan is usually in the existing controller cabinet. If not, a plan is available from the Division of Traffic Engineering upon request.

Unless shown on the plans it is not necessary to remove abandoned conduit in-trench and conduit under-roadway

When a traffic signal support strand, rigid metal conduit, down guy, or other traffic signal equipment is attached to a utility pole, secure from the pole custodian permission to work on the pole. All applicable Public Utility Regulatory Authority (PURA) regulations and utility company requirements govern. Keep utility company apprised of the schedule and the nature of the work.

Remove all abandoned hardware, conduit risers, and down guys, Remove anchor rods, to 6” (150mm) below grade.

When underground material is removed, backfill the excavation with clean fill material. Compact the fill to eliminate settling. Remove entirely the following material: pedestal foundation; controller foundation; handhole; pressure sensitive vehicle detector complete with concrete base. Unless otherwise shown on the plan, remove steel pole and mast arm foundation to a depth of 2 feet (600mm) below grade. Restore the excavated area to a grade and condition compatible with the surrounding area.

- If in an unpaved area apply topsoil and establish turf in accordance with Section 9.44 and Section 9.50 of the Standard Specifications.
- If in pavement or sidewalk, restore the excavated area in compliance with the applicable Sections of Division II, “Construction Details” of the Standard Specifications.

#### Relocated Equipment

In the presence of the Engineer, verify the condition of all material that will be relocated and reused at the site. Carefully remove all material, fittings, and attachments in a manner to safeguard parts from damage or loss. Replace at no additional cost, all material which becomes damaged or lost during removal, storage, or reinstallation.

#### Salvage Equipment

<b>Salvage Material</b>	<b>Stock No.</b>	<b>Value</b>
Controller Cabinet, Complete including but not limited to the following: Conflict Monitor Coordination Equipment Vehicle Detection Equipment	330-03-7010	\$ 500.00
Controller Unit	330-03-7005	\$ 500.00
Aluminum Pedestal 8 foot (2.4 m)	330-16-7108	\$ 100.00
4 foot, 4 inch (1.3 m)	330-16-7112	\$ 100.00
Steel Span Pole, 30’ (9.0 m)	330-16-7050	\$ 250.00
Steel Span Pole, all other lengths	330-16-7016	\$ 250.00

All material not listed as salvage becomes the property of the Contractor. Properly handle, transport, then dispose in a suitable dump or recycle this material. Comply with all Federal and State hazardous waste laws and regulations.

In the presence of the Engineer, verify the condition and quantity of salvage material prior to removal. After removal transport and store the material protected from moisture, dirt, and other damage. Coil and secure copper cable separate from other cable such as galvanized support strand.

Within 4 working days of removal, return the State owned salvage material to the Department of Transportation Stores warehouse listed below. Supply all necessary manpower and

equipment to load, transport, and unload the material. The condition and quantity of the material after unloading will be verified by the Engineer.

DOT Salvage Store #134  
660 Brook Street  
Rocky Hill, CT

Contact Materials Management Salvage Coordinator, at (860) 258-1980, at least 24 hours prior to delivery.

Municipal Owned Traffic Signal Equipment

Return all municipal owned material such as pre-emption equipment to the Town.

**Article 11.18.04 – Method of Measurement:**

This work will be measured as a Lump Sum.

**Article 11.18.05 – Basis of Payment:**

This work will be paid for at the contract lump sum price for “Removal and/or Relocation of Traffic Signal Equipment” which price shall include relocating signal equipment and associated hardware, all equipment, material, tools and labor incidental thereto. This price shall also include removing, loading, transporting, and unloading of signal equipment/materials designated for salvage and all equipment, material, tools and labor incidental thereto. This price shall also include removing and disposing of traffic signal equipment not to be salvaged and all equipment, material, tools and labor incidental thereto.

Payment is at the contract lump sum price for “Removal and/or Relocation of Traffic Signal Equipment” inclusive of all labor, vehicle usage, storage, and incidental material necessary for the complete removal of abandoned equipment/material and/or relocation of existing traffic signal equipment/material. Payment will also include the necessary labor, equipment, and material for the complete restoration of all affected areas.

