

**ADDENDUM #1**

**EXHIBIT A**

**DESCRIPTION OF GOODS AND SERVICES**

**SPECIAL PROVISIONS**

**FORM 816:** FORM 816 is ConnDOT's "Standard Specifications for Roads, Bridges and Incidental Construction". Work is to be in accordance with FORM 816 including all supplements and other applicable standards. Copies of these Standard Specifications, FORM 816 may be purchased from:

State of Connecticut  
Connecticut Department of Transportation  
Manager of Contracts  
P.O. Box 317546  
2800 Berlin Turnpike  
Newington, CT. 06131-7546

The price is twenty dollars (\$20.00) if FORM 816 is mailed and sixteen dollars (\$16.00) if FORM 816 is picked up. Checks are to be made out to: Treasurer - State of Connecticut.

**OR**

You may go to the following:

<http://www.ct.gov/dot/cwp/view.asp?a=3609&q=455784>

**CONTRACTOR NOTIFICATION:** A period of two (2) consecutive days or forty-eight (48) hours, Saturday and Sunday excluded, shall be the time limit for attempting to contact a low-award Contractor prior to contacting the next lowest available Contractor. The availability of a Contractor to start work when requested, normally within five (5) working days, shall be considered when selecting the "lowest available qualified Contractor". Another factor shall be the availability of equipment.

**WORK DAY:** In accordance with the normal work schedule in use by ConnDOT, prices are requested for rental rates based on seven and one-half (7 ½) hour work day. The rates requested are for rentals by the hour. When operations require work in excess of seven and one-half (7 ½) hours in any one (1) day, payment shall be made at the applicable hourly rate as bid for the actual hours worked.

**PREVAILING WAGES:** Utilization of Contract shall be in accordance with State funding and its corresponding regulations. Prevailing wage regulations shall be applied as follows:

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State Funds: Purchase orders issued for one hundred thousand dollars (\$100,000.00) or higher require the payment of prevailing wages and associated provisions. Purchase orders issued below one hundred thousand dollars (\$100,000.00), do not require payment of prevailing wages and associated provisions.

MINIMUM WAGE RATES: The wages paid to any mechanic, laborer or worker employed in the work contracted to be done shall be at a rate equal to the rate of wages customary or prevailing for the same work in the same trade or occupation and in the area in which Contract is to be performed. Payment shall be made to each employee engaged in work under Contract in the trade or occupation listed, not less than the wage rate set by category in accordance with wage schedule contained herein this ITB. In the event it becomes necessary for Contractor or any Subcontractor to employ any mechanic, laborer or worker in a trade or occupation for which no minimum wage is set forth, Contractor shall immediately notify the Labor Commissioner, who shall ascertain the minimum applicable wage rate from the time of the initial employment of the person affected and during the continuance of such employment. Every Contractor or Subcontractor performing work for the State is subject to the provisions noted herein, as determined by the Labor Commissioner, and shall post the prevailing wages in prominent and easily accessible places at each work site. Information Bulletin #2, contained herein this ITB, regarding Connecticut General Statutes (CGS) § 31-55a. Questions regarding wage regulations should be directed to the State of Connecticut, Department of Labor (DOL), Division of Wage and Workplace Standards, at 860-263-6790.

WAGE REGULATIONS: This ITB contains wage scales as provided by the DOL. All provisions outlined in these regulations shall be respected throughout the life of Contract including any extensions. During the term of Contract the State shall verify that these wage scales are being paid in accordance with CGS § 31. This regulation mandates certified payrolls and a statement of compliance to be submitted on a monthly basis to ConnDOT. **The wage certification form shall be included with the bid submission.** Contractors are cautioned that utilization of the term “working supervisor” does not exclude Contractor from paying this position less than the actual work being performed by this person as specified in the prevailing wage scales. **Contractor shall return the wage certification form with their bid.**

Contractor shall comply with the provisions of CGS § 31-55a, which reads as follows: Each Contractor that is awarded a Contract on or after October 1, 2002, for (1) the construction of a state highway or bridge that falls under the provisions of section 31-54, or (2) the construction, remodeling, refinishing, refurbishing, rehabilitation, alteration or repair of any public works project that falls under the provisions of section 31-53 shall contact the Labor Commissioner on or before July first of each

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year, for the duration of such Contract, to ascertain the prevailing rate of wages on an hourly basis and the amount of payment or contributions paid or payable on behalf of each mechanic, laborer or worker employed upon the work contracted to be done, and shall make any necessary adjustments to such prevailing rate of wages and such payment or contributions paid or payable on behalf of each such employee, effective each July 1<sup>st</sup>.

**SAFETY AND HEALTH:** Contractor supplying services is required to comply with the current Connecticut Occupational Safety and Health Standards, Volume I, General Industry Standards, Volume II, Construction Safety and Health Regulations.

**EQUIPMENT REGULATIONS:** Contractor renting or supplying equipment or vehicles shall equip them with all required devices. Equipment is to be in compliance with all of the applicable Federal, State and municipal laws, ordinances and regulations in force at the time of Contract.

**EQUIPMENT INSPECTION:** Contractor's equipment shall be in good operating condition and available for inspection by a State Inspector. The inspection shall be conducted within the State of Connecticut and shall be successfully completed prior to the issuance of a purchase order. If Contractor's equipment is unavailable for inspection or determined by the State to be unfit to perform the work specified, Contractor shall be so informed. The requesting unit may then contact the next low Contractor offering the equipment or service needed.

**MOTOR VEHICLE REGISTRATION:** Under Connecticut law, a commercial vehicle used by Contractors in connection with work under Contract may be subject to Connecticut registration requirements. CGS Section 14-12a requires such registration for any vehicle which is most frequently garaged in this state, or most frequently leaves from and returns to one or more points within this State in the normal course of operations. In addition, a vehicle shall obtain Connecticut registration if it continuously receives and discharges cargo within the State. Contractor shall comply with all applicable provisions and regulations of Title 14.

**TRANSPORTATION:** Cost of transporting equipment to and from the area in which it is used shall be the responsibility of Contractor. No transportation charges, setup or breakdown fees or charges shall be allowed.

**SAFETY EQUIPMENT:** Contractor is responsible for all personal protective equipment required by the Contractor's employees while participating in this Contract.

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**INTERMITTENT EQUIPMENT USE:** In situations where equipment is used on an intermittent basis, Contractor is advised to qualify basis of payment for such equipment with ConnDOT's District Maintenance personnel prior to usage.

**EQUIPMENT EXCEPTIONS:** In the event a Contractor is working on a project and additional unanticipated equipment is required, the State may request the existing Contractor to provide additional acceptable pieces of equipment. Charges for such equipment may be invoiced under the terms of Contract, provided that ConnDOT is advised of this in writing, and ConnDOT accepts and authorizes these charges prior to actual use. In the event that the on-site Contractor cannot fulfill the unanticipated needs, the State reserves the right to contact the next awarded Contractor in accordance with the methods listed above. It is the intention of this section to allow the State to complete projects in the most expedient manner possible. Efforts shall be made to use the contracted Contractor whenever possible.

**ENVIRONMENTAL COMPLIANCE:** Contractor shall be required to be in compliance at all times with the environmental regulations promulgated by the State of Connecticut, Department of Energy and Environmental Protection (DEEP). During any period that a Contractor is found to be in noncompliance, no new purchase orders shall be issued.

Contractor shall comply with Section 1.07.16 and Section 1.10.03, the ConnDOT's Best Management Practices, in the Standard Specifications, FORM 816 and any other sections that may apply including addenda.

**GEOGRAPHICAL LIMITS:** The geographical limits of each district are outlined on the State map contained herein this ITB.

#### **TRAFFIC CONTROL:**

- A. **Contractor Furnished Traffic Control:** When Contractor furnished traffic control is used Contractor shall supply and be responsible for all labor including two (2) Uniformed Flaggers and/or Uniformed Municipal Police Officers; equipment, signs, sign support, cones, and other materials necessary. Traffic Control shall be performed in accordance with "Traffic Control During Maintenance Operations", including the general notes for traffic control and traffic control patterns (Plan 13 - Plan 18), included. When ordered, Contractor furnished traffic control shall be paid at the additional rate added to the base unit bid price. When work is performed, the State shall have the option to determine who is responsible for traffic control. If, in the opinion of the State, Uniformed Municipal Police Officers are required, Contractor shall be responsible for providing the Officers up to a maximum of two (2). Any additional Uniformed Municipal Police Officers shall be

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paid for at the rate of seventy-seven dollars (\$75.00) each per hour. The cost for additional Uniformed Municipal Police Officers shall not be used in determining the low-awarded Contractor for the project. Traffic personnel are responsible for any and all representatives from ConnDOT including Inspectors and Lab personnel.

- B. Uniformed Flaggers: defined as: Persons who have successfully completed Flagger training by the American Traffic Safety Services Association, National Safety Council or other approved programs. A copy of the Flagger's training certificate shall be provided to ConnDOT Engineer before the Flagger performs any work on the project. Uniformed Flaggers shall wear garments (including high visibility headgear) so as to be readily distinguishable as a Flagger in accordance with Standard 6E-3 of the MUTCD, and these specifications. A Uniformed Flagger shall also be equipped with a Stop/Slow paddle that is at least 18 inches in width with letters at least 6 inches high and conforms to Standard 6E-4 of the MUTCD. Traffic control shall be performed in accordance with "Traffic Control During Maintenance Operations" including the general notes for traffic control, included and conform to NCHRP Report 350 (TL-3).
- C. State Furnished Traffic Control: When ConnDOT is responsible for traffic control it shall provide and install signs, barricades, traffic cones, and traffic delineators, as well as provide Flaggers.

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#### LIQUID SURFACE TREATMENT

**TECHNICAL DESCRIPTION:** This technical specification is for Contractor furnished and applied Liquid Surface Treatment; the purchase of liquid emulsions, treatment of stone, polymer additive; rental of an aggregate spreader, rubber-tired roller, triaxle dump trucks with tow bar, and equipment operators. This specification provides a method for Contractor to furnish materials in bulk, Complete in Place or Complete in Place by square yard.

**STATEMENT REQUIRED:** A statement of Contractor's financial responsibility including, but not necessarily limited to, plant and mechanical equipment along with personnel available for work in the State may be required.

**ASSESSMENTS:** At ConnDOT's discretion, Contractor shall be charged for damages or loss as a result of noncompliance with specification, defective equipment, negligent operation of equipment, delays caused by late delivery by Contractor, delays caused by inability of Contractor's equipment to get bitumen up to the application temperature after delivery, or delays due to Contractor having insufficient quantities of bitumen at application temperatures on the job for continuous operation. Work may be suspended until ConnDOT is satisfied that necessary corrections have been made to assure proper operation and adequate service.

When a Contractor fails to make delivery in accordance with the terms of Contract, a monetary assessment shall be imposed for the difference between award price and the price ConnDOT is required to pay in the open market, as well as any additional cost of ConnDOT's idle equipment and labor held pending delivery, up to a maximum of four hundred dollars (\$400.00) an hour (applies only to liquid emulsions).

Where bituminous material is applied and within sixty (60) days shows abnormal loss of aggregate or bleeding, ConnDOT reserves the right to demand the replacement, at no cost to ConnDOT. No further orders shall be placed with a Contractor whose material is not acceptable, until a product having acceptable field results can be furnished by said Contractor.

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**EXCEPTION TO ASSESSMENTS:** Contractor shall not be assessed for failure to deliver material under Contract where in the opinion of ConnDOT such failures result from Contractor's inability to secure materials as a result of federal regulations, strikes or conditions over which Contractor has no control. Exemption from penalties shall only be considered where Contractor has furnished proof satisfactory to ConnDOT that the failure to comply with the terms in this contract was due to conditions stated above.

**MATERIAL REQUIREMENTS:** All component materials used for Contract shall comply with the FORM 816 and as specified herein.

- A. **AGGREGATE:** Stone shall meet the requirement of M.04.01, #8 (3/8" stone) by washed sieve analysis (AASHTO T11), Coarse aggregate for Bituminous Concrete Materials. ConnDOT shall supply the stockpile locations for the stone and shall supply a loader to receive and load the stone into Contractor's trucks during Liquid Surface Treatment operations.
- B. **TREATED STONE:** Aggregate shall be crushed quarry stone free from dust, soft stone, or other contaminants, with the minimum of 70% of the stone having a fractured face. All stone shall satisfy a 40% minimum for the abrasion test. Aggregate shall be treated with emulsion specified by ConnDOT Engineer prior to application with a bituminous material at the rate of 0.4% to 0.8% residual asphalt. Proper aggregate treatment shall be obtained by the use of a shafted pug mill with a digital readout belt scale. ConnDOT shall provide the location to stockpile the stone. The stone shall be pre-treated by Contractor at the stockpile location.
- C. **ASPHALT EMULSION:** AASHTO M 140 Grade MS-2 or RS-2, M 208 Grade CMS-2 or CRS-2, and M 316 CRS-2L Polymer Modified Cationic Emulsified Asphalts. Manufacturer shall be required to furnish a Certified Test Report (FORM 816, Article 1.06.07) for every 50,000 gallons of material supplied or for each two (2) week period that material is supplied to ConnDOT, whichever comes first to ConnDOT's Office of Research & Materials Testing Laboratory. Each shipment shall be accompanied by a material sample, delivered to the Division of Material Testing and approved prior to the materials being dispersed to ConnDOT.
- D. **POLYMER ADDITIVE:** The polymer latex rubber additive shall be BASF Butonal NS198 or approved equal. It is required that the polymer additive be added at the emulsion colloid mill at the time of manufacture. The polymer additive shall be introduced at a rate of 2 - 3 %. Use of the asphalt emulsion polymer rubber latex additive shall be determined by ConnDOT Director of Maintenance, in each District prior to the pre-construction meeting.

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**Table 1 Styrene/Butadiene Copolymer Dispersion**

Item	Limits
Solids Content (%):	63.0-65.0
pH:	4.5-5.0
Brookfield Viscosity: (RVT Spindle #3 at 20 RPM mPa-s)	250-2000
Bound Styrene (%):	24
Residual Monomer (%):	0.08 max
Specific Gravity:	0.94
Weight/Volume lb/gal):	7.8
(Kg/L):	0.94

On Exhibit B, Price Schedule, under item number 3, note the item for Polymer Additive (Additional per gallon). In addition, every shipment of material to the job site shall be accompanied by a shipping certificate stating:

1. Applicable purchase order and reference file numbers.
2. Date and method of shipment.
3. Name and address of agency to which material is supplied.
4. Quantity of material represented by the certificate.
5. Means of identifying the consignment such as batch or lot number.
6. Name of manufacturer supplying the material.
7. Date material was manufactured or produced.
8. The shipping certificate shall state that the materials furnished conform to all requirements of the specifications, and it shall be signed by an authorized agent, giving name and title, for the organization supplying the material.

E. **MATERIAL PLACEMENT**: When material is ordered and furnished, Contractor shall be directed by ConnDOT Engineer where and when the material shall be applied and the quantity required at each location.

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- F. **AGGREGATE PLACEMENT:** Prior to the placement of aggregate, the emulsion shall be applied at a rate of 0.30 - 0.45 gallons per square yard. The exact rate shall be determined in the field by ConnDOT Engineer taking into consideration the aggregate gradation, traffic quantity, traffic volume, and pavement condition.

The aggregate shall be spread uniformly by a self-propelled spreader at a rate of 21 - 28 pounds per square yard. The exact rate shall be determined in the field by ConnDOT Engineer to achieve a minimum amount of loose stone, while allowing for complete uniform coverage.

**MATERIAL SAMPLING, INSPECTING, AND TESTING:** ConnDOT's Division of Materials Testing shall approve the source of supply of each of the materials specified before the delivery is started. Only materials conforming to the requirements of these specifications and approved by the Division of Materials Testing shall be used.

All materials, sampling and testing shall conform to the applicable ConnDOT specifications and American Association of State Highway and Transportation Officials (AASHTO) specifications, and as stated herein for Bituminous Materials. Material shall not be delivered by any Contractor until the results of tests by ConnDOT show the material conforms to the specifications and is acceptable.

If, after trial, it is found that sources of supply which have been approved do not provide a uniform product or if the product from any source proves unacceptable at any time, Contractor shall provide approved material from other approved sources. Materials, which, after approval, have in any way become unsuitable for use, shall not be accepted by ConnDOT.

All materials being used are subject to inspection, test, or rejection at any time during the preparation. Contractor shall use no bulk-storage material until it has been inspected, tested, and approved by ConnDOT's Division of Materials Testing. Tests shall be made by and at the expense of ConnDOT unless otherwise noted in these specifications. It is understood and agreed that Contractor shall proceed with such use of the material at its own risk. Trial acceptance or rejection of the material in accordance with the terms of Contract shall be based upon the laboratory test results on samples taken under the supervision of ConnDOT's Division of Materials Testing.

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Contractor shall provide a Certified Test Report complying with Article 1.06.07 of FORM 816 for each of its suppliers and the material is in compliance with the ConnDOT required specifications and is the material Contractor intends to provide. Contractor shall also be required to furnish a Certified Test Report whenever material previously certified has been stored for a period exceeding three (3) weeks. In addition, ConnDOT reserves the right to sample the material whenever it deems necessary or shall require more frequent Certified Test Reports from Contractor whenever the characteristics of the material supplied may be altered or not representative of the mixture as indicated by previous certification. All samples and tests shall be from the storage tank from which truck tankers are loaded or from the truck tankers.

Materials shall be stored so as to ensure the preservation of their quality and fitness for the work and shall be located so as to facilitate prompt inspection. Materials stored by Contractor, even though approved before storage, shall be inspected prior to their delivery and shall meet the requirements of the specifications at that time.

**EQUIPMENT:** Sufficient certified scales must be operational at the plant for material from that plant to be used.

- A. All bituminous carriers shall be clean, free from dirt, foreign material and material from previous loadings. Such carriers shall contain no material which shall tend to clog pipelines and pumps of distributors. Contractor shall be responsible for any loss ConnDOT may suffer as the result of defective or improperly closed valves. Bituminous carriers delivering bituminous materials shall be equipped with satisfactory thermometer and heating apparatus to ensure that the material is in proper condition for application. Each carrier or tanker shall have a valve in the bulkhead for sampling purposes.
- B. Contractor-operated aggregate spreader shall be a self-propelled chip spreader type or approved equal. The aggregate spreader shall be equipped with a segregated screen. Contractor operated rubber-tired roller shall be a self-propelled pneumatic tire roller equipped with wide-tread compaction tires capable of exerting an average contact pressure of anywhere from 60 to 90 pounds per square inch uniformly over the surface.
- C. Contractor's bituminous distributors shall be equipped with approved tachometers, which should be checked and calibrated at the start of each oiling season, for use in determining accurate applications for all grades of asphalt, for varying widths of spray bars through coordination of vehicle speed and pump output. Distributors shall be equipped with full circulating bars and have sufficient spare sections of spray bars to apply bitumen in multiples of two (2)

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feet for any reasonable total width of application. Distributors shall be equipped with a hand hose in operating condition for use in covering areas inaccessible for standard spray bars. The distributor shall be equipped with two (2) squeegees for removing excess bitumen at starts and stops. Contractor's distributor shall be equipped with an approved calibrated measuring stick and/or gauge to determine at any time the approximate gallons of bitumen remaining in the tank of the distributor. Distributor operators shall be trained in the use of these devices.

- D. When material is applied, Contractor shall have the ability to apply 3,000 gallons continuously without interruption. Contractor shall provide two (2) qualified people on the distributor when requested by ConnDOT for hand hose operation or any other activity requiring the services of two (2) people.

When material is ordered and Contractor uses a feeder truck to supply a bituminous distributor, the tractor unit and operator of the feeder truck shall remain on the job and be readily available to supply the applying distributor until the feeder truck is empty.

A plant location shall be a site where at least 20,000 gallons storage for each grade of material required is available with pumping, weighing equipment, and heating facilities necessary to supply bituminous materials at a satisfactory applying temperature, all to be situated within the control of one (1) State Inspector. There shall be present at all times, when material is drawn for ConnDOT's purposes, a responsible and competent representative of the Contractor. Plants shall be subject to the approval of ConnDOT's Division of Materials Testing.

**SWEEPING:** ConnDOT shall be responsible for sweeping the termini in preparation for the Liquid Surface Treatment. Contractor shall be required to sweep the termini three days after the Liquid Surface Treatment has been completed. Contractor shall supply the haul trucks for its sweeping; ConnDOT shall supply the disposal site. The sweeper shall be mobile, front or side unloading hopper, right and left gutter brooms, capable of unloading into a standard 9-ton dump truck.

**DELIVERY:** Delivery of liquid emulsion shall be requested at least one (1) day prior to the day it is required. Contractor shall have liquid emulsion delivered to the destination specified, within the required application temperature range and ready to apply at time requested by ConnDOT's representative.