A credit will be calculated and deducted from monies due the Contractor equal to the listed value of salvage material not returned or that has been damaged and deemed unsalvageable due to the Contractor’s operations.

Pay Item	Pay Unit
Removal and/or Relocation of Traffic Signal Equipment	L.S. (L.S.)

s:\traffic1406\signal specs\specs\1118012A-REMO & RELO T S EQUIP-Projects

## **ITEM #1131002A – REMOTE CONTROL CHANGEABLE MESSAGE SIGN**

**Description:** Work under this item shall include furnishing and maintaining a trailer-mounted, “Changeable Message Sign”, “Remote Control Changeable Message Sign”, “Changeable Message Sign with Radar”, or “Remote Control Changeable Message Sign with Radar” whichever is applicable, at the locations indicated on the plans or as directed by the Engineer.

**Materials:** The full matrix, internally illuminated variable message sign shall consist of a LED, fiber optic, lamp matrix, or hybrid magnetically operated matrix – LED message board; and a computer operated interface, all mounted on a towable, heavy duty trailer.

The sign shall have a minimum horizontal dimension of 115 inches and rotate a complete 360 degrees atop the lift mechanism.

In the raised position, the bottom of the sign shall be at least 7 feet above the roadway. The messages displayed shall be visible from a distance of 1/2 mile and be clearly legible from a distance of 900 feet during both the day and night.

The lighting system shall be controlled both manually and by a photocell for automatic sign dimming during nighttime use.

The sign shall be capable of storing a minimum of 100 preprogrammed messages and be able to display any one of those messages upon call from the trailer mounted terminal and/or through the cellular telephone hookup for the remote controlled sign.

The sign shall be a full matrix sign that is able to display messages composed of any combination of alphanumeric text, punctuation symbols, and graphic images (notwithstanding NTCIP limitations). The display shall be capable of producing arrow functions. Full- matrix displays shall allow the use of graphics, traffic safety symbols and various character heights.

Standard messages shall be displayed in a three-line message format with 8 characters per line. The letter height shall not be less than 18 inches.

The sign shall utilize yellow green for the display with a black background. Each matrix shall have a minimum size of 6 x 9 pixels. Each pixel shall utilize a minimum of four high output yellow green LEDs or equivalent light source. The LEDs or light source shall have a minimum 1.4 candela luminance intensity, 22 degrees viewing angle, and wavelength of 590 (+/- 3) nanometers.

For hybrid magnetically operated matrix – LED matrix, each pixel shall have one single shutter faced with yellow green retro-reflective sheeting with a minimum of four high output yellow green LEDs or equivalent light source. The hybrid magnetically operated matrix – LED matrix sign shall be capable of operating in three display modes; shutter only, LED only, and both LED and shutter. These modes shall be automatically controlled by a photocell for day and night conditions and also capable of being manually controlled through the software.

The sign shall be controlled by an on-board computer. The sign shall automatically change to a preselected default message upon failure. That default message shall remain on display until the problem is corrected.

The sign shall include all necessary controls, including, but not limited to, personal computer, keyboard or alphanumeric hand-held keyboard, and software. The sign shall interface with PCs, cellular phones, and radar speed detection devices as required.

Controls shall be furnished for raising and lowering the message board, aligning the message board and, for solar powered units, a read-out of the battery bank charge.

Power shall be provided by a self-contained solar maintained power source or a diesel engine driven generator. Hardware for connection to a 110-volt power source shall also be provided.

Solar powered signs shall display programmed messages with the solar panel disconnected, in full night conditions, for a minimum of 30 consecutive days.

Remote Control Changeable Message Signs shall include one (1) industrial-grade cellular telephone and be equipped with a modem to control the sign and a security system to prevent unauthorized access. The security system shall allow access only through use of a code or password unique to that sign. If the proper code or password is not entered within 60 seconds of initial telephone contact, the call will be terminated. Remote control for the Remote Control Changeable Message Sign shall be by cellular telephone and touch tone modem decoder.

The radar equipped signs shall include a high-speed electronic control module (ECM-X), Radar SI transceiver, signal processing board and radar logging software.

The radar software will operate the sign in four modes:

- 1) The sign will display words "YOUR SPEED" followed by the speed (2 digits). The display will repeat the message as long as vehicles are detected. The sign will blank when no vehicles are present.
- 2) The sign will display a series of up to six messages (programmed by the user) when a preset speed (programmed by the user) is exceeded. The sign will blank when no vehicles are present.
- 3) Will perform like mode #2 with the addition of displaying the actual speed with it.
- 4) The sign will work as a standard Changeable Message Sign or Remote Control Changeable Message Sign with no radar.

**Construction Methods:** The Contractor shall furnish, place, operate, maintain and relocate the sign as required. When the sign is no longer required, it shall be removed and become the property of the Contractor. The cellular telephone required for the Remote Control Changeable Message Sign shall be provided to the Engineer for his use, and subsequently returned to the Contractor.

When the sign is not in use, it shall either be turned off with a blank display or turned from view.

Any signs that are missing, damaged, defaced or improperly functioning so that they are not effective, as determined by the Engineer and in accordance with the ATSSA guidelines contained in "Quality Standards for Work Zone Traffic Control Devices," shall be replaced by the Contractor at no cost to the State.

**Method of Measurement:** This work will be measured for payment for each "Changeable Message Sign", "Remote Control Changeable Message Sign", "Changeable Message Sign with Radar", or "Remote Control Changeable Message Sign with Radar", whichever applies, furnished and installed, for the number of calendar days that the sign is in place and in operation, measured to the nearest day. When a sign is in operation for less than a day, such a period of time shall be considered to be a full day regardless of actual time in operation.

**Basis of Payment:** This work will be paid for at the Contract unit price per day for each "Changeable Message Sign", "Remote Control Changeable Message Sign", "Changeable Message Sign with Radar", or "Remote Control Changeable Message Sign with Radar" which price shall include placing, maintaining, relocating and removing the sign and its appurtenances and all material, labor, tools and equipment incidental thereto. Additionally, for the "Remote Control Changeable Message Sign", or "Remote Control Changeable Message Sign with Radar", the cellular telephone service and telephone charges shall be included.

<u>Pay Item</u>	<u>Pay Unit</u>
Remote Control Changeable Message Sign	Day

**ITEM #1210101A – 4” WHITE EPOXY RESIN PAVEMENT MARKINGS**

**ITEM #1210102A – 4” YELLOW EPOXY RESIN PAVEMENT MARKINGS**

**ITEM #1210103A – 6” WHITE EPOXY RESIN PAVEMENT MARKINGS**

**ITEM #1210104A – 8” WHITE EPOXY RESIN PAVEMENT MARKINGS**

**ITEM #1210105A – EPOXY RESIN PAVEMENT MARKINGS, SYMBOLS AND LEGENDS**

**ITEM #1210106A – 12” WHITE EPOXY RESIN PAVEMENT MARKINGS**

**SECTION 12.10 – EPOXY RESIN PAVEMENT MARKINGS, SYMBOLS AND LEGENDS is amended as follows:**

*Delete “SYMBOLS AND LEGENDS” from the title of the section.*

**SECTION 12.10.03 – Construction Methods is amended as follows:**

*Delete the entire sections titled “3. Performance and Warranty:” and “WARRANTY:” and replace them with the following:*

**3. Initial Performance:** The retroreflectivity of the markings applied must be measured by the Contractor three (3) to fourteen (14) days after installation. A Certified Test Report (CTR), in accordance with Section 1.06.07, must be submitted to the Engineer no later than ten (10) days after the measurements are taken using the procedures and equipment detailed below:

Test Lots - The following test lots shall be randomly selected by the Engineer to represent the line markings applied:

Table 3.1: Line Test Lots

Length of line	Number of Lots	Length of Test Lot
< 1.0 mi. (1.5 km)	1	1000 ft. (300 m)
≥1.0 mi. (1.5 km)	1 per 1.0 mi. (1.5 km)	1000 ft. (300 m)

ITEM #1210101A  
 ITEM #1210102A  
 ITEM #1210103A  
 ITEM #1210104A  
 ITEM #1210105A  
 ITEM #1210106A

## **Measurement Equipment and Procedure**

### Portable Retroreflectometer

1. Skip line measurements shall be obtained for every other stripe, taking no more than two readings per stripe with readings no closer than 20 in. (0.5 m) from either end of the marking.
2. Solid line test lots shall be divided into ten sub-lots of 100 ft. (30 m) length and measurements obtained at one randomly select location within each subplot.
3. For symbols and legends, 10 percent of each type shall be measured by obtaining five (5) measurements at random locations on the symbol or legend.
4. The Apparatus and Measurements shall be made in accordance with ASTM E1710 (Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer) and evaluated in accordance with ASTM D7585/D7585M (Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments).

### Mobile Retroreflectometer

1. Calibration of the instruments shall be in accordance with the manufacturer's instructions.
2. Retroreflectivity shall be measured in a manner proposed by the Contractor and approved by the Engineer. The basis of approval of the test method will be conformance to a recognized standard test method or provisional standard test method.

The measurements shall be obtained when the pavement surface is clean and dry and shall be reported in millicandellas per square foot per foot candle -  $\text{mcd}/\text{ft}^2/\text{fc}$  (millicandelas per square meter per lux ( $\text{mcd}/\text{m}^2/\text{lux}$ )). Measurements shall be obtained sequentially in the direction of traffic flow.

## **Additional Contents of Certified Test Report**

The CTR shall also list:

- Project and Route number
- Geographical location of the test site(s), including distance from the nearest reference point.
- Manufacturer and model of retroreflectometer used.
- Most recent calibration date for equipment used.
- Grand Average and standard deviation of the retroreflectivity readings for each line, symbol or legend.

**Initial Performance:**

In order to be accepted, all epoxy resin pavement markings must meet the following minimum retroreflectivity reading requirement:

**White Epoxy:** minimum retroreflectivity reading of 400 mcd/ft<sup>2</sup>/fc (mcd/m<sup>2</sup>/lux)

**Yellow Epoxy:** minimum retroreflectivity reading of 325 mcd/ft<sup>2</sup>/fc (mcd/m<sup>2</sup>/lux)

At the discretion of the Engineer, the Contractor shall replace, at its expense, such amount of lines, symbols and legends that the grand average reading falls below the minimum value for retro-reflectivity. The Engineer will determine the areas and lines to be replaced. The cost of replacement shall include all materials, equipment, labor and work incidental thereto.

## **ITEM #1220013A – CONSTRUCTION SIGNS - BRIGHT FLUORESCENT SHEETING**

**Article 12.20.01 – Description:** The Contractor shall furnish construction signs with bright fluorescent sheeting and their required portable supports or metal sign posts that conform to the requirements of NCHRP Report 350 (TL-3). The construction signs and their required portable supports or metal sign posts shall conform to the signing requirements stated in Article 9.71 "Maintenance and Protection of Traffic", as shown on the plans and/or as directed by the Engineer.

**Article 12.20.02 – Materials:** Prior to using the construction signs and their portable supports, the Contractor shall submit to the Engineer a copy of the Letter of Acceptance issued by the FHWA to the manufacturer documenting that the devices (both sign and portable support tested together) conform to NCHRP Report 350 (TL-3).

Portable sign supports shall be designed and fabricated so as to prevent signs from being blown over or displaced by the wind from passing vehicles. Portable sign supports shall be approved by the Engineer before they are used. Mounting height of signs on portable sign supports shall be a minimum of 1 foot and a maximum of 2 feet, measured from the pavement to the bottom of the sign.