Emulsion temperature at the point of origin and at the time of delivery shall be between 150°F and 170° F. Emulsions shall be heated to the lowest temperature

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necessary to obtain a satisfactory application. No emulsion shall be heated above 170° F.

No material shall be accepted unless it is accompanied by a delivery slip for liquid emulsion (Form MAT 27) which has been properly processed and SIGNED BY THE WEIGHER, covering each delivery and also a Contractor's delivery slip. Form MAT 27 is to be signed by ConnDOT Representative. One (1) copy of Contractor's delivery slip is to be left with Client Agency at the time of delivery.

If material is returned and reshipped, it must be covered by a new Form MAT 27, and if the material is held over twenty-four (24) hours, it shall be re-sampled.

At no time shall the material be heated above specification limits as listed elsewhere herein, and Contractor's equipment shall be equipped with satisfactory thermometer and heating apparatus. In addition to this equipment, bituminous distributors are to be equipped with pumps in good condition and capable of circulating materials whereby specification temperatures may be maintained without burning of material adjacent to the heating flues.

When delivery of material is requested and subsequent to the request, due to a change in weather or for any other reason this material is not required, the request shall be canceled by telephone not less than six (6) hours previous to the time set for delivery. ConnDOT shall not be responsible for any charges that may be incurred by Supplier pertaining to a request for delivery if it has been properly canceled.

Generally, all delivery and/or distribution equipment shall be emptied daily. During periods of continuous operation, material may be carried over from one day to the next. If this occurs, it shall be Contractor's responsibility to stick or gauge the tank in the presence of ConnDOT's Representative at the close of the day and prior to the start of the following day, to verify quantity of material.

**LIQUID SURFACE TREATMENT:** Operation for this method shall include supply and application of emulsion, application of #8 crushed stone cover material (State supplied) and traffic control.

Contractor shall be required to supply all necessary equipment and personnel to accomplish this work including but not limited to distributor truck, haul trucks, aggregate spreader, pneumatic tired rollers and sweepers.

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**METHOD OF MEASUREMENT FOR LIQUID SURFACE TREATMENT:** The quantity of asphalt emulsion material (with or without polymer) delivered on Contract shall be calculated on the net weight of the material reported in tons, which shall be converted to the U.S. standard gallon based on the specific gravity of the asphalt emulsion material (with or without polymer) at 60° F reported in pounds per cubic foot (lb/ft<sup>3</sup>) through the following formula:

$$G = \frac{W \times 14960}{SG}$$

Where

G = Gallons to be measured for payment

W= Net weight of the asphalt emulsion (with or without polymer) material, in tons,

And

SG = Specific gravity of the asphalt emulsion (with or without polymer) material, in pounds per cubic foot (lb/ft<sup>3</sup>).

Aggregates delivered on Contract shall be calculated on the net weight in English tons.

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**BASIS OF PAYMENT FOR LIQUID SURFACE TREATMENT:** Asphalt emulsion material (with or without polymer) delivered in supply trucks shall be paid for at Contract unit price per gallon and shall be paid by the average daily production rate for the total purchase order. This price shall include loading, heating, weighing, delivering and the furnishing of all material, labor, freight, equipment, tools, and work incidental thereto.

- A. When a truck shipment of asphalt emulsion (with or without polymer) ordered by ConnDOT District Personnel is received at destination and it would not be in ConnDOT's best interests to spread this material, ConnDOT reserves the right to order the return of the material to the shipping point, paying only the cost of the return transportation on the actual number of gallons returned, regardless of any minimum load regulations.
- B. When the delivery of material is delayed due to any fault or negligence of Contractor, the charges for the return of the material shall not be paid. Asphalt emulsion material (with or without polymer) delivered from Contractor's plant into designated distributors or trucks shall be paid for at Contract price per gallon. This price includes heating, loading, weighing, delivering and applying, and furnishing of all labor, freight, equipment, tools, and work incidental thereto. ConnDOT shall pay only for material furnished and applied in the quantity and location, as directed by Representative of ConnDOT.

**LIQUID SURFACE TREATMENT COMPLETE IN PLACE (BY THE SQUARE YARD):** Operation for this method shall include supply and application of asphalt emulsion (with or without polymer), supply and application of aggregate or treated stone cover material and sweeping of termini three (3) days after completion and traffic control. All materials shall conform to the requirements set forth in the "Material Requirements" section within these specifications.

Contractor shall be required to supply all necessary equipment and personnel to accomplish this work including but not limited to distributor truck, haul trucks, aggregate spreader, pneumatic tired rollers and sweepers

**METHOD OF MEASUREMENT FOR LIQUID SURFACE TREATMENT COMPLETE IN PLACE (BY THE SQUARE YARD):**

The delivered and applied liquid surface treatment shall be measured by the actual number of square yards applied.

Traffic control shall not be measured for payment.

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##### **BASIS OF PAYMENT FOR LIQUID TREATMENT COMPLETE IN PLACE (BY THE SQUARE YARD):**

Liquid surface treatment materials furnished and applied shall be paid for at Contract unit price per square yard. This price shall include loading, heating, weighing, delivering and the furnishing of all materials, labor, freight, equipment, tools, and work incidental thereto.

- A. When a truck shipment of asphalt emulsion (with or without polymer) ordered by ConnDOT District Maintenance personnel is received at destination and it would not be in ConnDOT's best interests to spread this material, ConnDOT reserves the right to order the return of the bituminous material to the shipping point, paying only the cost of the return transportation on the actual number of gallons returned, regardless of any minimum load regulations.
- B. When the delivery of material is delayed due to any fault or negligence of Contractor, the charges for the return of the material shall not be paid. Liquid surface treatment material delivered from Contractor's plant into designated distributors or trucks shall be paid for at Contract price per square yard. This price includes loading, heating, weighing, and furnishing of all labor, equipment, tools, and work incidental thereto. ConnDOT shall pay only for material furnished and applied in the quantity and location, as directed by ConnDOT Engineer.

Traffic control shall be in accordance with the geographical limits of each district shown on district map contained herein this ITB and shall be paid for at the additional rate per square yard which shall be added to the basic award price for the liquid surface treatment complete in place.

**EMULSION BULK SUPPLY:** Bulk delivery for the emulsion shall be accompanied by documentation approved by ConnDOT Engineer, which shall include as a minimum the net weight of the material reported in tons and the specific gravity at 60° F of the material reported in pounds per cubic foot (lb/ft<sup>3</sup>). Off loading will be the sole responsibility of Contractor. Delivery shall not be completed unless a ConnDOT Representative is present. Contractor shall not charge an additional delivery fee to ConnDOT.

**BASIS OF PAYMENT FOR EMULSION BULK SUPPLY:** Emulsions shall be paid for at Contract unit price per gallon. Prices are requested for pickup and for the delivery to various locations throughout the State.

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**AGGREGATE BULK SUPPLY:** Bulk delivery for the aggregate shall be accompanied by documentation approved by ConnDOT Engineer. Off loading shall be the sole responsibility of Contractor. Delivery shall not be completed unless a ConnDOT Representative is present. Contractor shall not charge an additional delivery fee to ConnDOT.

**BASIS OF PAYMENT FOR AGGREGATE BULK SUPPLY:** Aggregate shall be paid for at Contract unit price per square yard. Prices include delivery to various locations throughout the State.

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#### ASPHALT RUBBER LIQUID SURFACE TREATMENT

**TECHNICAL SPECIFICATION:** These specifications cover the requirements for materials, manufacture and application of an Asphalt Rubber Liquid Surface Treatment. The work shall consist of furnishing and applying a 10% asphalt rubber binder followed by an application of treated cover aggregate to the surface of the existing pavement. It shall be constructed in accordance with these specifications and close conformity with the lines, grades, thickness, and typical cross section shown on the plans or established by ConnDOT Engineer.

Contractor shall include all equipment with operators, tools and labor necessary for complete performance of the services required. Contractor furnishing the services has complete responsibility for all equipment and labor being used and shall furnish fuel, maintenance and repair for the equipment.

**DELIVERY AND/OR PICK UP OF EMULSIONS:** The delivery and/or pick up of emulsion shall be accompanied by documentation approved by ConnDOT Engineer, which shall include the net weight of the emulsion reported in tons and the specific gravity at 60°F reported in pounds per cubic foot (lb/ft<sup>3</sup>) as a minimum. Off loading shall be the sole responsibility of Contractor. Delivery shall not be completed unless a ConnDOT Representative is present. Contractor shall not charge an additional delivery fee to ConnDOT.

**Documentation:** Every shipment of material to the job site must be accompanied by a shipping certificate stating:

1. Applicable purchase order number.
2. Date and method of shipment.
3. Name and address of agency to which material is supplied.
4. Quantity of material represented by the certificate.
5. Means of identifying the consignment, such as batch or lot number.
6. Name of manufacturer supplying the material.
7. Date material was manufactured or produced.
8. The shipping certificate shall state that the materials furnished conform to all requirements of the specifications, and it shall be signed by an authorized agent, giving name and title, for the organization supplying the material.

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**MATERIALS:** The chip sealing shall be composed of asphalt rubber binder and cover aggregate as specified below:

**Asphalt Binder:** The asphalt binder for the asphalt rubber mixture shall be PG 58-28 complying with the requirements of AASHTO M 320 Table 1.

**Rubber:** The granulated rubber shall be a vulcanized rubber product from the ambient temperature processing of scrap, pneumatic tires. The granulated rubber shall meet the following gradation.

**Note:** The use of rubber of multiple types from multiple sources is acceptable provided that the overall blend of rubber meets the gradation requirements. The length of the individual rubber particles shall not exceed 1/8 of an inch. A Certified Test Report from the rubber supplier is required in accordance with FORM 816, Article 1.06.07.

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

**Cover Aggregate:** The cover aggregate shall be crushed quarry stone, free from dust and other contaminants.

The percentage of wear as determined by the Los Angeles Abrasion Test (AASHTO-T96) shall be a maximum of 30. The aggregate shall be pre-heated to a temperature between 200°F and 300°F and be pre-coated with 0.6% (+/- 0.2%) by weight of aggregate of PG 64-22 or PG 64-28 asphalt binder prior to application.

The gradation of the aggregate shall meet the following limits:

<u>Sieve Size</u>	<u>% Passing - Nominal Size 3/8"</u>
5/8"	100
1/2"	100
3/8"	85 - 100
#4	0 - 25
#8	0 - 5
#50	0 - 2
#200	0 - 2

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**Note:** Contractor is responsible for locating a suitable location for stockpiling the required aggregate and insuring that stockpiles do not become contaminated. Contractor shall be responsible for clean up at the stockpiles sites.

The delivery and stockpiling of aggregate shall be accompanied by documentation approved by ConnDOT Engineer. Off loading shall be the sole responsibility of Contractor. Delivery shall not be completed unless a ConnDOT Representative is present. Contractor shall not charge an additional delivery fee to ConnDOT.

A minimum of thirty (30) days prior to construction, Contractor shall send a ConnDOT Representative sample of the proposed aggregate to the asphalt rubber supplier for testing. Gradation testing shall be performed to determine the design application rates for the asphalt rubber binder and the cover aggregate. A Coating and Stripping Test (AASHTO T-182) shall be performed by Contractor to assure compatibility of the asphalt rubber binder with the processed aggregate. A copy of the test results shall be provided to ConnDOT Engineer prior to the start of work.

Mixing and Reaction: For the 10% Asphalt Rubber Binder, the percent of granulated rubber shall be 10% (+/- 2%) by weight of the total asphalt rubber binder. The exact granulated rubber content shall be the quantity that shall yield a final asphalt rubber viscosity of 300cP to 700cP at 347°F as determined by a Haake-type high range rotational viscometer (utilizing Rotor #1).

The temperature of the asphalt binder shall be 350°F to 425°F at the time of the addition of the granulated rubber. The asphalt binder and rubber shall be combined and mixed together in the mechanical blender and reacted for a minimum of one hour. The temperature of the asphalt rubber binder shall be above 325°F during the reaction period.

Delays: When a job delay occurs after full reaction, the asphalt rubber binder may be allowed to cool. The asphalt rubber binder shall be reheated slowly just prior to application, but not to a temperature exceeding 375°F. An additional quantity of granulated rubber, not exceeding 2% by weight of the asphalt rubber binder, may be added after reheating in order to maintain a 300cP to 700cP viscosity for the 10% granulated rubber mixture.

**EQUIPMENT:** The equipment used by Contractor shall include, but not be limited to the following:

- A. Mechanical Blender: A mechanical blender for proper proportioning and thorough mixing of the asphalt binder and granulated rubber is required. This

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unit shall be equipped with: asphalt totaling meter (gallons); a flow rate meter (gallons per minute); a positive displacement auger to feed the rubber properly to a mixing chamber at the specified rate; and a static motionless mixer. Blender shall have a separate asphalt binder feed pump and finished product pump to maximize production. Blender shall be capable of providing 100% proportional mix at any given time during the blending cycle and documentation from Manufacturer supporting this shall be submitted to ConnDOT Engineer if requested.

- B. Distributor Truck: On projects exceeding 35 tons of asphalt rubber, at least two pressure-type bituminous distributor trucks in good condition shall be required. Distributor shall be equipped with an internal heating device capable of heating the material evenly up to 425°F, an internal mixing unit capable of maintaining a proper mixture of asphalt cement and granulated rubber; have adequate pump capacity to maintain a high rate of circulation in the tank and to spray the asphalt rubber binder at a viscosity of 300cP to 2000 cP for the 10% granulated rubber mixture. Distributor shall be equipped with an electronically controlled computerized compensation unit for controlling application rates at various width and speed changes.

The application unit shall have electronic controls and a digital readout installed and operated from inside the cab of Distributor. The distribution bar on the distributor shall be fully circulating. Any Distributor that produces a streaked or irregular distribution of the material shall be promptly repaired or removed from the project. Distributor equipment shall include a tachometer, pressure gauges, volume measuring devices, and a thermometer for reading the temperature of tank contents. Controls for the spray bar shall be located in the truck cab for controlling the width and rate of spray of the product. The spray bar shall be capable of spraying from one foot to 16 feet.

It shall be constructed so that uniform application may be made at the specified rate per square yard.

- C. Aggregate Spreader: The aggregate spreader shall be hydrostatically driven and self propelled. It shall be equipped with a hydraulically controlled variable adjustable head that is capable of spreading stone in widths from 4 to 16 feet. The spreader shall be mounted on pneumatic tires, and shall apply the stone on the road surface in a manner that ensures that the tires do not contact the road surface until after the stone has been applied. The unit shall be equipped with an electronic radar type sensor used to measure ground speed and shall automatically adjust the stone application rate depending on the width of application and the speed of spreader. It shall have the ability to apply stone on any grade from 0% to 10%. The spreader shall be equipped

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with an integral hopper with a minimum capacity of 5 tons of stone which shall be filled by trucks in a manner which ensures that the truck tires never come in contact with asphalt treated road surfaces until the stone has been properly applied. To maintain constant stone application, a self-locking truck hitch shall permit towing of aggregate trucks without stopping the spreader. It shall be capable of maintaining positive engagement over irregular terrain.

- D. Pneumatic-Tired Roller: There shall be at least two self-propelled, multi-wheeled, pneumatic-tired rollers which shall weigh between 7 and 12 tons. Each roller shall have a minimum total compacting width of 5 feet, have a minimum tire pressure of 60 psi, and be equipped with a water system.
- E. Steel-Wheel Roller: One self-propelled, 2-axle steel-wheeled roller shall be used and shall weigh between 8 and 12 tons. It shall be equipped with scrapers, wetting pads and a watering system. Combination pneumatic and steel drum-type rollers are acceptable, as one unit only.
- F. Power Broom/Street Sweeper: A rotary power broom or street sweeper shall be provided that is capable of sweeping all loose material from the roadway surface.

**CONSTRUCTION PROCEDURES**: When material is ordered, furnished and applied, Contractor shall be governed by instructions received from ConnDOT's Representative as to where and when the material is to be applied and in what quantities.

- A. Weather Requirements: Work shall not be done unless the pavement is dry. No work shall be done during rain or foggy periods. No work shall be done if the ambient temperature is below 50°F. Work shall be restricted to the calendar year dates of April 15 to October 15.
- B. Road Surface Preparation: ConnDOT shall be responsible for roadway preparation. Potholes, other areas of pavement failure, and major depressions in the existing pavement surface shall be repaired by ConnDOT with hot mix asphalt.

A leveling course shall be placed on a planed, milled or existing surface by ConnDOT, if required. Immediately prior to the application of the asphalt rubber binder, the surface shall be thoroughly swept by ConnDOT.

Contractor shall be responsible for covering all utility irons (manholes, valve boxes, drop inlets, catch basins, and all other service entrances) just prior to the application and uncovering the same after aggregate is spread.

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- C. Application of Asphalt Rubber Binder: The asphalt rubber binder for a 10% granulated rubber mixture shall be applied at a temperature of 300°F to 390°F at a rate of 0.30 to 0.40 gallons per square yard. The actual rate of application within this range for a given pavement requires the cover aggregate be embedded at 50% of the stone particle size into the asphalt rubber binder with minimal stone loss following compaction.

Longitudinal and transverse joints shall be constructed to appear neat and uniform without buildup, uncovered areas, or unsightly appearance. Place longitudinal joints on lane lines reasonably true and parallel to centerline. Where any construction joint occurs, the edges shall be swept back and blended so there are no gaps and the elevations are the same, and free from ridges and depressions. Longitudinal joints shall be overlapped from 4 to 6 inches.

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

- D. Application of Cover Aggregate: The application of aggregate shall follow as close as possible behind the application of the hot asphalt rubber binder, not to exceed 300 feet. Construction equipment or other vehicles shall not drive on the uncovered asphalt rubber binder. The pre-coated aggregate shall be spread uniformly by a self-propelled spreader at a rate of spread directed by ConnDOT Engineer, generally between 25 and 30 pounds per square yard for the 10% granulated rubber mixture. Any deficient areas shall be covered with additional material.
- E. Rolling Operations: A minimum of three rollers shall be used for aggregate compaction into the asphalt rubber binder. Two of the rollers shall be pneumatic-tired and third must be steel-wheeled.

Rolling shall commence immediately following the spread of aggregate. There shall be at least three coverages by the pneumatic tired rollers to embed the aggregate particles firmly into the asphalt rubber binder. Coverage shall be as many passes as are necessary to cover the entire width being spread with a pass being one movement of a roller in either direction. Additional coverage of the steel-wheel roller shall follow, if used. Water shall be applied to the tires or wheels as required, limiting sticking of the asphalt rubber binder and aggregate to the rollers.

- F. Protection of Surface: No traffic shall be permitted on the chip sealed road surface until after all rolling has been completed and the asphalt rubber binder has set to a degree satisfactory to ConnDOT Engineer. All traffic shall

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be held to speeds not exceeding 25 miles per hour. "Loose Stone" signs shall be posted at the beginning limit of the chip seal operation and at every one mile interval. Speed limit signing and other required signing shall meet all ConnDOT and Contract requirements. They shall remain in place for a minimum of 24 hours after the chip seal was placed. Signing shall not be removed until the loose aggregate is removed from the roadway and all other contract requirements are fulfilled (i.e. line striping) so that the original posted speed limit can be reinstated.

- G. Cleanup: When the maximum amount of aggregate has been embedded into the asphalt rubber binder and the pavement has cooled, all loose material shall be swept or otherwise removed by Contractor. This shall be done at a time and in a manner, which shall not displace any embedded aggregate or damage the new surface.

METHOD OF MEASUREMENT: The furnished and applied Asphalt Rubber Liquid Surface Treatment shall be measured by the square yard and shall be the actual number of square yards applied.

BASIS OF PAYMENT: The Asphalt Rubber Liquid Surface Treatment shall be paid for at Contract unit price per square yard. This price shall include all labor, materials furnished and applied, and all equipment required to complete the work in accordance with these specifications.

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#### LIQUID 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 shall be based on the variance in price for the liquid asphalt component for contract bid items. An asphalt adjustment cost shall be applied to the following bid items:

Item 3.) Liquid Surface Treatment - Furnished and Applied (price per gallon)

Item 4.) Liquid Surface Treatment (by the square yard) Complete-In-Place

Item 5.) Asphalt Rubber Liquid Surface Treatment - Furnished and applied (Price per square yard).

ConnDOT shall post on its website, the average per ton selling price (asphalt price) of the liquid asphalt also referred to as performance-graded binder. The price is based on information provided 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."

The asphalt adjustment cost applies only when the difference between the posted *Asphalt Base Price* and *Asphalt Period Price* varies by more than \$5.00.