All sign faces shall be rigid and reflectorized. Sheet aluminum sign blanks shall conform to the requirements of Article M.18.13. Metal sign posts shall conform to the requirements of Article M.18.14. Application of reflective sheeting, legends, symbols, and borders shall conform to the requirements specified by the reflective sheeting manufacturer. Attachments shall be provided so that the signs can be firmly attached to the portable sign supports or metal posts without causing damage to the signs. A Materials Certificate and Certified Test Report conforming to Article 1.06.07 shall be required for the reflective sheeting.

The following types of construction signs shall not be used: mesh, non-rigid, roll-up, corrugated or waffle board types substrates, foam core and composite aluminum sign substrates.

### **Reflective sheeting shall conform to the following:**

The fluorescent orange prismatic retroreflective sheeting shall consist of prismatic lenses formed in a transparent fluorescent orange synthetic resin, sealed, and backed with an aggressive pressure sensitive adhesive protected by a removable liner. The sheeting shall have a smooth surface.

#### Physical Properties:

##### A. Photometric - Coefficient of Retroreflection $R_A$

When the sheeting applied on test panels is measured in accordance with ASTM E 810, it shall have minimum coefficient of retroreflection values as shown in Table I. The rotation angle shall be as designated by the manufacturer for test purposes, the observation angles

shall be 0.2 degrees and 0.5 degrees, the entrance angles (component B<sub>1</sub>) shall be -4 degrees and +30 degrees.

**TABLE I**  
Minimum Coefficient of Retroreflection R<sub>A</sub>  
Candelas per footcandle per square foot

Observation Angle (deg.)	Entrance Angle (deg.)	R <sub>A</sub> Orange
0.2	- 4	200
0.2	+ 30	90
0.5	- 4	80
0.5	+ 30	50

The rotation shall be as designated by the manufacturer.

**B. Daytime Color**

Color shall conform to the requirements of Table II. Daytime color and maximum spectral radiance factor (peak reflectance) of sheeting mounted on test panels shall be determined instrumentally in accordance with ASTM E 991. The values shall be determined on a Hunter Lab Labscan 6000 0/45 Spectrocolorimeter with option CMR 559 (or approved equal 0/45 instrument with circumferential viewing illumination). Computations shall be done in accordance with ASTM E 308 for the 2 degree observer.

**TABLE II**  
Color Specification Limits\*\* (Daytime)

Color	1		2		3		4		Reflectance Limit Y (%)	
	X	Y	X	Y	X	Y	X	Y	MIN	MAX
Orange (new)	.583	.416	.523	.397	.560	.360	.631	.369	28	-
Orange (weathered)	.583	.416	.523	.397	.560	.360	.631	.369	20	45

Maximum Spectral Radiance Factor, new: 110%, min.  
weathered: 60%, min.

\*\* The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 standard colorimetric system measured with standard illuminant D65.

**C. Nighttime Color**

Nighttime color of the sheeting applied to test panels shall be determined instrumentally in accordance with ASTM E 811 and calculated in the u', v' coordinate system in accordance with ASTM E 308. Sheeting shall be measured at 0.33 degrees observation

and -4 degree entrance at rotation as determined by the manufacturer for test purposes. Color shall conform to the requirements of Table III.

**TABLE III**  
Color Specification Limits \*\* (Nighttime)

Color	1		2		3		4	
	u'	v'	u'	v'	u'	v'	u'	v'
Orange (new and weathered)	.400	.540	.475	.529	.448	.522	.372	.534

**D. Resistance to Accelerated Weathering**

The retroreflective surface of the sheeting shall be weather resistant and show no appreciable cracking, blistering, crazing, or dimensional change after one year's unprotected outdoor exposure in south Florida, south-facing and inclined 45 degrees from the vertical, or after 1500 hours exposure in a xenon arc weatherometer in accordance with ASTM G26, Type B, Method A. Following exposure, panels shall be washed in a 5% HCL solution for 45 seconds, rinsed thoroughly with clean water, blotted with a soft clean cloth and brought to equilibrium at standard conditions. After cleaning, the coefficient of retroreflection shall be not less than 100 when measured as in D.2, below, and the color is expected to conform to the requirements of Tables II and III for weathered sheeting. The sample shall:

1. Show no appreciable evidence of cracking, scaling, pitting, blistering, edge lifting or curling or more than 0.031 inch shrinkage or expansion.
2. Be measured only at angles of 0.2 degrees observation, -4 degrees entrance, and rotation as determined by the manufacturer for test purposes. Where more than one panel of color is measured, the coefficient of retroreflection shall be the average of all determinations.