- *Asphalt Base Price*: The asphalt price that is posted on ConnDOT website twenty-eight (28) days before the actual bid opening posted.
- *Asphalt Period Price*: The asphalt price that is posted on ConnDOT website that is in effect on the date the Liquid Surface Treatment is furnished and applied by the vendor.

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The selling price furnished from the Asphalt Weekly Monitor<sup>®</sup> is based on a standard ton (US\$/ST). The following constants shall be applied in the formula for cost adjustment.

**Constants:**

- 235 gallons of liquid asphalt = 1 ton of liquid asphalt
- Liquid asphalt represents 67% of the liquid asphalt emulsion
- Application rate used is 0.33 gallons of liquid asphalt emulsion per square yard of liquid surface treatment.

**Formula if Contract Item is paid by Square Yard:**

$$P / 235 \times 0.67 \times 0.33 \times (\text{QUANTITY IN SQUARE YARDS}) = \$ \text{-----}$$

Where:  $P = [(\text{Period Price} - \text{Asphalt Base Price})]$

**Formula if Contract Item is paid by Gallons:**

$$P / 235 \times 0.67 \times (\text{NUMBER OF GALLONS APPLIED}) = \$ \text{-----}$$

Where:  $P = [(\text{Period Price} - \text{Asphalt Base Price})]$

The adjustment shall not be considered as a changed condition in Contract because of this provision and because Contractor is being notified before submission of bids.

**Basis of Payment:** The "Asphalt Adjustment Cost" shall be calculated using the formulas indicated above. A payment shall be made for an increase in costs. A deduction from monies due Contractor shall be made for a decrease in costs.

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##### **TRAFFIC CONTROL DURING MAINTENANCE OPERATIONS (English Version)**

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 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:

1. Speed and volume of traffic.
2. Duration of operation.
3. 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 20 through 25 may be used for moving operations such as painting, pot hole patching, mowing, or sweeping when it is necessary for equipment to occupy a travel lane.

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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 flaggers 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 Engineer or Supervisor must contact both the District Traffic Representative and the District Safety Advisor 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 may 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 or Supervisor 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.

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The Engineer or Supervisor may require that the signing 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

**PAVING OPERATIONS ON HIGHWAYS - WORK BY CONTRACTOR:**

The Engineer or Supervisor will be assigned to each project to coordinate the traffic control for paving operations and determine the number of traffic control personnel required.

The District Traffic Representative will determine the hours of the paving operations and will coordinate the paving operations with other construction activities in the immediate area. The District Traffic Representative will be available to assist field forces on traffic control issues and may contact the Division of Traffic Engineering for additional assistance.

When work hours on a particular project have been established, an on-site meeting between the Department and the Contractor will be held two weeks prior to the starting date. If the District Traffic Representative determines that

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it is necessary, a news release will be prepared and distributed to the local papers, radio stations, State Police, and municipalities.

#### MOVING OPERATIONS - WORK BY STATE FORCES:

The Engineer or Supervisor will be assigned to each project and will direct the entire moving operation. If the Engineer or Supervisor must leave the operation, a substitute shall be assigned to continue the operation.

All personnel involved in this work will be instructed by the Engineer or Supervisor regarding the proper application of traffic control patterns that will be used to complete the work.

The first advance warning to the motorist shall be vehicle #1 which shall be located considering ramps, grades, curves, volumes, and speed of the traffic. This vehicle shall not restrict any portion of the travelway on multilane highways, except as noted on plans.

All vehicles shall have the appropriate illuminated warning devices.

#### INSTALLING AND REMOVING TRAFFIC CONTROL PATTERNS

Lane Closures shall be installed beginning with the advanced warning signs and proceeding forward toward the work area.

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.

#### USE OF TRUCK MOUNTED IMPACT ATTENUATOR VEHICLES (TMAs)

On limited access, high volume roadways, a TMA shall be placed prior to the first work area in the traffic control pattern. If there are multiple work areas within the same pattern, then additional TMAs may be positioned at each additional work area in the pattern as needed.

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.

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##### **TRAFFIC CONES**

Traffic Cones shall be fluorescent orange PVC with 6" and 4" white retroreflective collars. Traffic cones shall be 36" minimum in height and 12 lbs. minimum in weight with the following approximate dimensions: 14" square base, 2 ¼" top O.D., 10 ½" bottom O.D.

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##### NOTES FOR TRAFFIC CONTROL PLANS

1. IF A TRAFFIC STOPPAGE OCCURS IN ADVANCE OF SIGN (A), THEN THE INSTALLATION OF AN ADDITIONAL SIGN (A) IN ADVANCE OF THE STOPPAGE SHOULD BE CONSIDERED.
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. A CHANGEABLE MESSAGE SIGN MAY BE UTILIZED ONE HALF TO ONE MILE IN ADVANCE OF THE LANE CLOSURE TAPER.
5. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 72 HOURS, THEN TRAFFIC DRUMS SHALL BE USED IN PLACE OF TRAFFIC CONES.
6. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN ANY LEGAL SPEED LIMIT SIGNS WITHIN THE LIMITS OF A ROADWAY / LANE CLOSURE AREA WILL BE COVERED WITH AN OPAQUE MATERIAL WHILE THE CLOSURE IS IN EFFECT AND UNCOVERED WHEN THE ROADWAY / LANE CLOSURE IS REOPENED TO ALL LANES OF TRAFFIC.
7. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN THE EXISTING CONFLICTING PAVEMENT MARKINGS SHALL BE ERADICATED OR COVERED AND TEMPORARY PAVEMENT MARKINGS THAT DEPICT THE PROPER TRAVEL PATHS SHALL BE INSTALLED.
8. DISTANCES BETWEEN SIGNS IN THE ADVANCE WARNING AREA MAY BE REDUCED TO 200' ON LOW SPEED URBAN ROADS (SPEED LIMIT < 40 MPH).
9. FOR SHORT DURATION OPERATIONS, 4 TRUCK MOUNTED ATTENUATOR UNITS MAY BE USED TO CREATE THE TAPER IN LIEU OF TRAFFIC CONES/DRUMS.
10. FOR THE INSTALLATION OF PAVEMENT MARKINGS, VEHICLE 1 SHALL HAVE A SIGN WITH THE LEGEND "LINE PAINTING".

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DIVISION OF TRAFFIC ENGINEERING

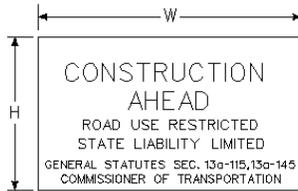
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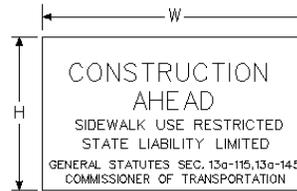
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### SERIES 16 SIGNS



		W	H
16-E	80-1605	84"	60"
16-H	80-1608	60"	42"
16-M	80-1613	30"	24"



		W	H
16-S	80-1619	48"	30"

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 RAMP PRIOR TO OR WITHIN THE WORK ZONE LIMITS.

THE LOCATION OF SERIES 16 SIGNS SHOULD BE INSTALLED AS DIRECTED BY THE ENGINEER OR SUPERVISOR, OR MAY BE FOUND ELSEWHERE IN THE PLANS.

IF SIGNS ARE TO BE POST MOUNTED THEN:

SIGN 16-E OR 16-H SHALL BE USED ON ALL EXPRESSWAYS.

SIGN 16-H OR 16-M SHALL BE USED ON ALL RAMPS, OTHER STATE ROADWAYS, AND MAJOR TOWN/CITY ROADWAYS.

SIGN 16-M SHALL BE USED ON OTHER TOWN ROADWAYS.

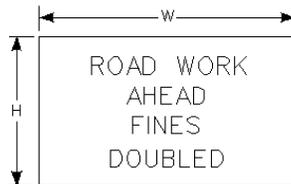
IF SIGNS ARE TO BE MOUNTED ON PORTABLE SUPPORTS, THEN SIGN 16-M SHALL BE USED.

### 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 WHEN THERE ARE WORKERS ON THE HIGHWAY OR WHEN THERE IS OTHER THAN EXISTING TRAFFIC OPERATIONS.

THE "ROAD WORK AHEAD, FINES DOUBLED" REGULATORY SIGNS SHALL NOT BE INSTALLED ON TOWN ROADS.

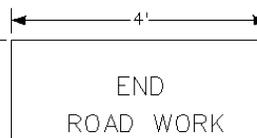
THE "ROAD WORK AHEAD FINES DOUBLED" REGULATORY SIGN SHALL BE PLACED AFTER THE SERIES 16 SIGN AND IN ADVANCE OF THE "ROAD WORK AHEAD" SIGN.



		W	H
31-1906		48"	42"

### "END ROAD WORK" SIGN

THE LAST SIGN IN THE PATTERN MUST BE THE "END ROAD WORK" SIGN.



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DIVISION OF TRAFFIC ENGINEERING  
MAINTENANCE

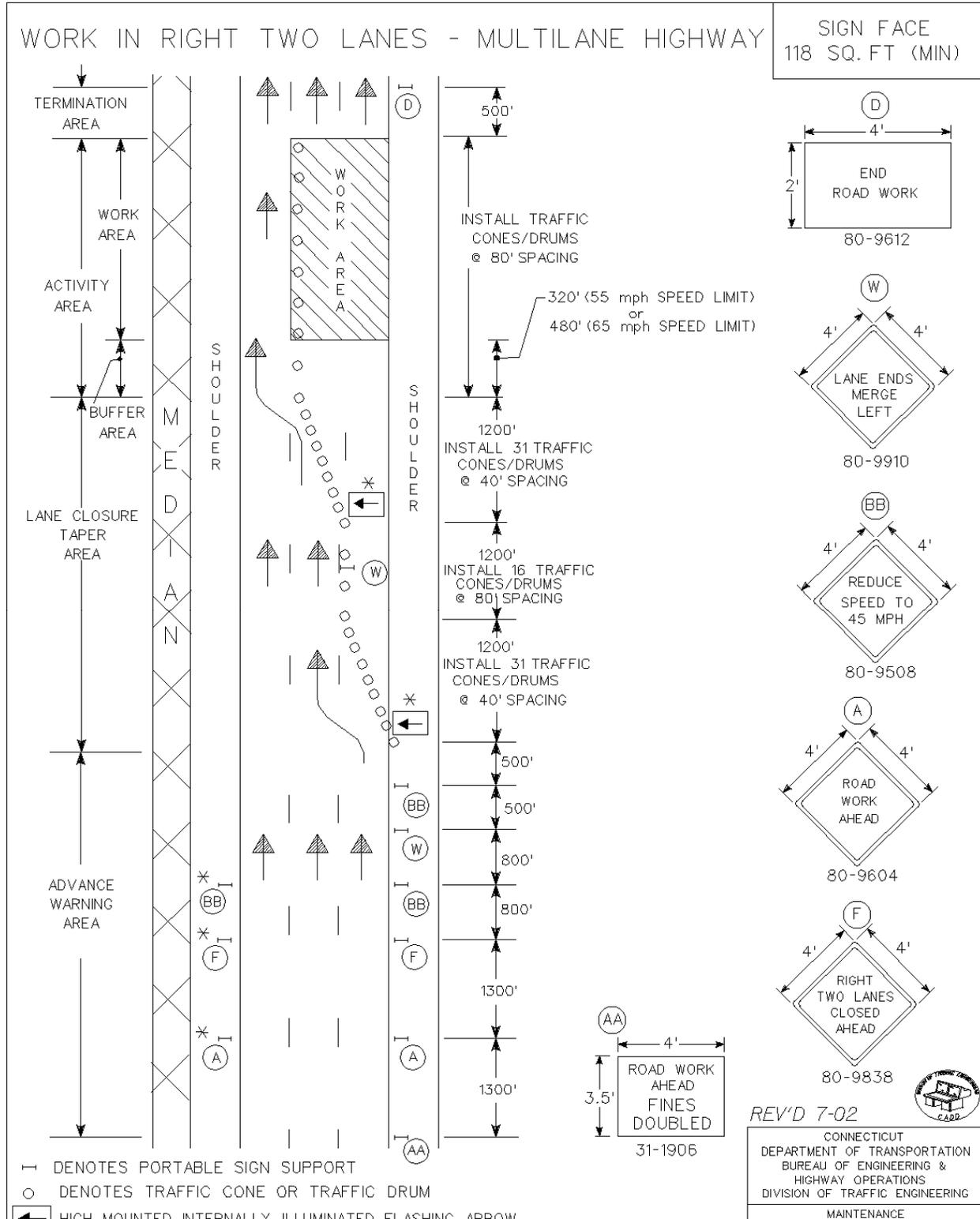


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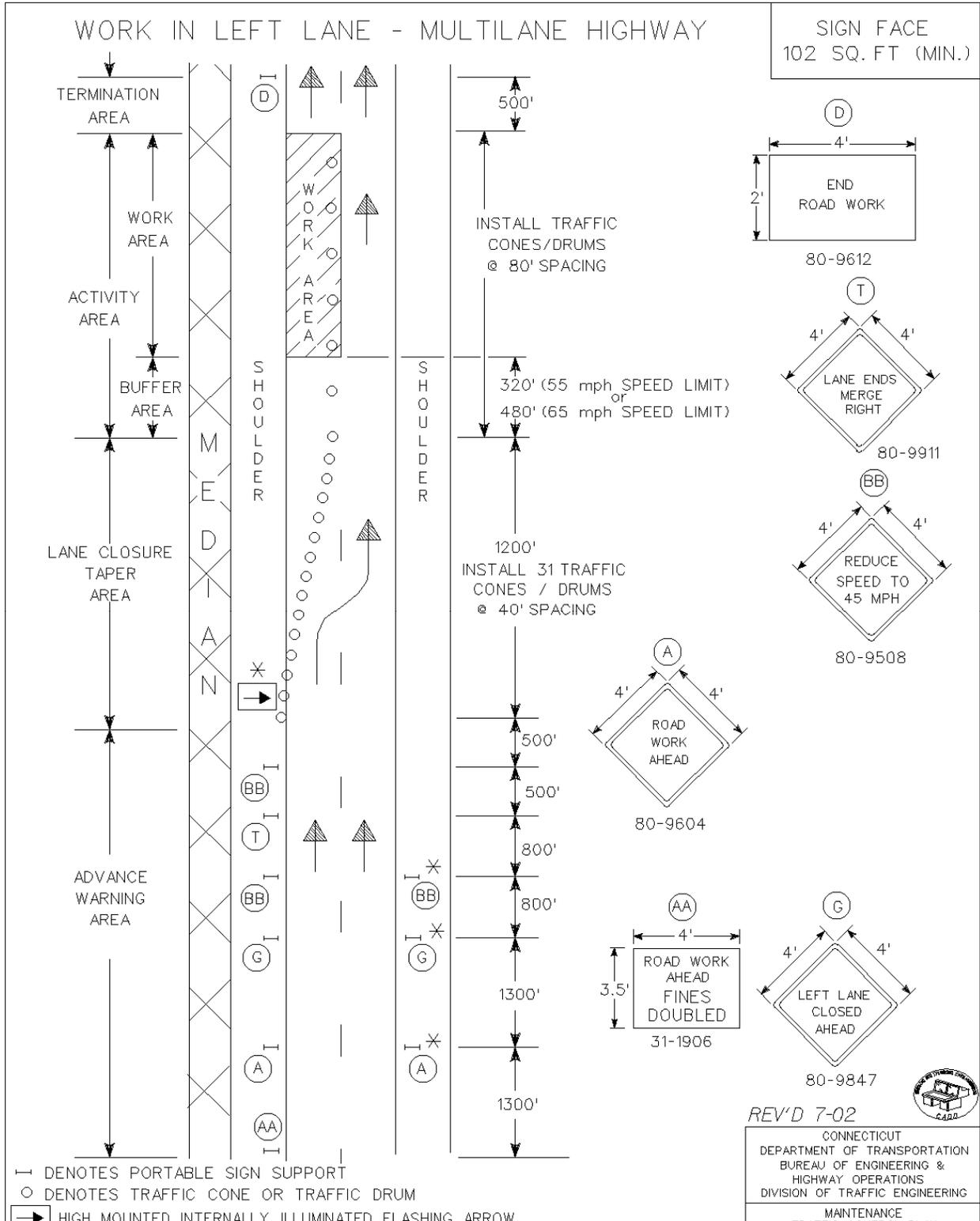


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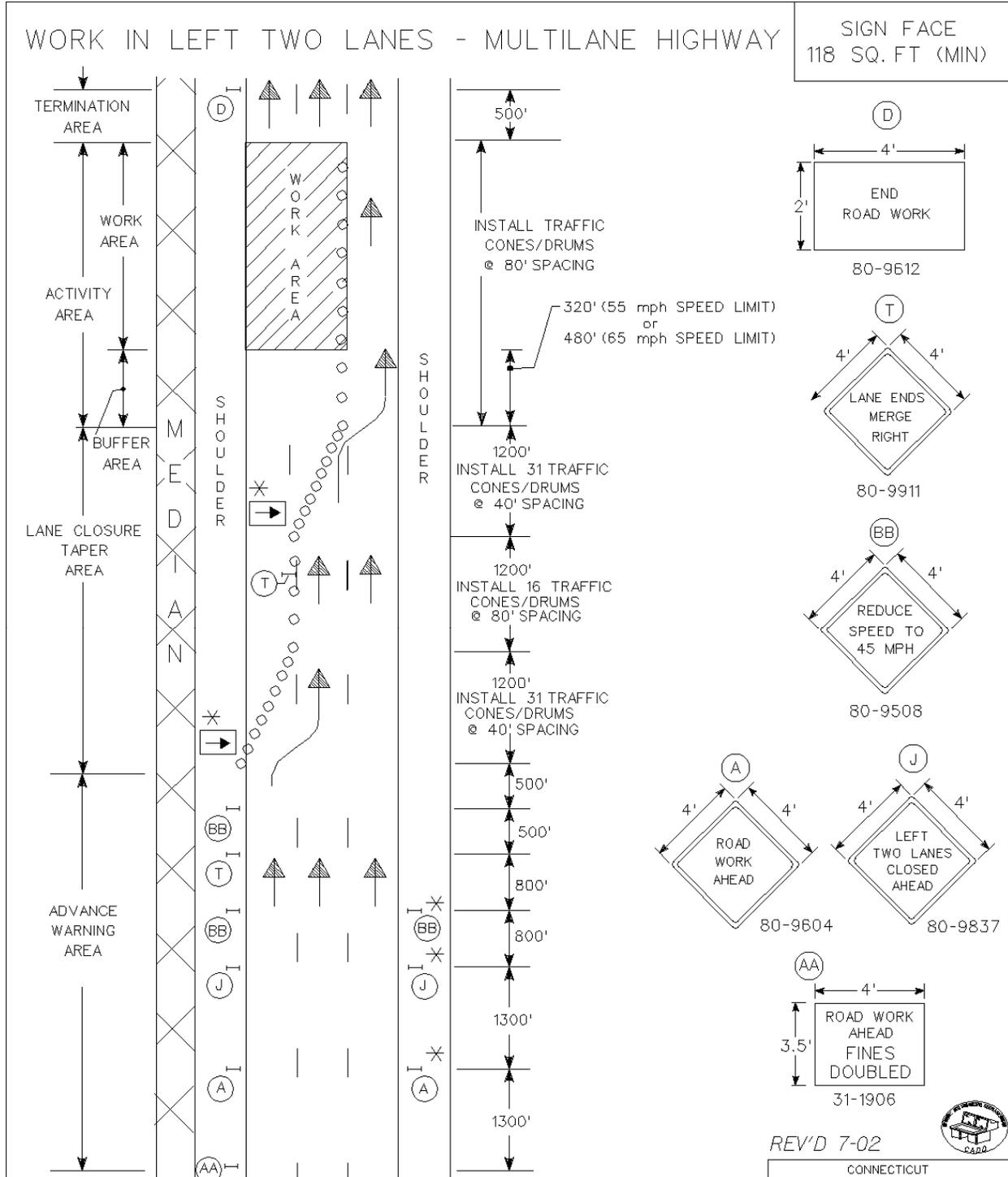


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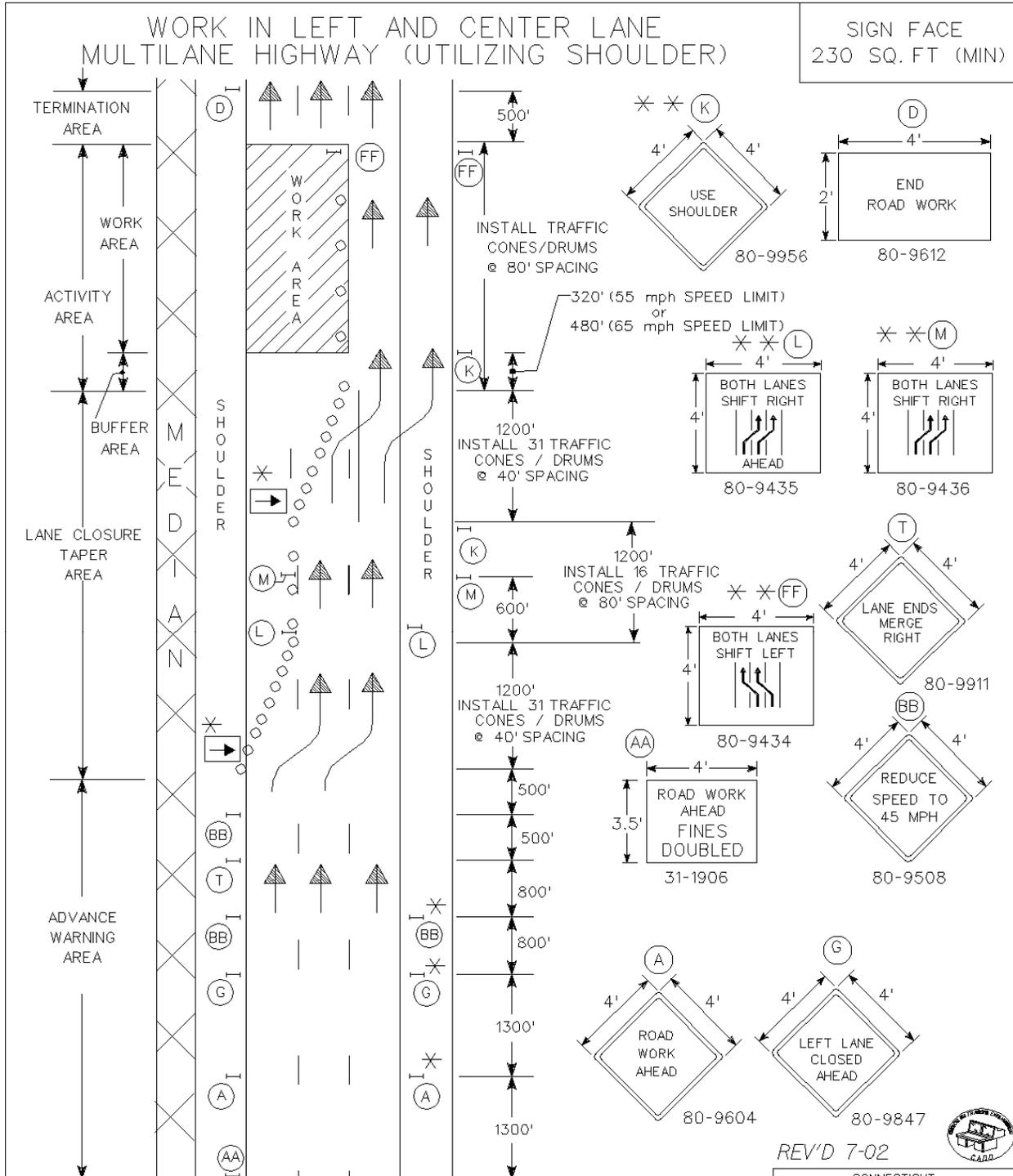
- DENOTES PROBABLE SIGN SUPPORT
- DENOTES TRAFFIC CONE (36" MIN.) OR TRAFFIC DRUM
- ◻ DENOTES HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



\* \* NOT REQUIRED IF PAVEMENT MARKINGS ARE CHANGED TO REFLECT THE NEW TRAVELPATH.

○ DENOTES TRAFFIC CONE (36" MIN.) OR TRAFFIC DRUM

▭ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

REV'D 7-02



CONNECTICUT  
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HIGHWAY OPERATIONS  
DIVISION OF TRAFFIC ENGINEERING

MAINTENANCE

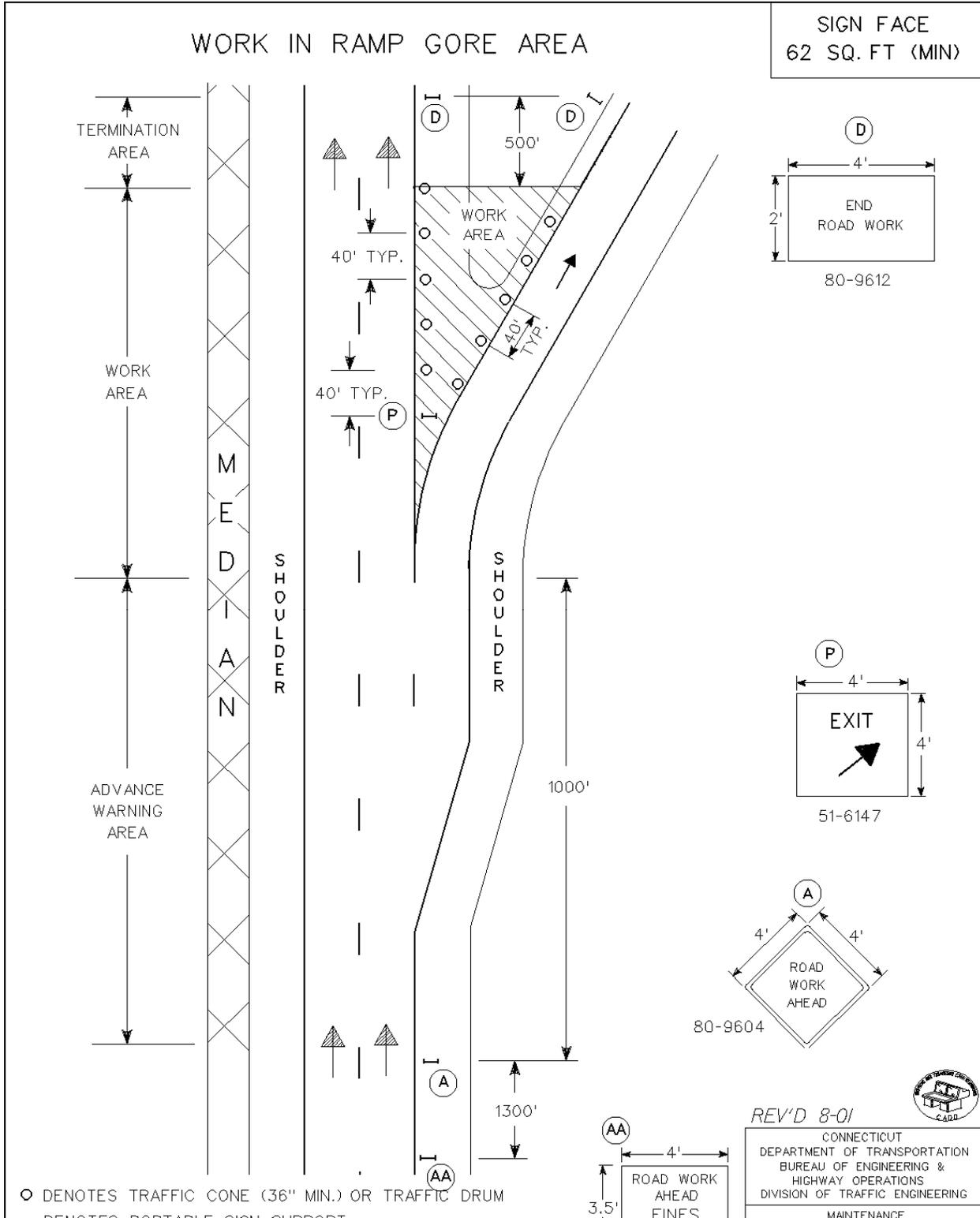


# ADDENDUM #1

Rev. Date 11/8/01

Contract # 12PSX0331  
 Rev. 6/25/2012 - Prev. Rev. 4/26/2012

## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES

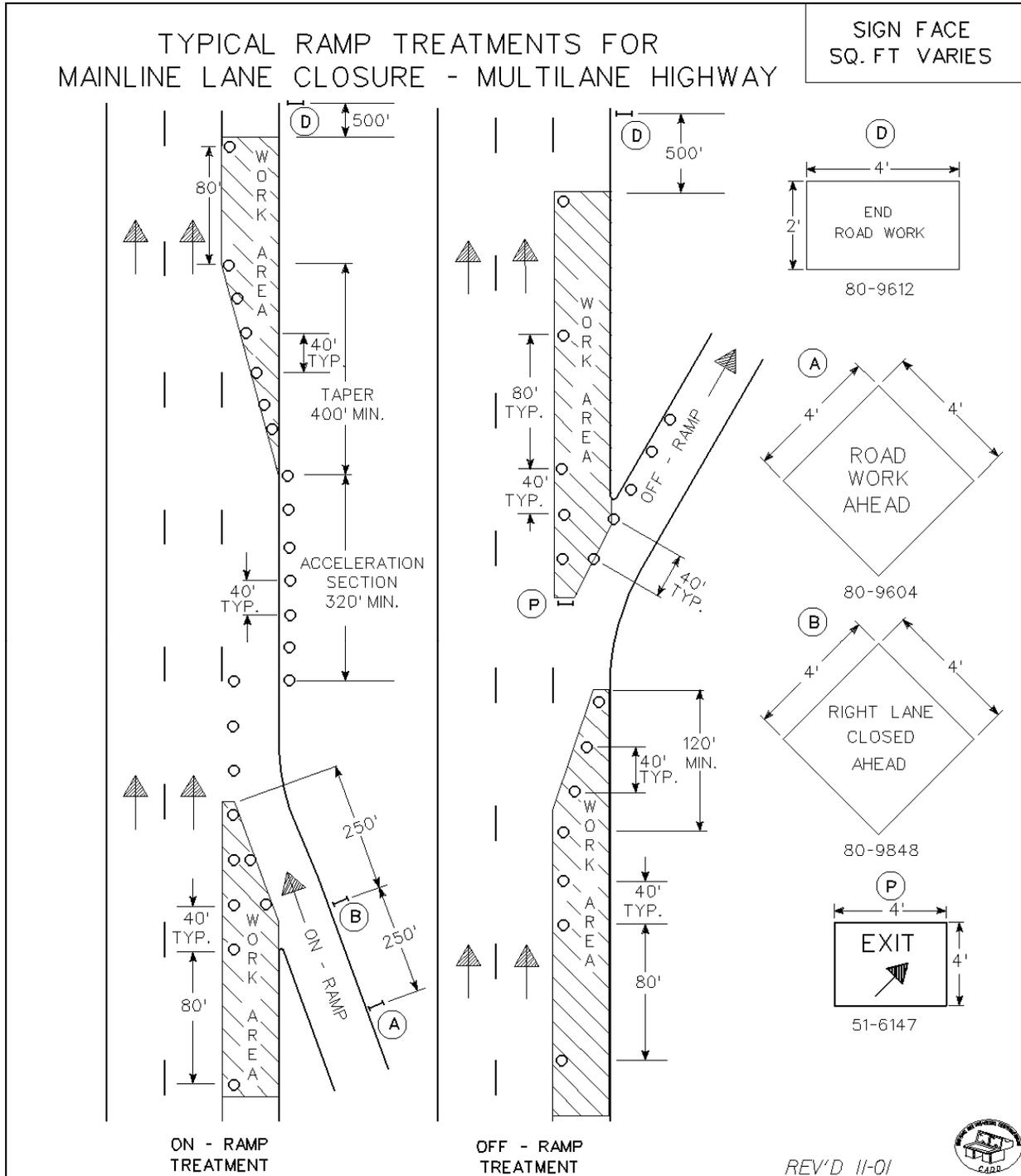


# ADDENDUM #1

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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



USE TRAFFIC CONTROL PLAN 1 TO CLOSE THE RIGHT LANE.  
 ▴ DENOTES PORTABLE SIGN SUPPORT  
 ○ DENOTES TRAFFIC CONE (36" MIN.) OR TRAFFIC DRUM

REV'D 11-01

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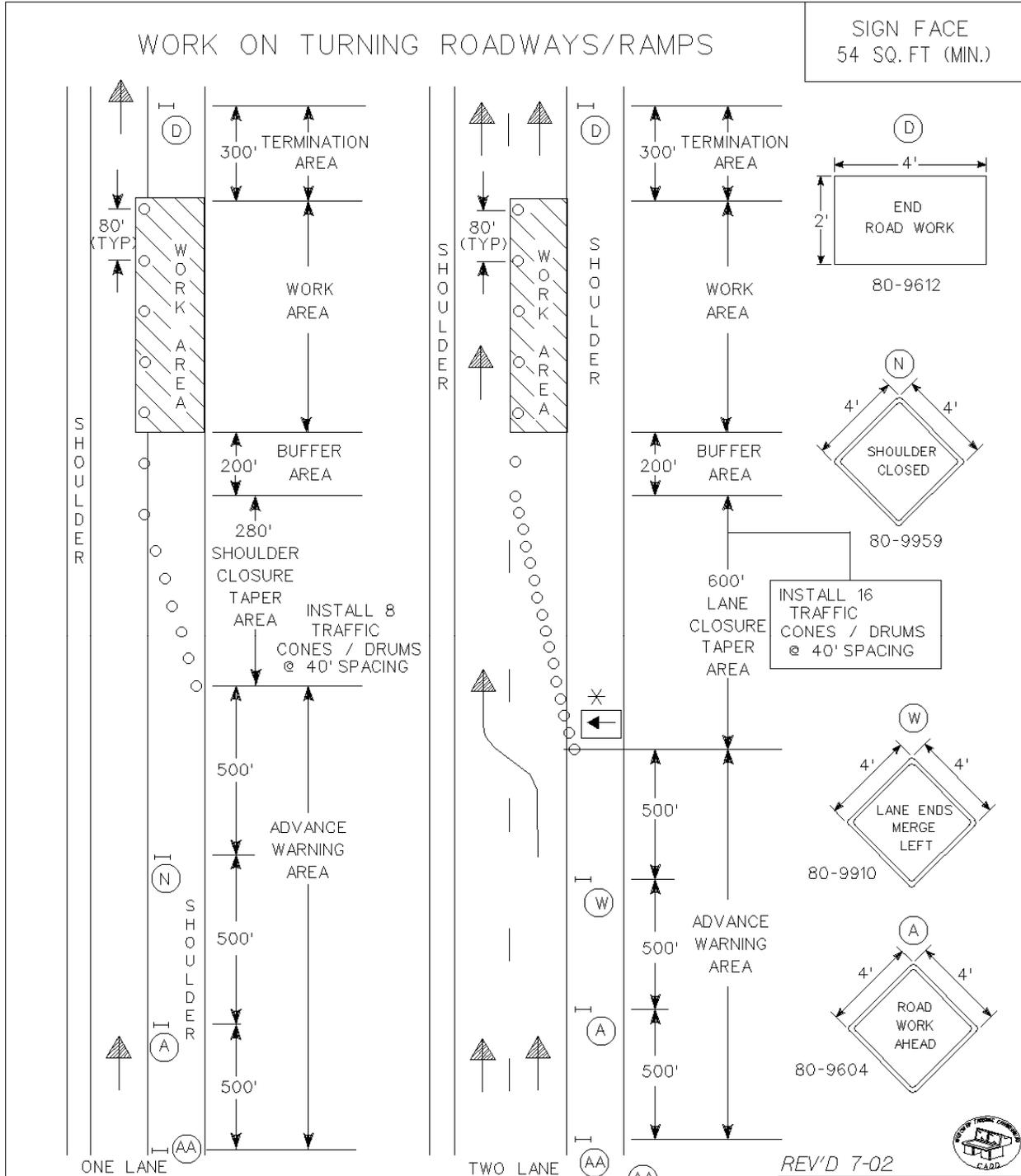
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Contract # 12PSX0331  
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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



— DENOTES PORTABLE SIGN SUPPORT  
○ DENOTES TRAFFIC CONE (36" MIN.) OR TRAFFIC DRUM  
◀ DENOTES HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

REV'D 7-02

CONNECTICUT  
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DIVISION OF TRAFFIC ENGINEERING  
MAINTENANCE

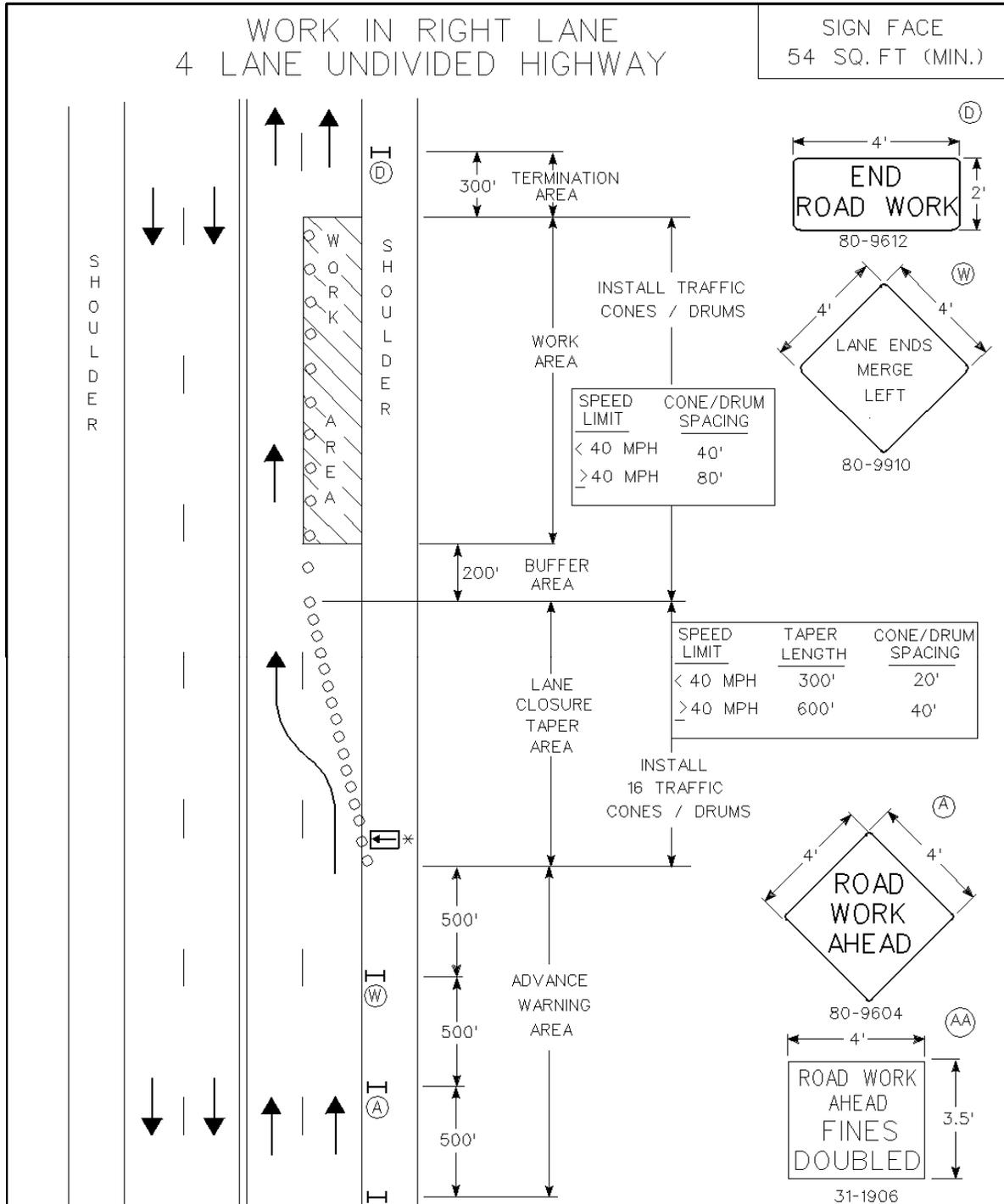
# ADDENDUM #1

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## EXHIBIT A

### DESCRIPTION OF GOODS AND SERVICES



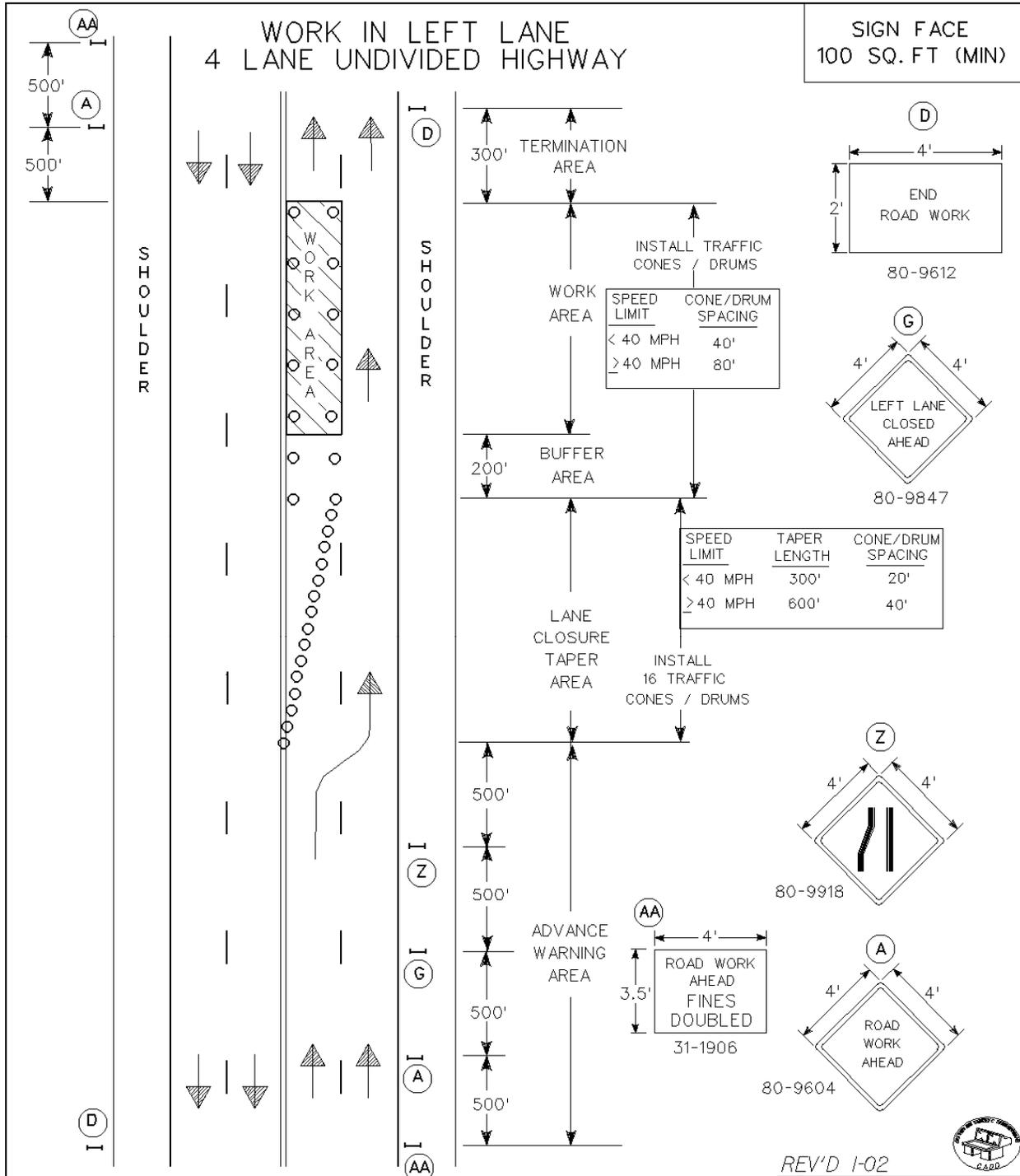
H DENOTES PORTABLE SIGN SUPPORT  
\* DENOTES OPTIONAL