**E. Impact Resistance**

The retroreflective sheeting applied according to the manufacturer's recommendations to a test panel of alloy 6061-T6, 0.040 inch by 3 inches by 5 inches and conditioned for 24 hours, shall show no cracking outside the impact area when the face of the panel is subjected to an impact of 100 inch-pounds, using a weight with a 0.625 inch diameter rounded tip dropped from a height necessary to generate an impact of 100 inch-pounds, at test temperatures of both 32° F and 72° F.

**F. Resistance to Heat**

The retroreflective sheeting, applied to a test panel as in E., above, and conditioned for 24 hours, shall be measured in accordance with Paragraph A. at 0.2 degree observation and -4 degree entrance angles at rotation as determined by the manufacturer for test purposes and

exposed to  $170^{\circ} \pm 5^{\circ}$  F for 24 hours in an air circulating oven. After heat exposure the sheeting shall retain a minimum of 70% of the original coefficient of retroreflection.

**G. Field Performance:**

Retroreflective sheeting processed and applied to sign blank materials in accordance with the sheeting manufacturer's recommendations, shall perform effectively for a minimum of 3 years. The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retroreflection is less than 100 when measured at 0.2 degrees observation and -4 degree entrance. All measurements shall be made after sign cleaning according to the sheeting manufacturer's recommendations.

**Article 12.20.03 – Construction Methods:** Ineffective signs, as determined by the Engineer and in accordance with the ATSSA guidelines contained in "Quality Standards for Work Zone Traffic Control Devices", shall be replaced by the Contractor at no cost to the State.

Signs and their portable sign supports or metal posts that are no longer required shall be removed from the project and shall remain the property of the Contractor.

**Article 12.20.04 – Method of Measurement:** Construction Signs - Bright Fluorescent Sheeting will be measured for payment by the number of square feet of sign face. Sign supports will not be measured for payment.

**Article 12.20.05 – Basis of Payment:** "Construction Signs - Bright Fluorescent Sheeting" required and used on the project will be paid for at the Contact unit price per square foot. This price shall include the furnishing and maintenance of the signs, portable sign supports, metal sign posts and all hardware. Each sign and support or posts will be paid for once, regardless of the number of times it is used.

<b>Pay Item</b>	<b>Pay Unit</b>
Construction Signs – Bright Fluorescent Sheeting	S.F.

## **PERMITS AND/OR SUPPLEMENTAL TO FORM 816 AND REQUIRED PROVISIONS**

The following Permits and/or Supplemental to Form 816 and Required Provisions follow this page and are hereby made part of this Contract.

- **PERMITS AND/OR PERMIT APPLICATIONS**

CTDOT Coastal Consistency Review Form                      Approved August 11, 2014

- **SUPPLEMENTAL SPECIFICATIONS TO STANDARD SPECIFICATIONS FORM 816**

- **Construction Contracts - Required Contract Provisions (State Funded Only Contracts)**



**CONNECTICUT DEPARTMENT OF TRANSPORTATION**  
**Office of Environmental Planning**  
**Water and Natural Resources**  
**COASTAL CONSISTENCY REVIEW FORM**

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*This form must be completed when a state project falls within the coastal boundary as defined in subsection (b) of section 22a-94 of the Connecticut General Statutes. The following information is being provided to the Office of Environmental Planning (OEP) for review with consistency with the Coastal Goals and Policies defined in CGS section 22a-92.*