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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



NOTE:  
PLACE THE FIRST TWO TRAFFIC CONES / DRUMS ON THE CENTERLINE.  
○ DENOTES TRAFFIC CONE (36" MIN.) OR TRAFFIC DRUM





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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES

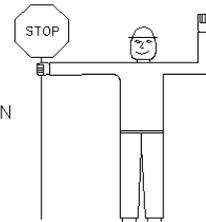
### WORK IN TRAVEL LANE AND SHOULDER TWO LANE HIGHWAY ALTERNATING ONE-WAY TRAFFIC OPERATIONS

#### HAND SIGNAL METHODS TO BE USED BY TRAFFIC CONTROL PERSONS

THE FOLLOWING METHODS FROM SECTION 6E.04 TRAFFIC CONTROL PERSON PROCEDURES IN THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" SHALL BE USED BY TRAFFIC CONTROL PERSONS WHEN DIRECTING TRAFFIC THROUGH A WORK AREA. THE STOP/SLOW SIGN PADDLE ( SIGN NO. 80-9950) SHOWN ON THE TYPICAL DETAIL SHEET ENTITLED "SIGNS FOR CONSTRUCTION AND PERMIT OPERATIONS" SHALL BE USED.

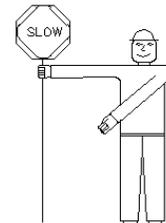
#### A. TO STOP TRAFFIC

TO STOP ROAD USERS, THE TRAFFIC CONTROL PERSON 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.



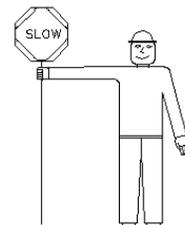
#### B. TO DIRECT TRAFFIC TO PROCEED

TO DIRECT STOPPED ROAD USERS TO PROCEED, THE TRAFFIC CONTROL PERSON 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 TRAFFIC CONTROL PERSON SHALL MOTION WITH THE FREE HAND FOR ROAD USERS TO PROCEED.



#### C. TO ALERT OR SLOW TRAFFIC

TO ALERT OR SLOW TRAFFIC, THE TRAFFIC CONTROL PERSON 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 TRAFFIC CONTROL PERSON HOLDING THE SLOW PADDLE FACE TOWARD ROAD USERS MAY MOTION UP AND DOWN WITH THE FREE HAND, PALM DOWN.



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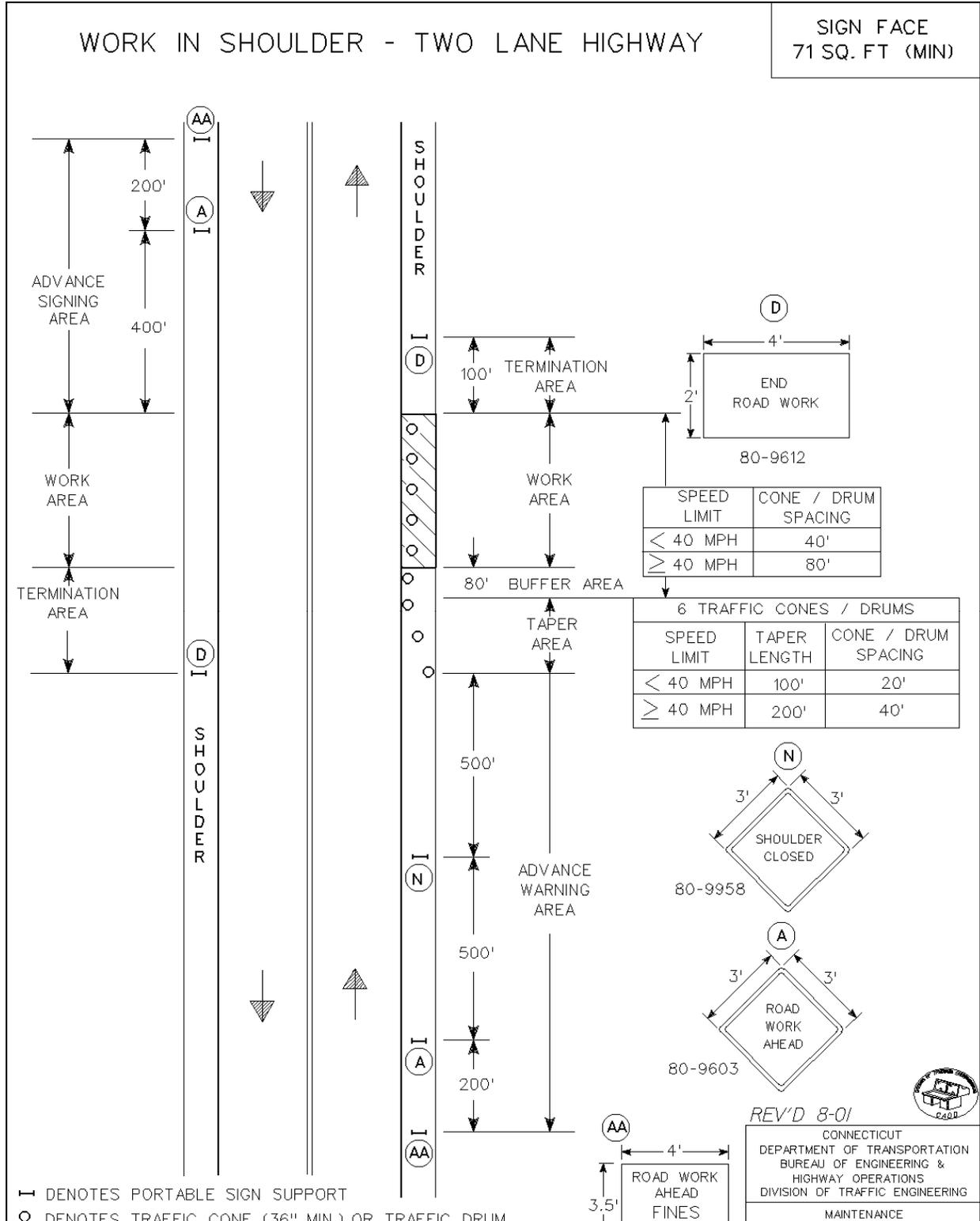
MAINTENANCE

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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES

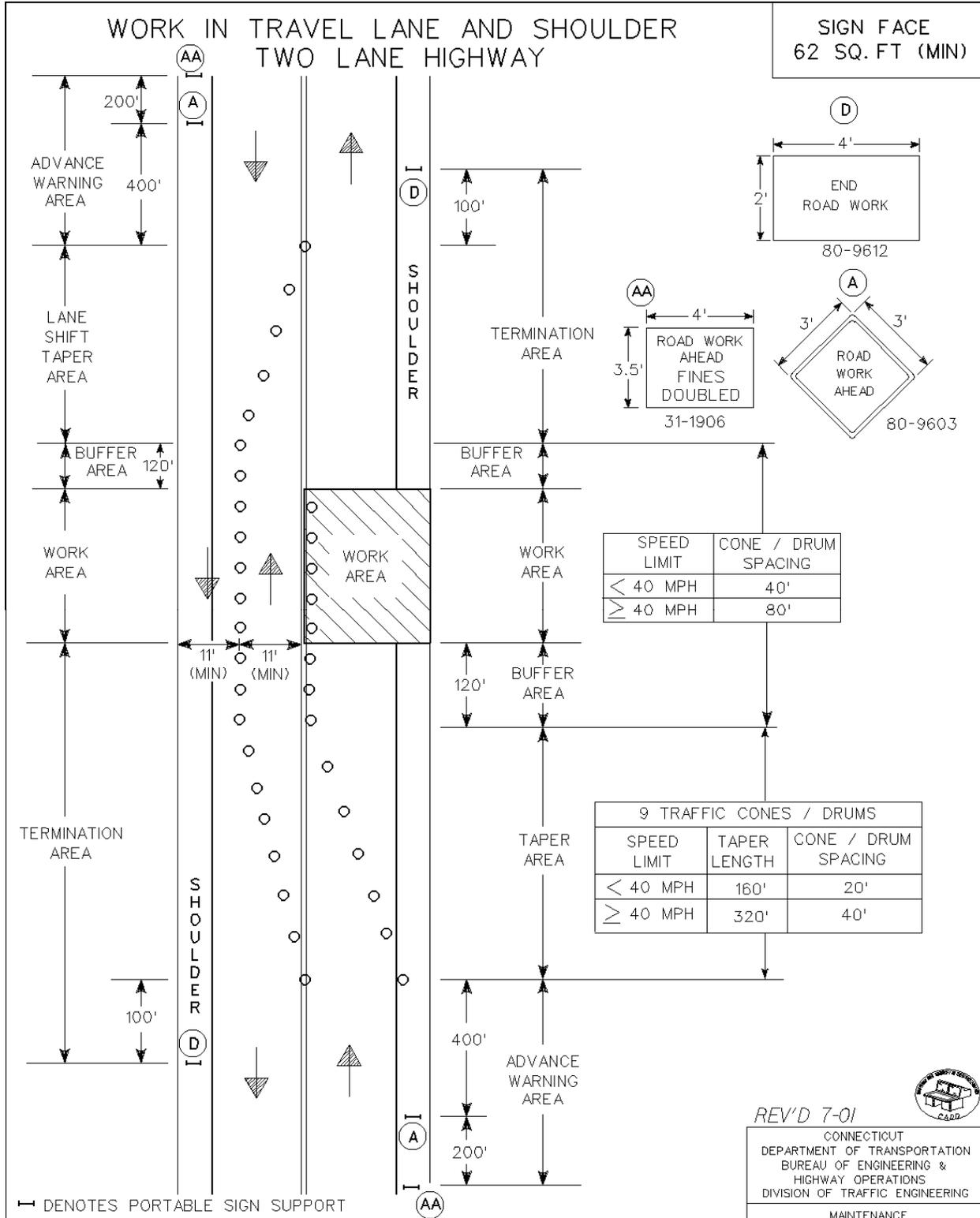


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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



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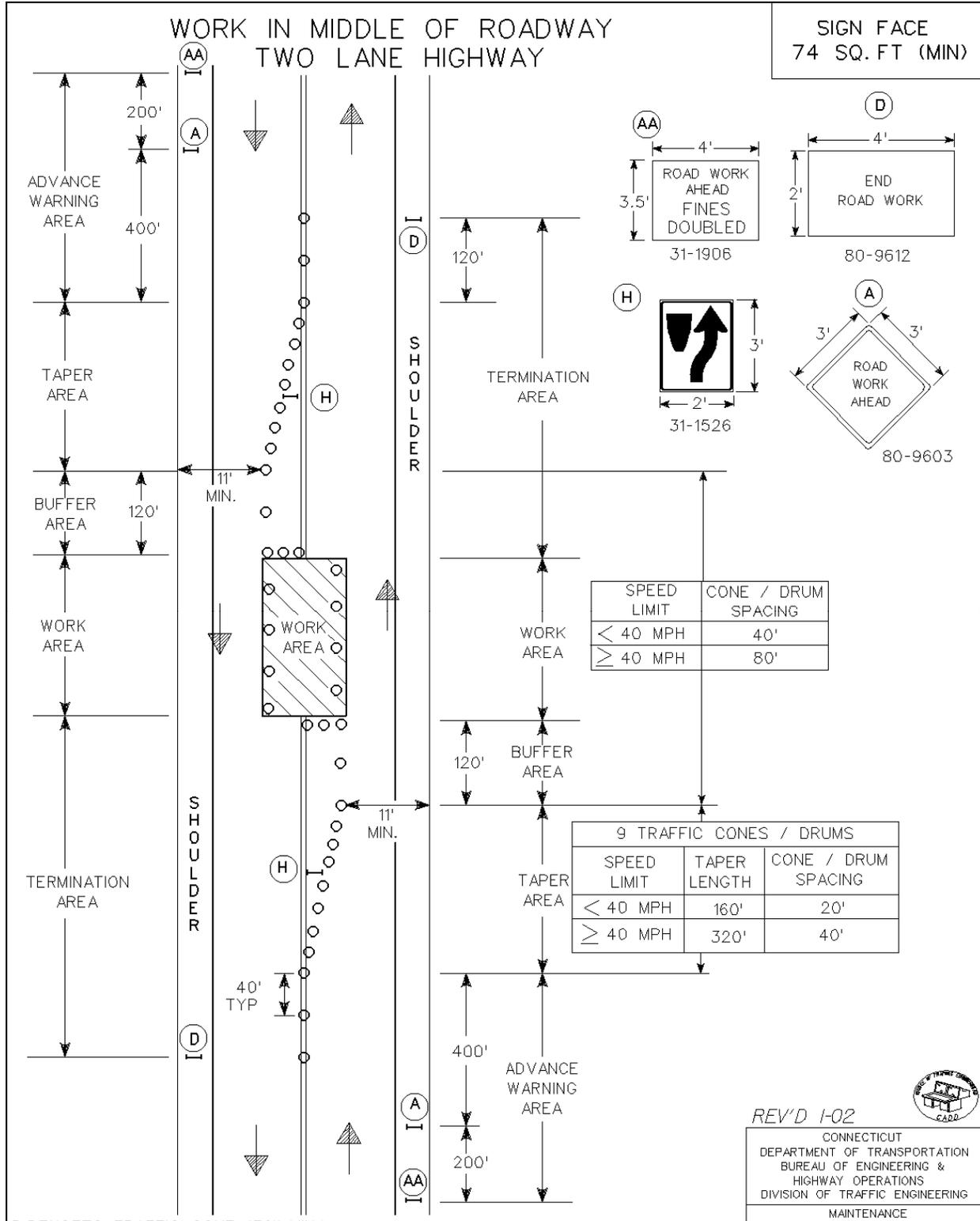
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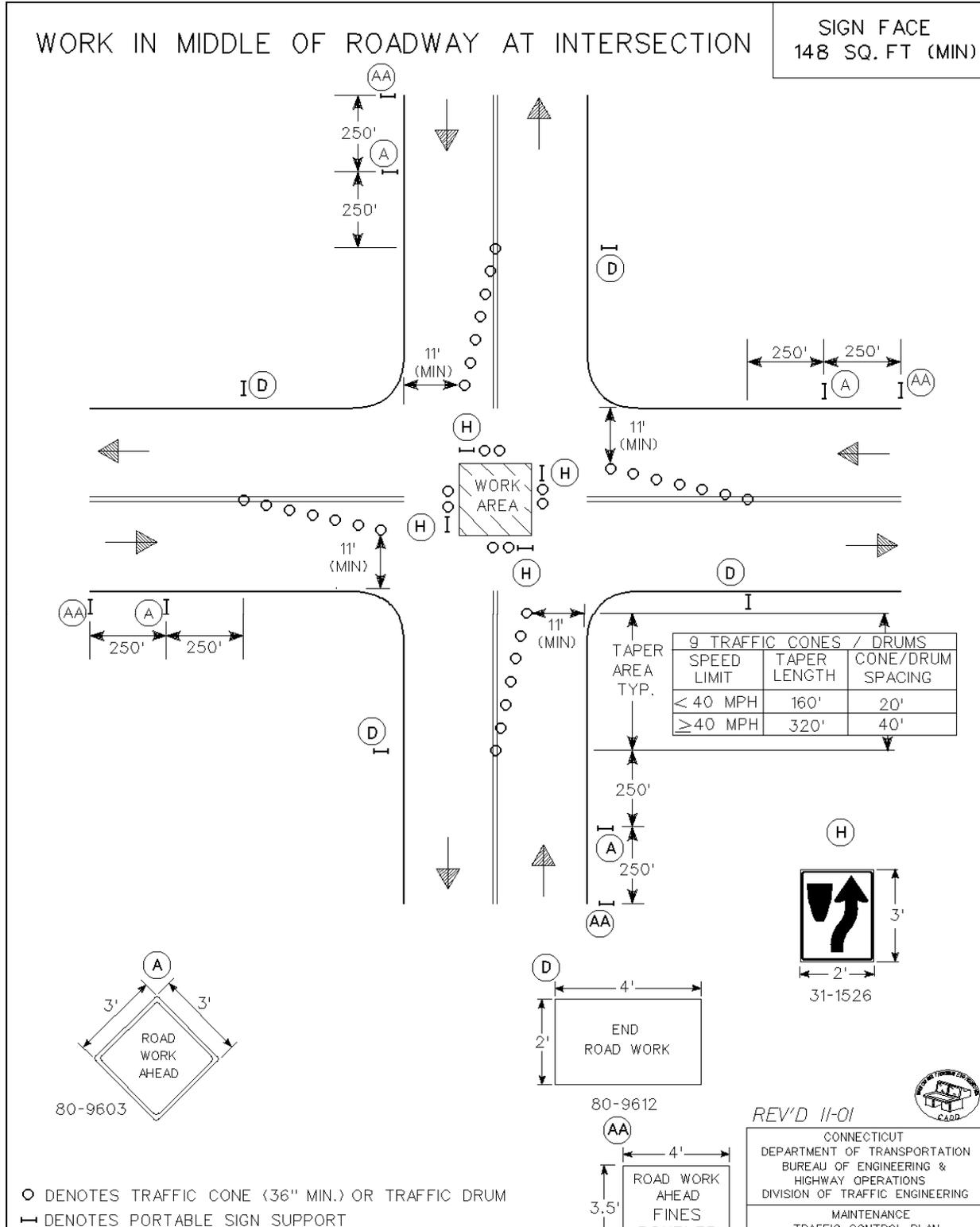