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**State Project #: 0035-0195**  
**Designer: Michelle Saldana Phone: 860-594-3348**  
**Project Description: I-95 Pavement Preservation**  
**Date of submittal: 07/07/2014**  
**Anticipated Construction Start Date: Spring 2015**  
**Town: Darien & Norwalk**

**Required Attachments:** Location map; project description; pertinent plan sheets (including E & S), and site photos.

**Stormwater Treatment Concerns**

- Does the project result in an increase in impervious surface? If so, how much (square feet) and what percentage increase over existing does that represent? *This project consists of preserving the pavement by milling and overlaying. This activity will be done from curb to curb, therefore, it won't result in an increase of impervious surface.*
- If drainage systems are being upgraded or modified, what Primary and Secondary Stormwater Treatment measures (as defined by the 2004 DEP Stormwater Quality Manual) have been incorporated into the design? *Because the roadway work will be limited to the pavement only, the existing drainage systems will remain in place. Thus, no drainage systems are being upgraded or modified with this project.*
- The ultimate outfall of any drainage on the project must be identified on the plans provided. Please provide a status on the stability of that outfall and if any improvements are required in conformance with the DOT Drainage Manual: *The general scope consists of milling 2.5" of the existing pavement and overlaying it with 3" of Polymer Modified Asphalt from curb to curb. Given the limited scope and the nature of the work, a survey was not obtained. Therefore, the outfall of any drainage cannot be identified on the plans.*

**Erosion & Sedimentation Control**

- Does the project result in ground disturbance / erodible surface? If so, how much? (acres): *Since the work will be confined to the existing pavement, no grading will be required. Thus, the project won't result in any ground disturbance/erodible surface.*

- What is the anticipated construction duration? *The project will be completed in one construction season, from April to October (approximately 7 months).*
- Have staging and storage, constructability, and access needs been incorporated into the plan and considered? *Staging and storage, constructability and access needs have been incorporated into the plans. A Notice to Contractor will be included in the Contract to address the staging and storage within regulated area.*
- Are engineered measures for E & S necessary during construction? Describe how the project is in accordance with the 2002 CT E & S Guidelines: *The project consists of milling and overlaying, no grading is expected to occur, and therefore, no E & S measures will be necessary during construction.*

THIS SECTION TO BE COMPLETED BY ENVIRONMENTAL PLANNING

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It has been determined that:

- This project has been reviewed and found to be consistent with the Coastal Goals and Policies as defined in CGS section 22a-92.
- More information is required at this time to ensure consistency with coastal goals and policies. Please provide the information listed below.
- This project has been determined to *not* be in conformance with coastal goals or policies or may have an adverse impact on coastal resources. OEP has determined that a Coastal Consistency Review Form must be prepared and submitted to the Department of Energy and Environmental Protection (via OEP) for review and approval.

*If the project design / scope of work changes, affecting water or natural resource impacts; the project must be resubmitted for review by Environmental Planning. All projects must be in conformance with Section 1.10 of the Form 816, Standard Specifications for Roads, Bridges and Incidental Construction. Any other Time of Year Restrictions, and permit special conditions for other programs must be adhered to at all times.*

Required Information / Special Conditions / Notes:

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**Natural Diversity Database (NDDDB) and Drinking Water Resources**

Do the project limits possibly contain State or Federally listed species?  Yes  No If yes, further coordination with OEP is required for this project.

Does the project contain public watershed, a well head protection area, and/or aquifer protection area (APA)?  Yes  No If yes, further coordination with OEP and possibly the Department of Public Health and Water Company will be required for this project.

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Peregrine Falcon, a state threatened species, is located within the project limits. An amended item for

Form 816, Section 1.10 will need to be included in the project contract and will be provided by OEP once  
It has been finalized.

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Reviewed By: Michael Salter *MS 7/23/14* Extension: 2933 Date: 7/23/2014  
Approved By: *Andrew Kim* Extension: 2157 Date: 8-11-2014

cc: Andrew Davis – Kevin Carifa – Ryan Apanovitch<sup>KKA</sup>  
Scott Bushee – Byong Kim