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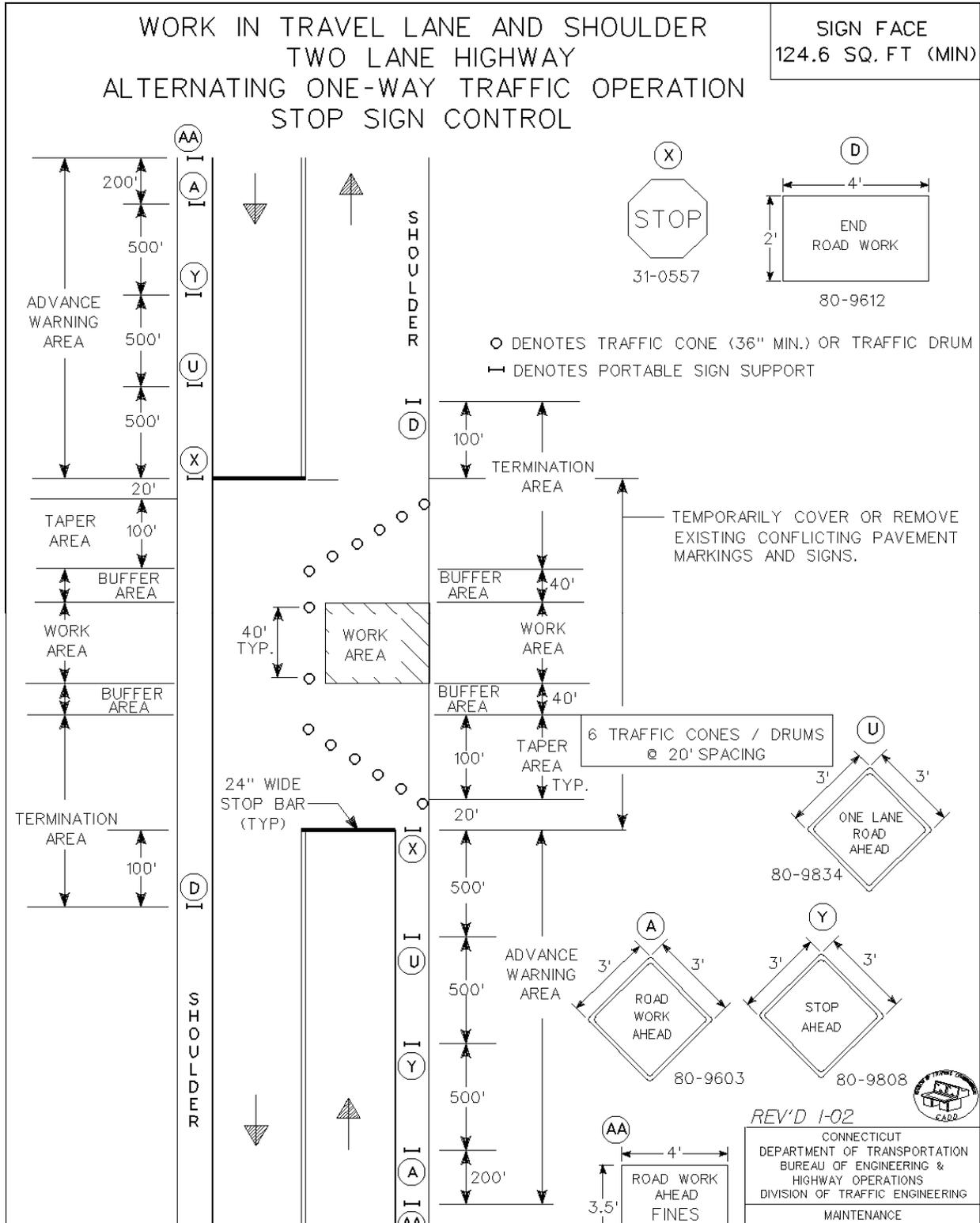


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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES

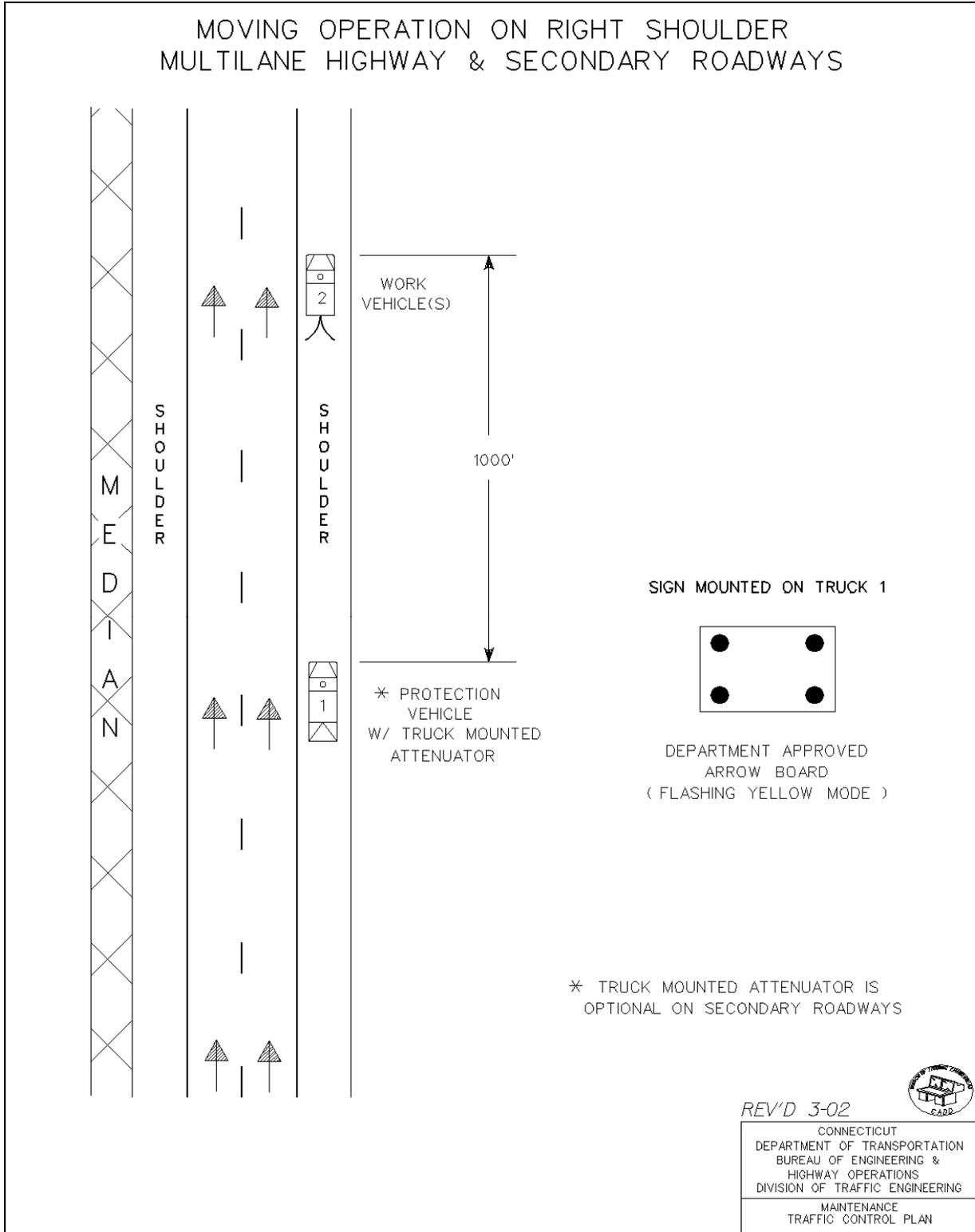


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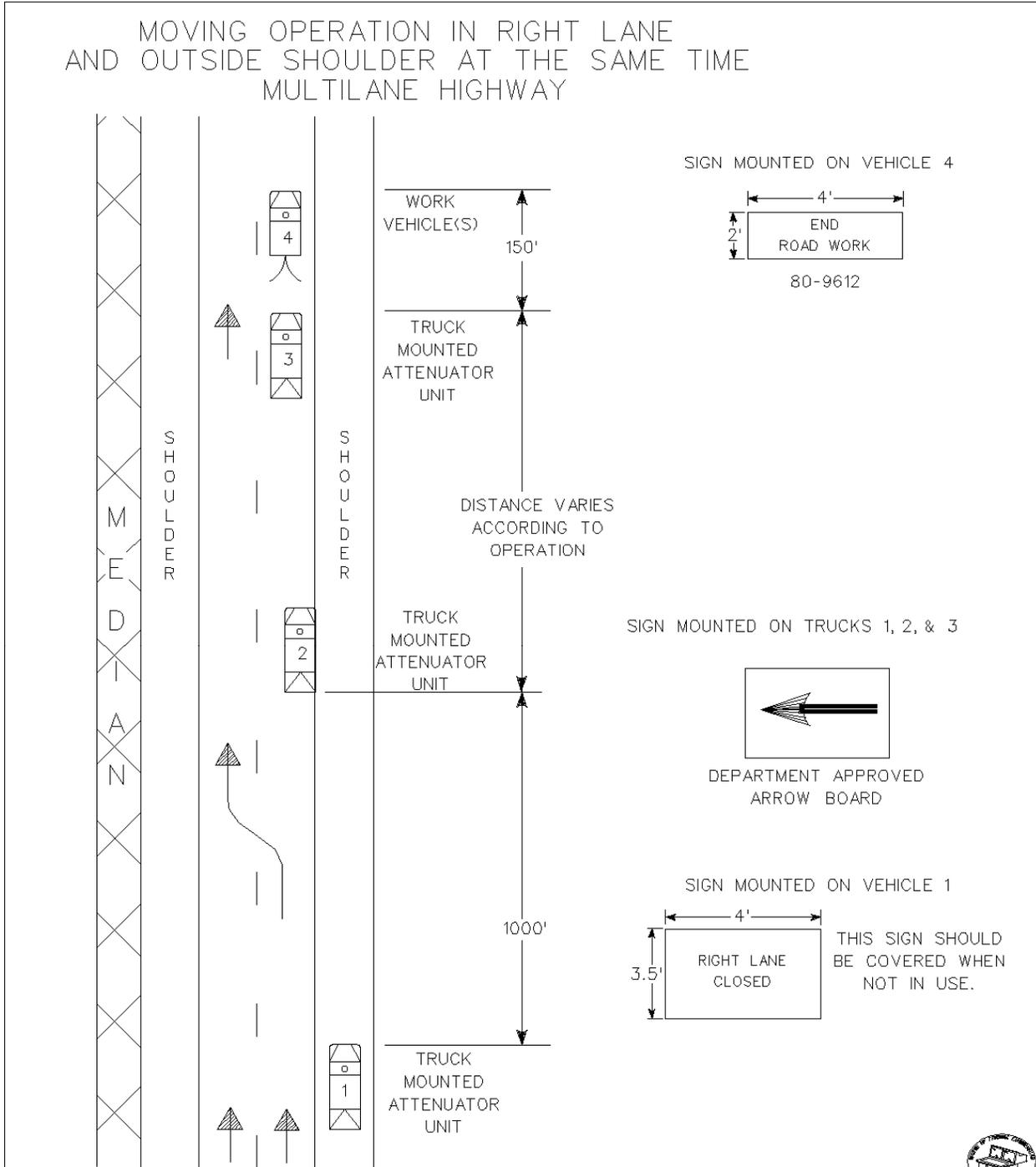


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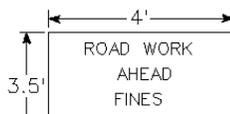
Contract # 12PSX0331  
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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



ON NON-LIMITED ACCESS HIGHWAYS AND THE MERRITT PARKWAY, VEHICLE 3 MAY BE ELIMINATED AND VEHICLE 2 WILL TAKE THE POSITION OF VEHICLE 3. WHERE ADEQUATE SHOULDER WIDTH IS NOT

SIGN MOUNTED ON VEHICLE 2



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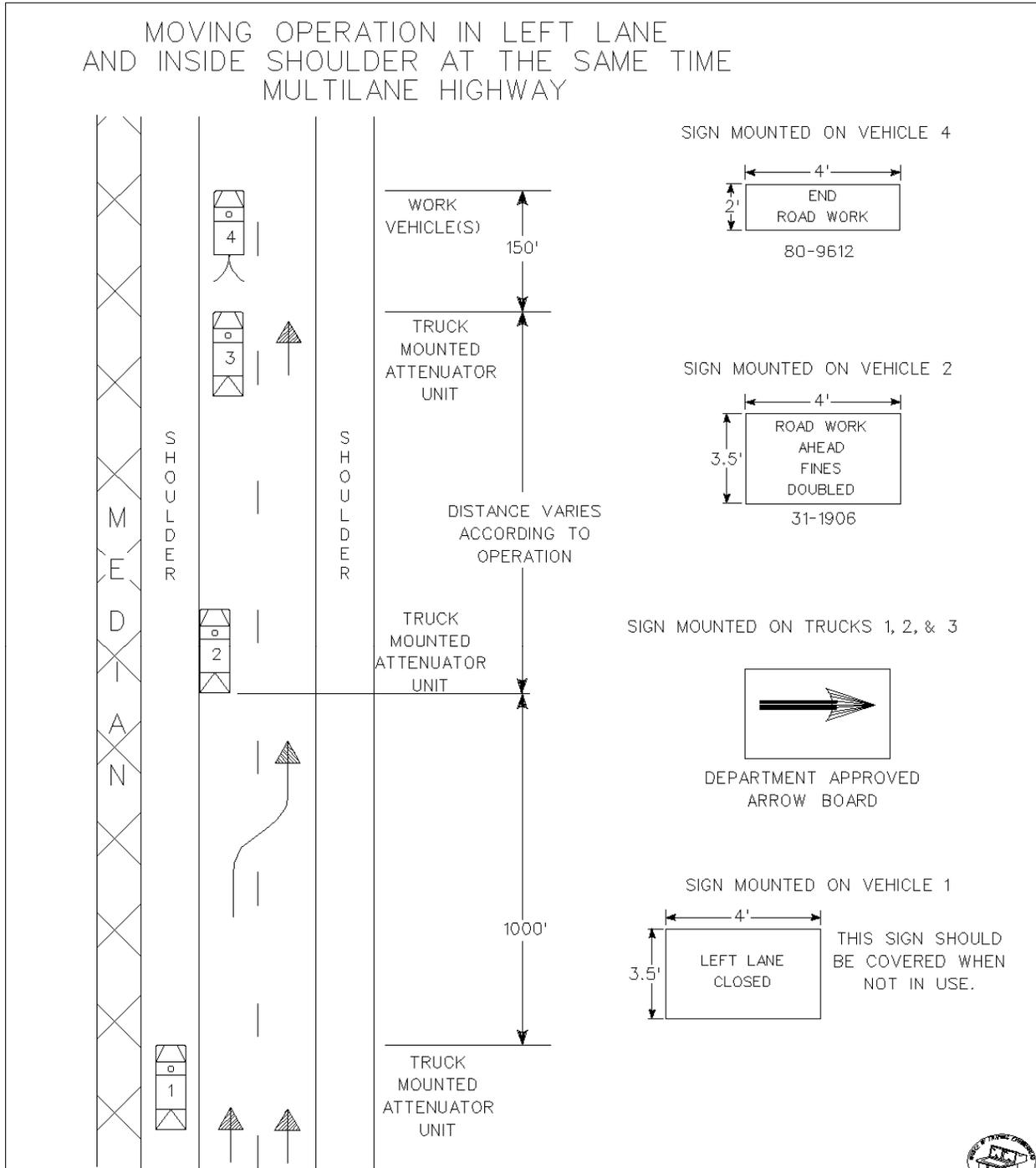
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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



ON NON-LIMITED ACCESS HIGHWAYS AND THE MERRITT PARKWAY, VEHICLE 3 MAY BE ELIMINATED AND VEHICLE 2 WILL TAKE THE POSITION OF VEHICLE 3. WHERE ADEQUATE SHOULDER WIDTH IS NOT

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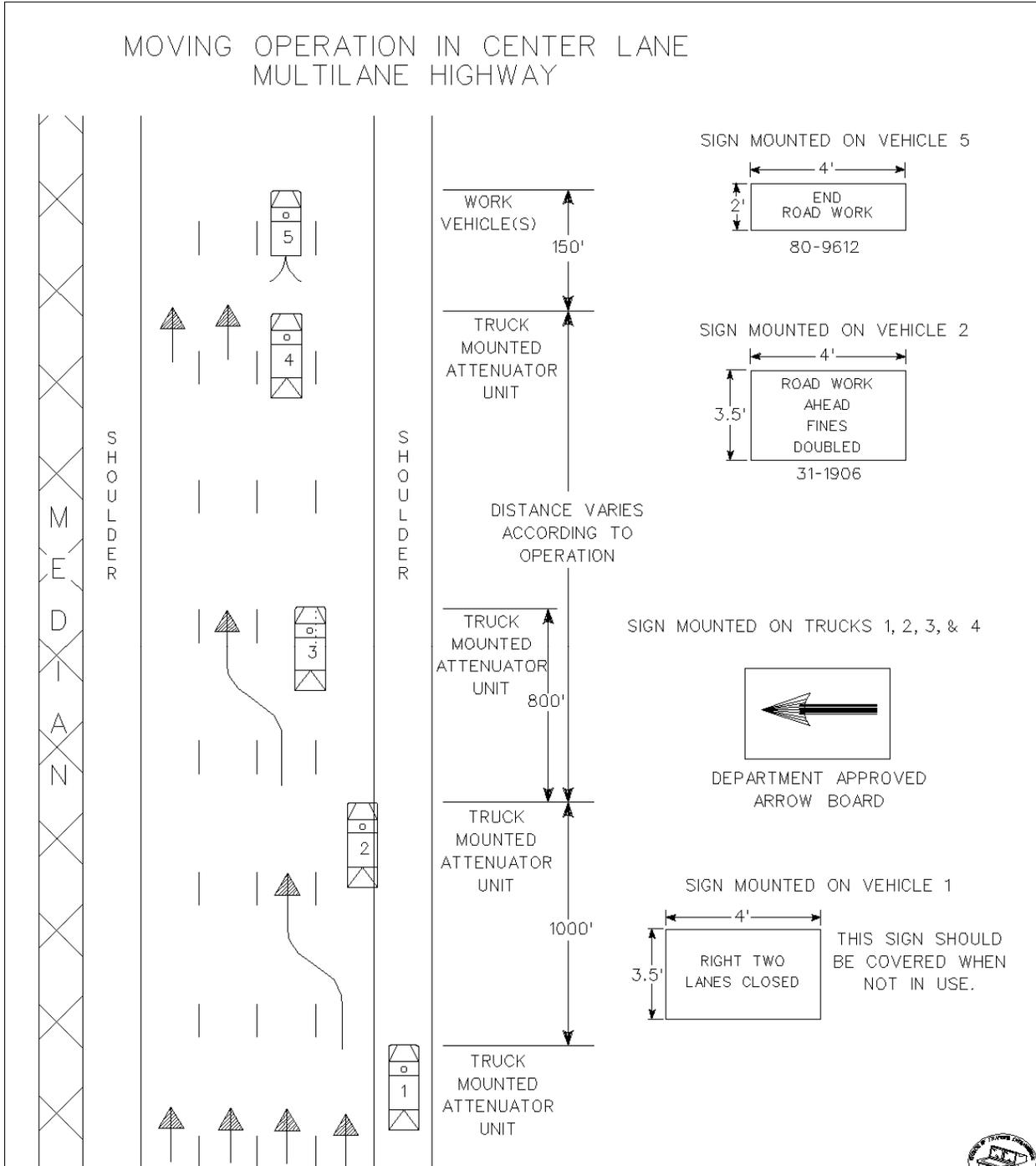
CONNECTICUT  
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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



WHERE ADEQUATE SHOULDER WIDTH IS NOT AVAILABLE,  
VEHICLE 1 MAY DRIVE PARTIALLY IN THE LANE.

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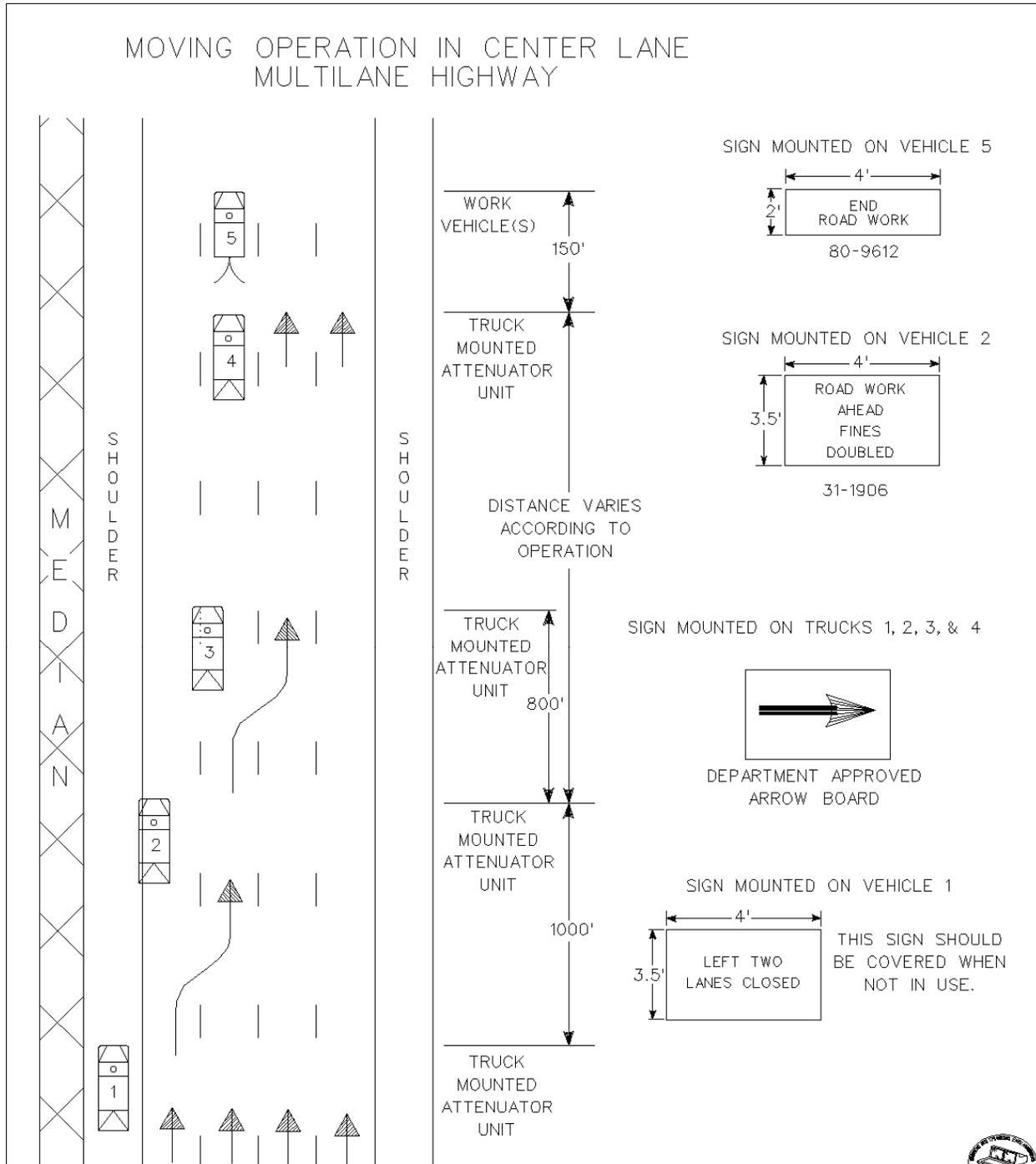
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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



WHERE ADEQUATE SHOULDER WIDTH IS NOT AVAILABLE,

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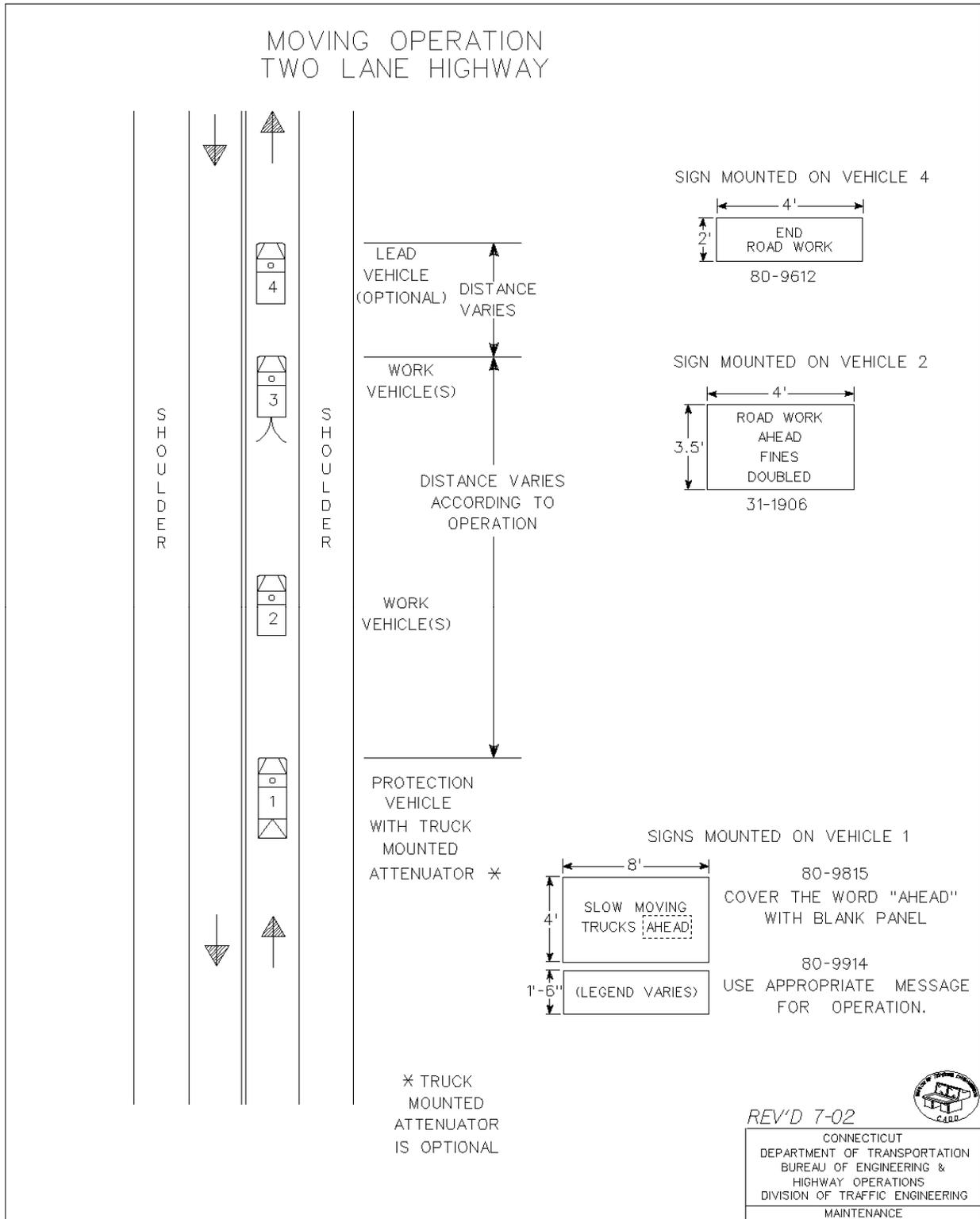
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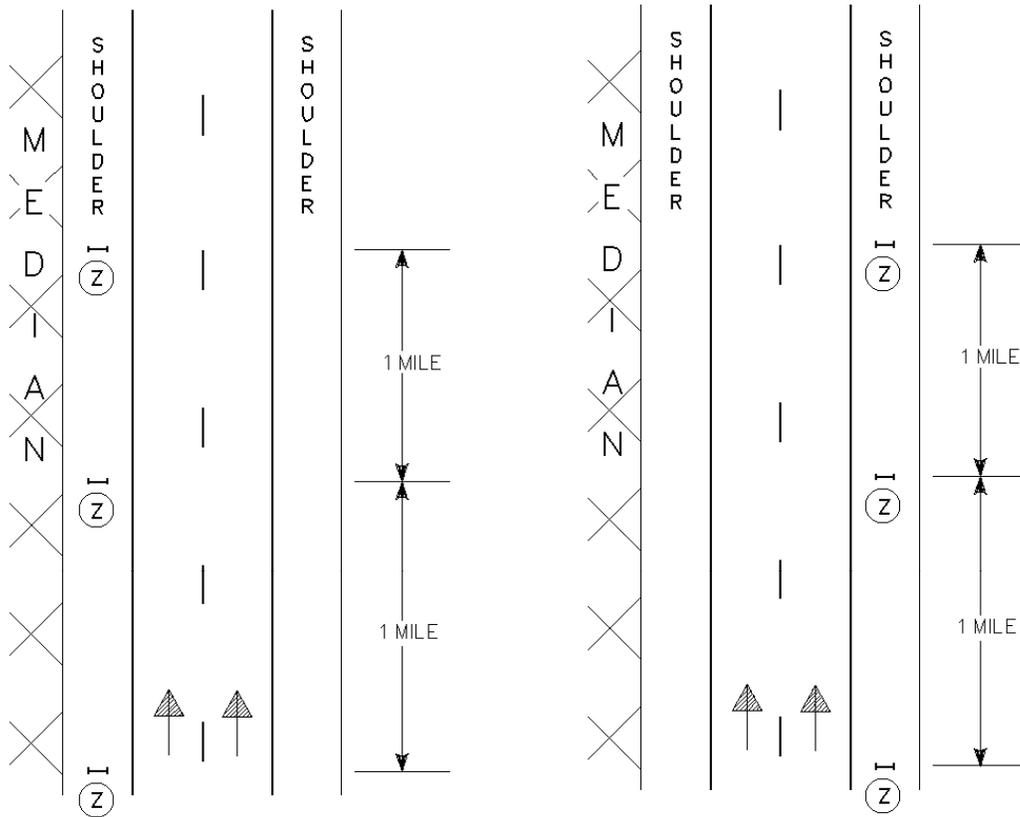
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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES

### MOWING OPERATION - MULTILANE HIGHWAY

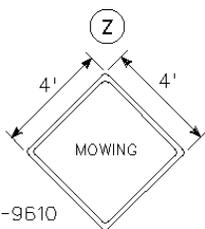
FOR EQUIPMENT ON THE ROADWAY, ROADSIDE  
OR ON THE MEDIAN COMPLETELY OFF THE ROADWAY



**MOWING IN MEDIAN**

INSTALL "MOWING" SIGNS ON OPPOSITE TRAVELWAY MEDIAN SHOULDER AS SHOWN ABOVE.

**MOWING RIGHT OF TRAVELWAY**



ERECT "MOWING" SIGNS AT 1 MILE INTERVAL AND IMMEDIATELY BEYOND THE ENTRANCE RAMP.

WHEN MOWING FROM A TRAVEL LANE, USE BACK UP VEHICLES 1, 2 & 3 AS SHOWN ON PLANS 20 & 21 TO PROTECT MOWING OPERATIONS. WHEN MOWING EQUIPMENT MUST USE THE TRAVELWAY TO GET AROUND AN OBSTACLE, USE BACKUP VEHICLES 2 & 3 ONLY. THE BACKUP VEHICLES MUST REMAIN OFF THE ROADWAY UNTIL MOWING EQUIPMENT HAS COMPLETED THE CUT AND IS RETURNING TO THE SHOULDER.

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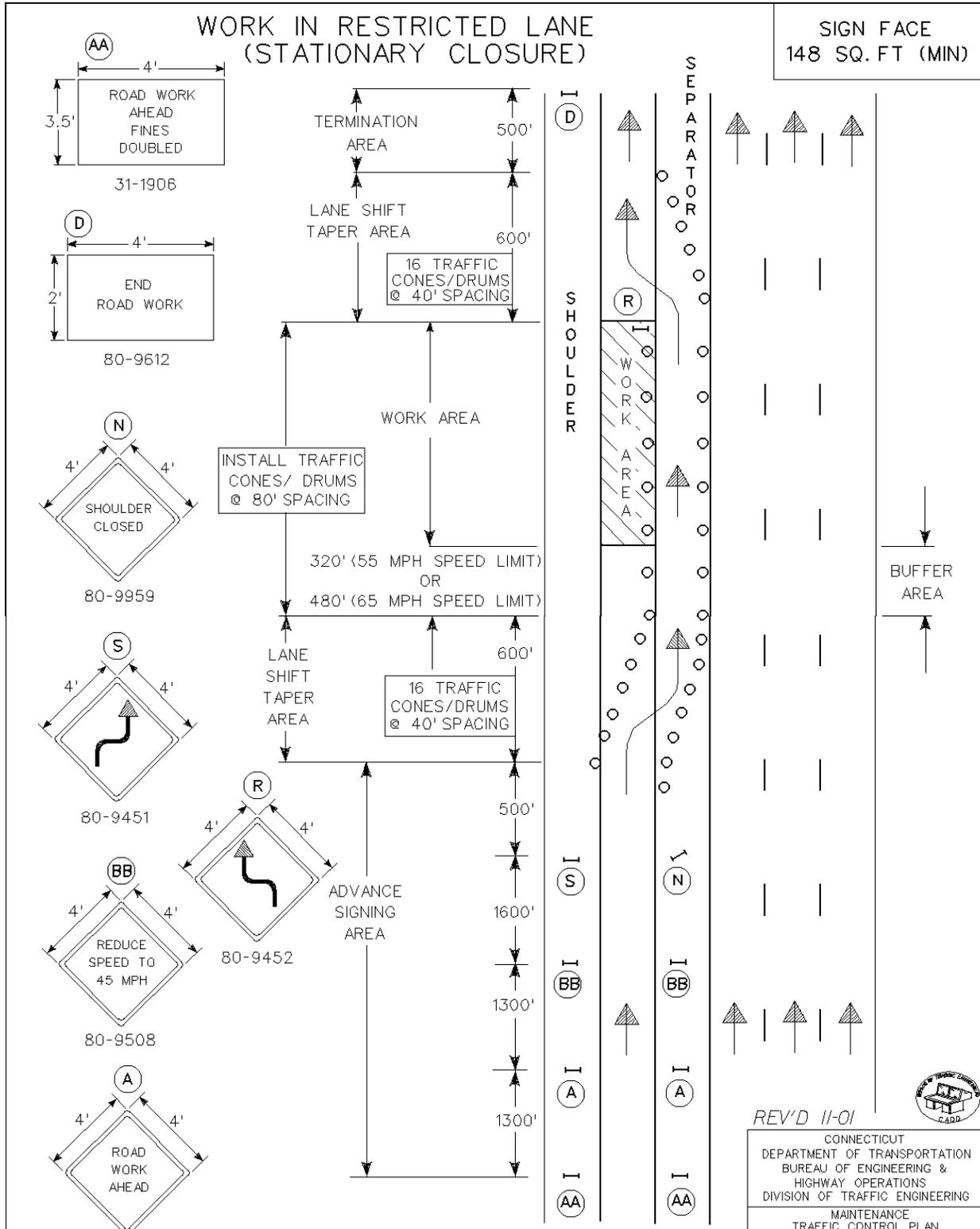
CONNECTICUT  
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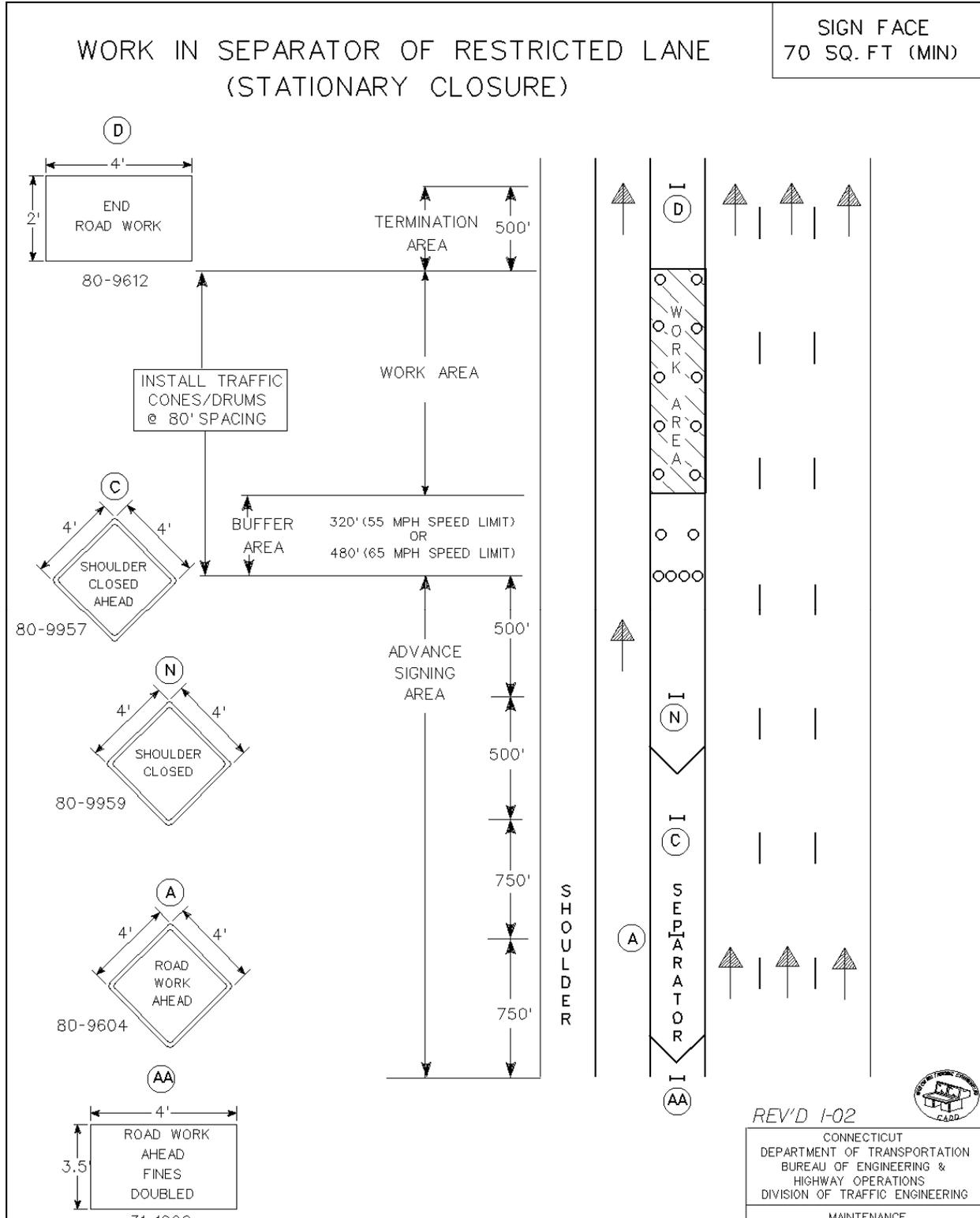


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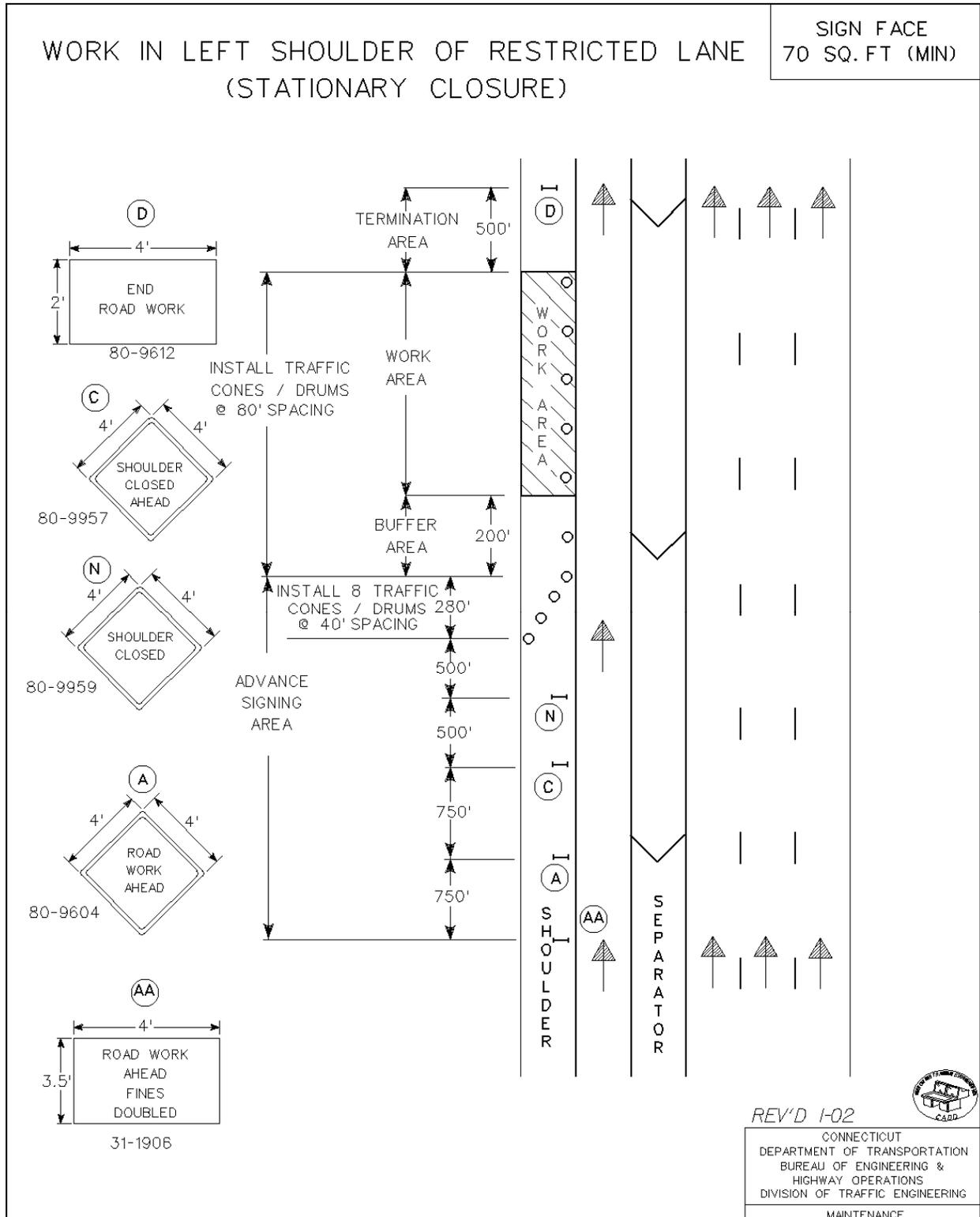


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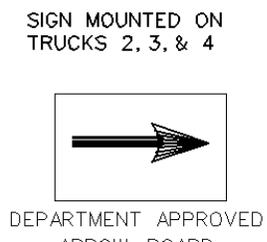
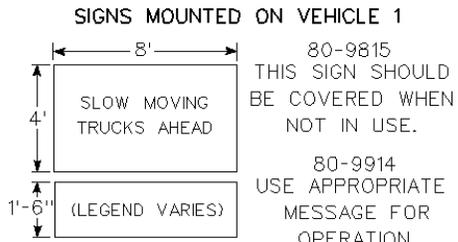
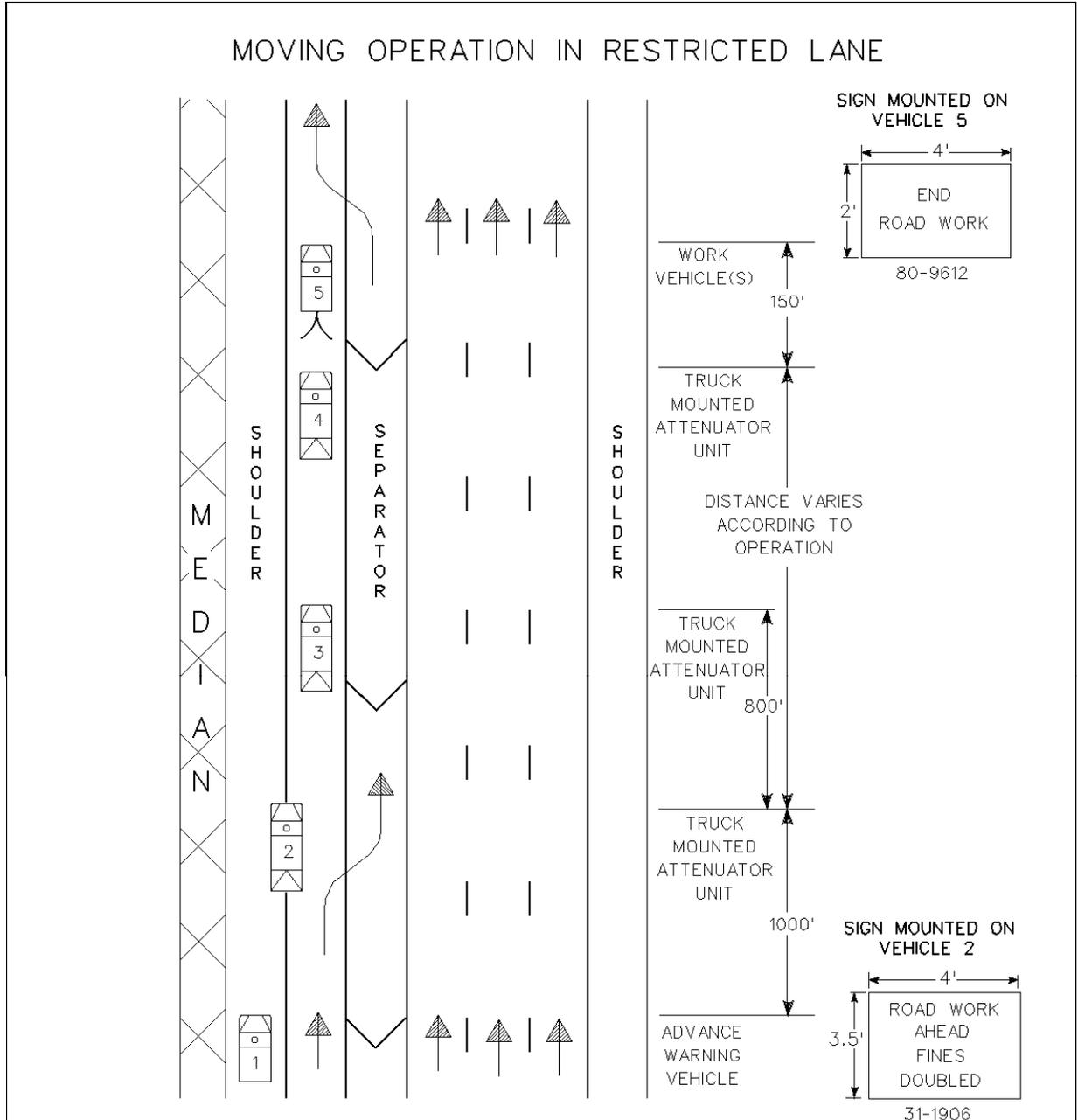


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## EXHIBIT A DESCRIPTION OF GOODS AND SERVICES



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MAINTENANCE  
TRAFFIC CONTROL PLAN

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English

### EXHIBIT A

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#### SECTION M.04 BITUMINOUS CONCRETE

##### **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 shall be qualified on an annual basis by ConnDOT 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 ConnDOT Engineer and are detailed in Table M.04.03-6.

Contractor shall submit to ConnDOT 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. Contractor shall submit a Material Safety Data Sheet (MSDS) for each grade of binder, and additive to be used on ConnDOT Project. Contractor shall not change any material sources without prior approval of ConnDOT 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 ConnDOT 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 shall not be mixed or stored in the same stockpile.

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- 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><sup>a</sup> shall be determined in accordance with AASHTO T 85. The coarse aggregate shall 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 shall 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 ConnDOT Engineer. 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 shall 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.

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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 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 shall be resubmitted any time the process, location or manner of how the fine aggregate (FA) is manufactured changes, or as requested by ConnDOT Engineer. The QCPFA shall include the locations and manufacturing processing methods. The QCPFA for any source may be suspended by ConnDOT Engineer due to the production of inconsistent mixtures.

Contractor shall submit all test results to ConnDOT Engineer for review. 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

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#### DESCRIPTION OF GOODS AND SERVICES

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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.

Contractor shall be notified by ConnDOT Engineer if any qualified source of supply fails any portion of Table M.04.01-1. One retest shall be allowed for 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 shall be required in accordance with item 8.

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

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

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#### DESCRIPTION OF GOODS AND SERVICES

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#### 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 shall be classified as a supplier and shall 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). 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 shall 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. 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 shall be transferred and stored until used, and provide binder samples to ConnDOT 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 shall 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 shall 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) shall be allowed to supply PG binders to ConnDOT projects.

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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 shall 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.neupg.uconn.edu/wma\\_info.html](http://www.neupg.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. Contractor shall submit a Certified Test Report showing the results of the testing

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- demonstrating the binder grade. In addition, it shall 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 (7) days prior to its use listing the location where the materials shall be produced, and manufacturing, processing, handling and storage methods. 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 ConnDOT 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 shall include the location where the materials shall 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 ConnDOT Engineer. Each shipment shall be accompanied with a Certified Test Report listing Saybolt viscosity, residue by evaporation, penetration of residue, and weight per gallon.

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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 shall not be performed unless deemed necessary by ConnDOT Engineer. When ambient temperatures are 80° F and rising, grade CSS-1 or CSS-1h may be substituted if accepted by ConnDOT 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 ConnDOT Engineer. For bituminous concrete mixtures containing RAP, Contractor shall submit a JMF in accordance with Article M.04.02 to ConnDOT Engineer for review.
- b. Basis of Approval: The RAP material shall 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 ConnDOT projects, 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, Contractor shall test the material and provide the following information along with a request for approval to ConnDOT Engineer at least thirty (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. Contractor is prohibited from using unapproved material on ConnDOT 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:

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1. A fifty (50)-pound sample of the RAP to be incorporated into the recycled mixture.
2. A twenty-five (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: 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: Contractor shall submit to ConnDOT 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 shall 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

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shall comply with AASHTO M-156(M)/ASTM D 995 for a Batch Plant or a Drum Dryer Mixer Plant, and be approved by ConnDOT Engineer.

b. Storage Silos:

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

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There shall 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 ConnDOT project shall be provided a clear, legible copy of these recordings on each delivery ticket.

- d. Aggregates: 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 ConnDOT Engineer. For drum plants only, 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.

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: 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 ConnDOT Engineer.
- g. Asphalt Binder: The last day of every month, a binder log shall be submitted when the monthly production for ConnDOT exceeds five thousand (5000) tons. Blending of PG binders from different suppliers or grades at the bituminous concrete production facility is strictly prohibited.

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- 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: Contractor shall furnish ConnDOT 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 ConnDOT 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 shall 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 ConnDOT 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 shall 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. Contractor shall ensure that the laboratory is adequately

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

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. Contractor shall notify ConnDOT Engineer if any modifications are made to the equipment within the field laboratory. 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 shall meet the requirements as shown in Table M.04.02-1.
- b. Basis of Approval: Contractor shall submit to ConnDOT 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 shall be accepted by ConnDOT Engineer, and e Contractor shall 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%.

ConnDOT Engineer shall test each class of mixture for compliance with the submitted JMF and Table M.04.02-1. The maximum theoretical density (Gmm) shall 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.

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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 ConnDOT 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.

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 ConnDOT 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. Contractor shall submit to ConnDOT 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 ConnDOT 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.
- Contractor may increase the RAP percentage in 5% increments up to a maximum of 30% provided a new JMF is accepted by ConnDOT 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.

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- 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, Contractor shall submit a materials certificate to ConnDOT 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 shall be capable of being stockpiled and workable at all times. A non-stripping agent accepted by ConnDOT Engineer shall be used in accordance with manufacturer's recommendations. 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 six (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 four (4) feet during the first forty-eight (48) hours prior to its use.
- i. Class 5A mixture shall have 3/8 to 1/2 inch polypropylene fibers that have been approved by ConnDOT Engineer added at a rate of 6 pounds per ton of mixture.
  - ii. Class 5B mixture shall have 1/4 inch polyester fibers that have been approved by ConnDOT Engineer added at the rate of 2 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

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content as shown in Table M.04.02-1 shall be subject to rejection. There is a two (2) 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.

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**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

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Mixture Properties						
<b>VOIDS - %</b>	3.0 – 6.0 (a)	2.0 – 5.0 (b)	0 – 4.0		0 - 5.0 (a)	
<b>Stability (f) lbs. min.</b>	1200 (c)	1000	1000		1000	
<b>FLOW (f) in.</b>	.08 - .15	.08 - .15	.08 - .18		.08 - .15	
<b>VMA % - min.</b>	15(h) :16 (i)					

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

- a. Requirements: Contractor or its representative shall design and submit Superpave mix designs annually for approval. The design laboratory developing the mixes shall be approved by ConnDOT Engineer. The mix design shall be based on the specified Equivalent Single-Axle Loads (ESAL). Each bituminous concrete mix type shall 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.

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  $G_{sa}$ ,  $G_{sb}$ ,  $Pw_a$  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 Contractor for review.

Contractor shall supply ConnDOT Engineer with one (1) gallon of the specified PG binder and one (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

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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. Contractor shall submit a JMF, on a form provided by ConnDOT 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 ConnDOT 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 ConnDOT 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.

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- RAP amounts up to 20% may be used provided a new JMF is approved by ConnDOT 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 ConnDOT Engineer, RAP material shall not be used with any other recycling option.

- b. Basis of Approval: On an annual basis, Contractor shall submit to ConnDOT Engineer any bituminous concrete mix design, and JMF anticipated for use on ConnDOT projects. Prior to the start of any paving operations, the mix design and JMF shall be approved by ConnDOT Engineer. Bituminous concrete mixture supplied to the project without an approved mix design and JMF shall be rejected. The following information shall 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, 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).

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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.

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 ConnDOT Engineer for approval. Any approved JMF applies only to the plant for which it was submitted. Only one (1) mix with one JMF shall be approved for production at any one (1) 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 ConnDOT Engineer. Based on the rating a type of mixture receives it shall determine whether the mixture can be produced without the completion of a PPT. Ratings shall 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.

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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, shall be averaged.

The final rating assigned shall 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 ConnDOT from the previous year;
2. there is a source change in one (1) 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 ConnDOT 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 ConnDOT inspector can be at the facility to witness a passing “PPT” test or,

Option B: When Contractor or their representative performs a “PPT” test without being witnessed by a ConnDOT inspector,

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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 shall designate the bituminous concrete type to be on an "A" status. Failing verifications shall require Contractor to submit additional trials.

Option C: When Contractor or their representative performs a "PPT" test without being witnessed by a ConnDOT inspector, ConnDOT Engineer may verify the mix in Contractor's laboratory. Passing verifications shall designate the bituminous concrete type to be an "A" status. Failing verifications shall require 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 shall be followed. If the "PPT" Option (B) procedure is followed, the mixtures along with the test results shall be delivered to the Materials Testing Lab. The test results shall meet the "C" tolerances established by ConnDOT Engineer. The tolerance Table is included in ConnDOT'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 shall be submitted annually seven (7) days prior in order to obtain an "A," or "PPT" status for that mix. A "U" shall 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 ConnDOT projects.

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**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 shall require ConnDOT Engineer's approval. (6) For WMA and PMA, the mix temperature shall meet manufacturer's recommendations.

Sieve  inches	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	
	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			

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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 ConnDOT Engineer			

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**TABLE M.04.02-3**

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

<b>Notes: (1)</b> 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.**

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**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
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

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**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.

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

**1. Quality Control Plan and Processes:** 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 ConnDOT Engineer on an annual basis.

The QCP shall describe the organization and procedures which 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 shall 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 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 ConnDOT 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 ConnDOT Engineer upon request.

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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 shall 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 ConnDOT Engineer that adherence to the plan shall result in production of bituminous concrete that complies with these specifications. 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 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 one hundred fifty one (151) tons or as directed by ConnDOT 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 shall be calculated per sub lot as described in Section 4.06.

An acceptance test shall not be performed within one hundred fifty (150) tons of production from a previous acceptance test unless approved by ConnDOT Engineer. Quality Control tests are not subject to

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this restriction. Unless otherwise tested, a minimum of one (1) acceptance test shall be performed for every four (4) days of production at a facility for each type/level mix (days of production may or may not be consecutive days).

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

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

Contractor personnel performing acceptance sampling and testing shall 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 shall be suspended by Contractor if such personnel are not present.

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

Anytime during production that testing equipment becomes inoperable, production can continue for a maximum of one (1) hour. 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 ConnDOT Engineer. Production beyond one (1) hour may be considered by ConnDOT Engineer. Production shall not be permitted beyond that day until the subject equipment issue has been resolved.

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**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

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**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:

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- i. Off-Test Status: The results of AASHTO T 164 or AASHTO T 308(M) and T 30(M) shall be used to determine if the mixture is within the tolerances shown in Table M.04.02-1. Contractor shall 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 (1) site, mixture supplied to one (1) project is considered as coming from one (1) 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, Contractor may make a single JMF change on classes 1, 2, 3, 4 and 12 as allowed by ConnDOT Engineer prior to any additional testing. A JMF change shall include the date and name of ConnDOT 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. ConnDOT Engineer may cease supply of mixture from the plant when the test results from three (3) 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 (1) 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 ConnDOT 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 ConnDOT project:

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- i. When the test results from three (3) consecutive samples are “off test” and not within the JMF tolerances or,
- ii. The test results from two (2) 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 (3) 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 ConnDOT Engineer and shall be adjusted in accordance with Section 4.06.
  - b. Following cessation, a trial production period shall be required at the plant for that class of mixture. Use of that class of mixture from that plant shall be prohibited on ConnDOT project until the plant has demonstrated the ability to consistently produce acceptable mixture.
  - c. When ConnDOT Engineer has accepted the mixtures from the trial production period, the use of that mixture on the Project may resume.

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**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

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).

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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 ConnDOT Engineer for review. This shall be completed within thirty (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. Contractor shall submit the name, manufacturer, percent used, and MSDS sheet for the anti-strip additive (if applicable) to ConnDOT Engineer. In addition, compaction of samples shall be accomplished utilizing an accepted Superpave Gyrotory Compactor (SGC), supplied by 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. Contractor shall notify ConnDOT 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

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- (1) project is considered as coming from one (1) source for the purpose of applying the “*off test*” determination.
  2. Contractor shall 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 shall not be used for acceptance and is solely for the use of Contractor in its quality control process.
- b. Cessation of Supply for Superpave Mixtures with no Payment Adjustment: Production of bituminous concrete shall cease for ConnDOT 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” shall not be adjusted for deficient mixtures.

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 (one) 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, 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 shall be prohibited on ConnDOT project until Contractor has demonstrated the ability to

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produce acceptable mixture from that facility. When Contractor has a passing test and has received approval from ConnDOT Engineer, the use of that mixture to ConnDOT project may resume.

- c. Cessation of Supply for Superpave Mixtures with Payment Adjustment:  
Production of bituminous concrete shall cease for ConnDOT 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” shall be adjusted for deficient mixtures in accordance with Section 4.06.

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, 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 shall be prohibited on ConnDOT project until Contractor has demonstrated the ability to produce acceptable mixture from that facility. When Contractor has a passing test and has received approval from ConnDOT Engineer, the use of that mixture to ConnDOT 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 Contractor to minimize this to ensure a uniform and dense pavement.

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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 ConnDOT Engineer;
- ii. Are based on a minimum of a two (2) test trend;
- iii. Are documented with a promptly submitted revised JMF on form provided by ConnDOT Engineer.
- iv. A revised JMF submittal shall include the date and name of ConnDOT Engineer that allowed it.

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

<i>Notes:</i> (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 Conn DOT 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.									
Sieve	S0.25		S0.375		S0.5		S1		Tolerances
	CONTROL POINTS <sup>(4)</sup>		CONTROL POINTS <sup>(4)</sup>		CONTROL POINTS <sup>(4)</sup>		CONTROL POINTS <sup>(4)</sup>		JMF Limits <sup>(4)</sup>
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

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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 ConnDOT Engineer	N/A	

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

Traffic Level	Design ESALs	Number of Gyration by Superpave Gyratory 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.**

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**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.

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**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 (1) 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 (3) 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 shall 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 (1) 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 two (2) minutes prior to reading rather than ten (10) minutes. This makes no significant difference in results.</p> <p>Section 7.2 The average of two (2) 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>

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<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, ConnDOT has adopted a procedure that addresses a correction factor that is calculated using the composite aggregate percentages (<b>Composite Aggregate Correction Factor Method (CACF)</b>).</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 Contractor to ConnDOT Engineer prior to the Annual Plant Inspection. ConnDOT 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 shall 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), Contractor shall immediately investigate, determine an assignable cause and correct the issue. When two (2) consecutive moving average differences are 0.3% or more, ConnDOT Engineer may require a new correction factor calculation for all the aggregate components in the mix.</p>

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	<p>In addition to the standard testing procedure, ConnDOT 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 shall be ready to be placed in an approved ignition furnace for testing within ten (10) minutes of being obtained from the hauling vehicle and the test shall start immediately after.</p>
<b>T 331</b>	<p>6.1 Cores are dried to a constant mass prior to testing using a core-dry machine.</p>

<b>AASHTO Standard Recommended Practices</b>	
<b>Reference</b>	<b>Modification</b>
<b>R 35</b>	<p><b><u>Volumetric Calculations of VMA and Correction Factor</u></b>  <b>VMA<sub>a</sub></b> - 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 <math>Pb_a \times (100 - Pb_t) / 100</math> is known and substituted for <math>A_{cf}</math>, 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 style="margin-left: 40px;">i. <math>A_{cf} = Df \times Pwa \times (100 - Pb_t) / 100</math></p> <p style="margin-left: 40px;">ii. <math>A_{cf} = (Pb_a \text{ from annual JMF submittal}) \times (100 - Pb_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  Pb<sub>a</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>

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	<p>mix design <math>D_f</math> (derived from formula X1.2 APPENDIX XI of AASHTO R 35) for each class of material, in accordance with Formula 5.16.1B.</p> <p>Formula 5.16.1B. 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>